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REMEDIAL ACTION WORK PLAN
For

Grand Union Hotel Bowling Alley Site
148-150 Westchester Avenue
Port Chester, Westchester County, New York
NYSDEC BCP Site # C360222

Prepared for:
Port Chester OZ Fund III QOZB, LLC
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LIST OF ACRONYMS

Acronym	Definition
AWQS	Ambient Water Quality Standards
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
CAMP	Community Air Monitoring Plan
CCR	Construction Completion Report
COC	Certificate of Completion
CVOC	Chlorinated Volatile Organic Compound
DER	Division of Environmental Remediation
DER-10	NYSDEC Technical Guidance for Site Investigation & Remediation Division of Environmental Remediation
EC	Engineering Control
ELAP	Environmental Laboratory Accreditation Program
ESA	Environmental Site Assessment
FER	Final Engineering Report
ft-bgs	feet below ground surface
GPR	Ground Penetrating Radar
GSR	Green and Sustainable Remediation
HASP	Health and Safety Plan
IRM	Interim Remedial Measures
IRMWP	Interim Remedial Measures Work Plan
ISCO	In Situ Chemical Oxidation
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PAHs	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PCE	Tetrachloroethene
PDB	Passive Diffusion Bag
PFAS	Per and Polyfluoroalkyl Substances

Acronym	Definition
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctanesulfonic Acid
PGWSCOs	Protection of Groundwater Soil Cleanup Objectives
PHC	Petroleum Hydrocarbon
PropCo	Port Chester Oz Fund III PropCo, LLC
QAPP	Quality Assurance Project Plan
RA	Remedial Action
RAWP	Remedial Action Work Plan
RECs	Recognized Environmental Concerns
RI	Remedial Investigation
RIR	Remedial Investigation Report
RIWP	Remedial Investigation Work Plan
RRSCOs	Restricted Residential Soil Cleanup Objectives
SESI	SESI Consulting Engineers, DPC
sf	Square feet
SGS	SGS North America
SOE	Support of Excavation
SSDS	Sub-slab Depressurization System
SVI	Soil Vapor Intrusion
SVOCs	Semi-Volatile Organic Compounds
SWPPP	Stormwater Pollution Prevention Plan
TAL	Target Analyte List
TCE	Trichloroethane
TCL	Target Compound List
UST	Underground Storage Tank
UUSCO	Unrestricted Use Soil Cleanup Objectives
VOCs	Volatile Organic Compounds

1.0 INTRODUCTION

Port Chester OZ Fund III QOZB, LLC ("Volunteer") entered into a Brownfield Cleanup Agreement (BCA) with the New York State Department of Environmental Conservation (NYSDEC) on March 25, 2022, to investigate and remediate the Grand Union Hotel Bowling Alley Site, designated NYSDEC Brownfield Cleanup Program (BCP) Site No. C360222. The BCP Site is located at 146 Westchester Avenue, Port Chester, New York (hereinafter referred to as the "Site") and consists of two (2) adjacent parcels that encompass approximately 0.4486 acres. The two (2) tax parcels are identified on local tax maps under Tax Map IDs 142.30-2-65 and 142.30-2-17 (Block 2, Lots 65 and 17). A change of use notice was sent to the NYSDEC on January 18, 2023, notifying the Department of the fact that the Volunteer is acquiring the Site. A Site Location Map is presented as **Figure 1.1**. A BCP Site Boundary Map is presented as **Figure 1.2**. Historic operations at the Site have included tin smith, blacksmith, plumbing supply, carpet cleaning, lodging, bowling alley, and locksmith. A Brownfield Cleanup Agreement (BCA) Amendment (First Amendment) was filed with NYSDEC on June 8, 2023, for a change of ownership in which the Volunteer purchased the Site by two (2) deeds. A second BCA Amendment (Second Amendment) was filed on August 20, 2024, with the NYSDEC to add the Volunteer Port Chester Oz Fund III PropCo, LLC, (PropCo), the new owner of the BCP Site. Port Chester OZ Fund III QOZB, LLC remains a Volunteer in the BCA. The Second Amendment was also filed to reflect the merger of the two (2) lots (142.30-2-65 and 142.30-2-17) into one (1) lot known as 146 Westchester Avenue (143.30-2-70).

The following reports were previously submitted to NYSDEC:

- Remedial Investigation Work Plan (RIWP) prepared by SESI dated March 2022, revised in June 2022 and approved by NYSDEC on July 1, 2022.
- Supplemental Groundwater RIWP prepared by SESI dated December 2022, revised in March 2023 and approved by NYSDEC on March 3, 2023.
- Proposed Supplemental GW RI prepared by SESI dated June 2023 and approved by NYSDEC on June 26, 2023.
- Interim Remedial Measures Work Plan (IRMWP) prepared by SESI dated February 2023, revised in April 2023, and approved by NYSDEC on June 1, 2023.
- Remedial Investigation Report (RIR) prepared by SESI dated April 2024
- Supplemental Groundwater RIWP prepared by SESI dated July 2024, revised in September 2024 and approved by NYSDEC on November 20, 2024.

- Revised RIR prepared by SESI dated April 2025 (approval of the RIR was pending at the time of submission of this report).
- Interim Remedial Measures Construction Completion Report (CCR) prepared by SESI dated April 24, 2026.

The Remedial Investigation (RI) defined the nature and extent of contamination on-Site, identified contaminant source areas, migration pathways and produced data of sufficient quantity and quality to complete an on-Site exposure assessment and a qualitative off-Site exposure assessment for purposes of designing the remedial action for the Site. The IRMWP describes the Interim Remedial Measures (IRM) activities at the Site with the objective of preparing the Site for construction and the removal of all Site soils exceeding the NYSDEC Unrestricted Use Soil Cleanup Objectives (UUSCOs). Implementation of the IRMWP began in September 2024.

The remedial alternatives presented in this Remedial Action Workplan (RAWP) have been developed with the goal of achieving a Track 1 remedy for the Site. This RAWP has been prepared to address the following objectives.

- To describe the remedial action (RA) activities for soil, which are being conducted under the approved IRMWP. Soils are being excavated to achieve the NYSDEC USCOs.
- To outline the planned RA activities for groundwater, which include a groundwater extraction, biological amendment and recirculation designed to reduce groundwater contamination to levels below the Ambient Water Quality Standards (AWQS), followed by remedy verification.
- To detail the installation of a vapor barrier and the components of a sub-slab depressurization system (SSDS) and the planned soil vapor evaluation.

The results of the Fish and Wildlife Impact Analysis indicated the Site did not contain, nor is it proximate to, fish and wildlife resources. Per DER-10 Appendix 3C, no fish and wildlife impact analysis is needed since there are no fish or wildlife resources on or near the Site.

1.1 SITE LOCATION AND DESCRIPTION

The Site is located at 146 Westchester Avenue, Port Chester, Westchester County, New York. A Site Location Map (topographic map) is provided as **Figure 1.1**. The BCP Site is located in a mixed use commercial and residential area.

The Volunteer and NYSDEC entered into a BCA for the Site, which is identified as Index No. C360222-03-22, with an effective date of March 25, 2022. A map depicting the boundaries of the overall property and BCP Site is provided as **Figure 1.2**.

1.2 PROPOSED REDEVELOPMENT PLAN

The property is currently proposed to be redeveloped as a 12-story mixed-use building consisting of approximately 234,849 square feet (sf). The proposed development contains multi-family residential, retail, restaurants, parking, and flex community space. This includes approximately 4,763 sf of commercial space, 223 total residential units (99 studios, 86 one-bedrooms, 38 two-bedrooms) with residential amenities, and garage parking. The proposed parking garage will be located in the lower portion of the building and will include a portion of the cellar, as well as the entirety of the first and second floors. While the majority of parking will be provided on the first and second floors, five (5) multi-vehicle racks are proposed for the southernmost portion of the cellar. A mechanical ventilation system with exhaust vents and louvers will be installed in the garage areas to remove vehicle exhaust vapors in accordance with the building design and applicable code requirements. **Figure 1.3** depicts the proposed garage configuration, including the cellar parking area and the first- and second-floor parking levels. Other site improvements would include Site landscaping as well as an integrated stormwater management system.

1.3 DESCRIPTION OF SURROUNDING PROPERTY

The Site is located in a mixed-use commercial and residential area. Surrounding properties are described on **Table 1.1** below.

Table 1.1 - Summary of Surrounding Properties

Direction	Adjacent Property
North	Westchester Avenue, restaurants, a local theater, apartments
South	Commercial and industrial properties
East	New Broad Street and commercial/residential properties
West	Pearl Street and a parking lot

2.0 DESCRIPTION OF REMEDIAL INVESTIGATION FINDINGS

The Site was investigated in accordance with the scope of work outlined in the RIWP prepared by SESI in June 2022, which was approved by the NYSDEC in an Approvals and Modifications Letter dated July 2022. Supplemental RIWPs were subsequently approved in March 2023, June 2023, and November 2024. The draft RIR was submitted to the NYSDEC and New York State Department of Health (NYSDOH) in April 2024. The NYSDEC provided comments in June 2024. Actions were taken to address the comments from the NYSDEC and a revised RIR was submitted in April 2025.

The RI consisted of collecting thirteen (13) soil samples, thirty-five (35) groundwater samples, five (5) soil vapor samples, one (1) ambient air sample and one (1) sub-slab soil vapor sample. The purpose of the RI was to complete the horizontal and vertical delineation of the nature and extent of contamination on-Site, identify any potential source areas of contamination, determine the remedial action needed to protect human health and the environment, and collect sufficient data to advance the remediation of the Site.

For purposes of evaluating the remedial alternatives associated with the proposed Site redevelopment, the analytical results of the soil samples were compared to the NYSDEC UUSCOs, Restricted Residential Soil Cleanup Objectives (RRSCOs), and Protection of Groundwater Soil Cleanup Objectives (PGWSCOs) for contaminants also identified in groundwater). The constituent concentrations in groundwater were compared to the applicable AWQS.

2.1 SOIL REMEDIAL INVESTIGATION FINDINGS

During its July 2022 investigation, thirteen (13) soil samples were collected from thirteen (13) soil borings. The borings were advanced utilizing direct-push drilling techniques. Borings were advanced to depths ranging from 2.5-5.5 feet below ground surface (ft-bgs). The soil boring locations are shown on **Figure 2.1A through 2.1F**. One (1) soil sample was collected from each boring at depth intervals which appeared to be most contaminated based on visual observations, PID readings and olfactory observations. A summary of the RI findings for the soil investigation is included below.

Soil samples were submitted to SGS North America (SGS) for analysis of full suite Target Compound List/Target Analyte List (TCL/TAL) + 30, 1,4-dioxane and per and polyfluoroalkyl substances (PFAS) with NYSDEC Category B deliverables. Boring logs documenting soil classifications, PID readings, and visual observations are included in Appendix D of the RIR.

Volatile Organic Compounds (VOCs):

Acetone, tetrachloroethene (PCE) and/or trichloroethene (TCE) were detected at concentrations above their respective UUSCOs in two (2) borings on Block 2, Lot 65.

Semi-volatile Organic Compounds (SVOCs)

Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene and indeno(1,2,3-cd)pyrene were detected in exceedance of their respective UUSCOs and/or RRSCOs in four (4) borings on Block 2, Lot 65.

Metals

Cadmium, copper, lead, mercury, nickel, and zinc were detected in exceedance of their respective UUSCOs and/or RRSCOs in eight (8) borings on Block 2, Lot 65.

Pesticides

The pesticides 4,4'-DDD, 4,4'-DDE, 4,4'-DDT and dieldrin were detected in exceedance of their respective UUSCOs in five (5) borings on Block 2, Lot 65.

PCBs

Total PCBs were detected above the UUSCOs but below the RRSCOs in one (1) sample on Block 2, Lot 65.

Emerging Contaminants

Perfluorooctanesulfonic acid (PFOS) was detected above the UUSCO but below the RRSCO in one (1) boring on Block 2, Lot 65 and one (1) boring on Block 2, Lot 17.

Exceedances are presented on **Figure 2.1A to Figure 2.1F**.

2.2 GROUNDWATER REMEDIAL INVESTIGATION RESULTS

Four (4) monitoring wells (RI-MW-1 through RI-MW-4) were sampled for TCL/TAL+30 (including VOCs, SVOCs, PCBs, pesticides, and metals), PFAS, and 1,4-dioxane during the July 2022 sampling event. Five (5) monitoring wells (MW-5, MW-6, MW-7D, MW-8D, and MW-9D) were sampled for VOCs, SVOCs, metals, and PFAS during the April 2023 sampling event. Six (6) monitoring wells (MW-10, MW-11D, MW-11DD, MW-12D, MW-12DD, MW-13DD) were sampled for VOCs during the November 2023 sampling event utilizing passive diffusion bag (PDB) samplers at multiple depths within each well. Accordingly, not all monitoring wells were sampled for all analytical parameters, and the November 2023 VOC results are based on passive diffusion bag sampling rather than low-flow sampling methods. Associated tables and figures will identify which results were obtained by PDB sampling.

In response to the NYSDEC's June 2024 comment letter pertaining to the July 2024 RIR, particularly with regards to the vertical delineation, MW-14 was installed to a depth of 200 ft-bgs and was screened from 180-200 ft-bgs. MW-14 was sampled for VOCs, SVOCs, metals and PFAS in February 2025 and the results are presented in the 2025 RIR**.**

In response to the NYSDEC's June 2025 comment letter pertaining to the March 2025 revised RIR, eight (8) monitoring wells were installed (MW-13R and MW-15 through MW-21). Nine (9) monitoring wells (MW-13 and MW-14 through MW-21) were sampled for VOCs, SVOCs, metals, and PFAS during the March to April 2026 sampling event.

It should be noted that all of the wells, except for MW-14, have since been abandoned in advance of construction / excavation, and select wells will be reinstalled for long-term monitoring.

Results of groundwater sampling are presented in the 2026 RIR. Results of compounds exceeding the AWQS are summarized below.

<u>VOCs</u>

The VOCs PCE, vinyl chloride, TCE, cis-1,2 dichloroethene (cis-1,2 DCE), trans-1,2-dichloroethene, acetone, naphthalene, and 1,2,4,5-tetramethylbenzene were identified in exceedance to the AWQS.

<u>SVOCs</u>

The SVOCs benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, and/or indeno(1,2,3-cd)pyrene were detected in five (5) wells at concentrations exceeding the AWQS. No SVOC exceedances were identified during the March-April 2026 sampling event.

Metals

The metals iron, lead, chromium, magnesium, manganese, and/or sodium were detected in all wells at concentrations exceeding the AWQS.

Emerging Contaminants

Perfluorooctanoic acid (PFOA) and PFOS were detected at concentrations exceeding the NYSDEC guidance values of 0.0027 ppb for PFOS and 0.0067 ppb for PFOA in all wells sampled that were analyzed for PFAS.

A summary of groundwater samples with contaminants exceeding the NYSDEC AWQS is presented on **Figure 2.2**.

2.3 SOIL VAPOR REMEDIAL INVESTIGATION RESULTS

A total of five (5) soil vapor points (RI-SV-1 through RI-SV-5) were installed and sampled during the RI. The vapor points were installed to a depth of five (5) ft-bgs. The soil vapor sample locations and detections are presented on **Figure 2.3**. New York State does not have promulgated standards for soil vapor. However, for discussion purposes SESI has used the NYSDOH Matrices lower threshold levels to evaluate the Matrix A, B, C, D, E, and F listed compounds. The NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006 and revisions) was updated to include Matrices D, E, and F in February 2024.

The results of the soil vapor sampling identified PCE, TCE, cis-1,2 DCE, vinyl chloride, and methylene chloride at elevated levels.

The soil vapor detections were sporadically distributed across the Site with no discernable source area. As a result of the elevated levels of chlorinated volatile organic compounds (CVOCs) regulated by the NYSDOH there is a potential for vapor intrusion for the proposed development.

2.4 GEOPHYSICAL INVESTIGATION RESULTS

Prior to drilling activities, a GPR survey was conducted across the Site to locate potential underground storage tanks (USTs) and any underground utilities/anomalies not identified by the One-Call system. Results of the geophysical survey identified no anomalies indicative of USTs.

2.5 GEOLOGICAL CONDITIONS

As per the USDA National Cooperative Soil Survey map for the area, the soils at the Site are characterized as Uf (Urban Land) urban land, surface covered by 60 percent by pavement, concrete, buildings, and other structures underlain by disturbed and natural soil material. Based on the Phase II ESA investigation conducted by SESI, the stratigraphy of the Site consists of primarily brown sand, silt and gravel, with fill material from ground surface to top of bedrock, which varied from 1.2 to 12 ft-bgs, with the deeper rock in the northwest and southeast corners of the Site. According to the June 2021 Geotechnical Investigation Report prepared by SESI, bedrock was identified to be generally composed of gray mica schist with a Rock Quality Designation value measured as 45 to 91.7 percent. Furthermore, evidence of fill material, including asphalt, brick and concrete was observed.

2.6 CONCEPTUAL SITE MODEL

The following subsections present the Conceptual Site Model for the Site and discuss the potential sources of contamination, types of contaminants and affected media, potential contaminant pathways and actual/potential human and environmental receptors. Isopleths of CVOCs are presented for three depth intervals: the shallow zone (ground surface [approximately +37 ft EL.] to 0 ft EL.), the intermediate zone (0 ft EL. to -50 ft EL.), and the deep zone (-50 ft EL. to -150 ft EL.), as shown on Figures **2.4** through **2.12**. Four (4) cross sections are presented as **Figures 2.14, 2.15, 2.16** and **2.17**.

As reported in the Phase I and Phase II ESAs prepared for the Site, the suspected sources of discharge at the Site are primarily related to historical Site operations (i.e. painting shop, warehouse, bowling alley, hotels and other unidentified commercial operations) and the solvents used for cleaning operations.

The overall depth of impacted soils sampled during the RI ranged from one (1) to four (4) ft-bgs

with exceedances as deep as 9 feet identified during the Phase II ESA. The contaminants of concern in soil exceeding either the UUSCOs or RRSCOs (or both) at the Site consist of VOCs, polycyclic aromatic hydrocarbons (PAHs), pesticides, metals, PCBs, and PFAS, as follows:

- Fill material was identified in soil borings from ground surface to the top of rock across the Site; rock ranging from 2-12 feet bgs on the Site.
- VOC-contaminated soils exceeding UUSCOs were identified in soils from one (1) to 2.5 ft-bgs in the central area of the southern portion of the Site. This presents a potential source for VOC impacted groundwater on the Site.
- PAH-contaminated soils exceeding UUSCOs and/or RRSCOs were identified in soils from 1.5 to 3.5 ft-bgs in the southern portion of the Site.
- Pesticide-contaminated soils exceeding UUSCOs were identified in soils from one (1) to four (4) ft-bgs in the south and east portions of the Site.
- Metals-contaminated soils exceeding the UUSCOs were identified in soils from 1.5 to four (4) ft-bgs at the center, south and east portions of the Site, and soils exceeding the RRSCOs were identified in soils from two (2) to four (4) ft-bgs at the south and east of the Site.
- PCB-contaminated soils exceeding the UUSCOs were identified in soils from three (3) to 3.5 ft-bgs at the south of the Site.
- PFOS-contaminated soil exceeding UUSCOs was identified in soils between 2.5 and 3.5 ft-bgs in northwest of the Site.

Migration pathways include surface water runoff and soil leaching from soil to groundwater. Receptors include humans coming in direct contact with soil and groundwater and being exposed vapors from the onsite contamination.

The Site groundwater has been impacted with VOCs, SVOCs, metals, and PFAS compounds above NYSDEC TOGS AWQS or the PFAS Guidance Values, as follows.

- VOCs were detected above the AWQS in twenty-one (21) monitoring wells/boreholes.
- PCE and TCE levels appear to decrease with depth, particularly in boreholes MW-10D, MW-11D, MW-11DD, MW-12D, MW-12DD, and MW-13DD that were profile sampled using the passive diffusion bags.
- cis-1,2-Dichloroethene concentrations generally increase with depth in the central and southern portions of the site, indicating more optimal reducing conditions and the

degradation of PCE and related parent compounds to daughter products in the deeper groundwater zone.

- MW-14 was installed to 200 ft-bgs and was sampled in February 2025 for VOCs, SVOCs, Metals and PFAS. Chlorinated solvents minimally exceed the AWQS. MW-14 was resampled during March-April 2026 sampling event. PCE and TCE concentrations increased to double digits, and a significantly higher concentration of cis-1,2-DCE was detected.
- PFOS, PFOA, and metals were detected above the guidance values and/or AWQS across the entire Site.
- SVOCs were detected above the AWQS in five (5) monitoring wells. SVOCs were not detected above the AWQS during the March-April 2026 sampling event.

As discussed in the Supplemental RIR, the Site is interpreted to be controlled by fractured bedrock, with groundwater flow and contaminant transport occurring through discrete transmissive fractures and weathered intervals rather than through a uniformly connected bedrock matrix. Cross sections shown on **Figures 2.14, 2.15, 2.16 and 2.17** present the interpolated distribution of contaminants in groundwater, and water-level measurements relative to site topography shown on **Figures 2.18, 2.19, and 2.20** indicate that groundwater flow in bedrock fractures is primarily from the west to the east-southeast. Available hydrogeologic, geophysical, and analytical data further indicate that vertical hydraulic gradients are low, and that contaminant migration is controlled by a limited number of hydraulically conductive fractures and weathered intervals rather than by a laterally uniform bedrock flow system. The Supplemental RIR also concludes that the southern/central and northern portions of the Site appear to function as hydraulically distinct fracture-controlled zones, with greater apparent vertical connectivity and daughter-product development at depth in the southern/central portion of the plume. The highest parent-compound concentrations are associated with the weathered and upper bedrock intervals in the southern portion of the Site. The prior detection (pre-excavation to bedrock) of PCE and TCE above the UUSCOs at RI-SB-6 further supports the interpretation that this portion of the Site functioned as a historical shallow source area, with contaminant mass likely transmitted into the adjacent weathered and upper bedrock fracture network.

As further discussed in the Supplemental RIR, updated groundwater data from Treatment Area C suggest that MW-15 and MW-16 are likely influenced by a productive upper-bedrock fracture

zone, rather than being solely representative of deeper bedrock conditions. That interpretation is supported by borehole geophysics identifying the clearest productive shallow-bedrock fracture zone on site in MW-12D, including a dominant transmissive fracture at approximately 17.5 feet bgs, and by the elevated parent-compound concentrations and relatively strong purge/sampling yields observed in MW-15 and MW-16. This same fracture-controlled transport mechanism also provides a reasonable explanation for continued impacts observed downgradient in Treatment Area B, including deeper impacts in MW-21 and MW-14. Accordingly, the remedial approach for groundwater must account for the likelihood that contaminant migration and amendment distribution will be governed by discrete fracture pathways, and that effective treatment may require targeting isolated depth intervals using packers rather than relying on broader open-interval injection.

Because groundwater in this area of Port Chester is not used for potable water, the pathway of the contaminated groundwater to human receptors is limited to the ingestion of the groundwater or direct exposure through excavation work. Further, because the nearest surface water is approximately 900 feet to the east (Byram River), impacted Site groundwater is not expected to have a pathway to an ecological receptor.

Finally, the petroleum hydrocarbon (PHC) VOCs and CVOCs detected in soil vapor can result in soil vapor intrusion into the future on-Site buildings.

2.7 IDENTIFICATION OF STANDARDS, CRITERIA AND GUIDANCE

The following standards and criteria typically will apply to Site Characterizations, Remedial Investigations, remedy selection, UST closures, remedial actions and Site management activities:

- DER-10 / Technical Guidance for Site Investigation and Remediation
- DER-13 / Strategy for Evaluating Soil Vapor Intrusion at Remedial Sites in New York New York State Department of Environmental Conservation
- DER-31 / Green Remediation
- 6 NYCRR Part 257 - Air Quality Standards
- 29 CFR Part 1910.120 - Hazardous Waste Operations and Emergency Response
- TOGS 1.1.1 - Ambient Water Quality Standards & Guidance Values and Groundwater Effluent Limitations

- Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (October 1994)
- NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (Final October 2006 and revisions)
- DER Interim Strategy for Groundwater Remediation at Contaminated Sites in New York State
- 6 NYCRR Part 375 - Regulations Subparts 1, 3 and 6 applicable to the Brownfield Cleanup Program
- Citizen Participation in New York's Hazardous Waste Site Remediation Program: A Guidebook (June 1998)
- USEPA Office of Solid Waste and Emergency Response Directive 9355.047FS Presumptive Remedies: Policy and Procedures (September 1993)
- USEPA Office of Solid Waste and Emergency Response Directive 9355.048FS Presumptive Remedies
- Site Characterization and Technology Selection for CERCLA sites with Volatile Organic Compounds in Soils (September 1993)
- 6 NYCRR Part 612 - Registration of Petroleum Storage Facilities (February 1992)
- 6 NYCRR Part 613 - Handling and Storage of Petroleum (February 1992)
- 6 NYCRR Part 614 - Standards for New and Substantially Modified Petroleum Storage Tanks (February 1992)
- 6 NYCRR Part 371 - Identification and Listing of Hazardous Wastes (November 1998)
- 6 NYCRR Subpart 374-2 - Standards for the Management of Used Oil (November 1998)
- 6 NYCRR 375 Table 375-6.8(a) and Table 375-6.8(b)
- 6 NYCRR Parts 700-706 - Water Quality Standards (June 1998)
- 40 CFR Part 280 - Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks
- STARS #1 - Petroleum-Contaminated Soil Guidance Policy
- STARS #2 - Biocell and Biopile Designs for Small-Scale Petroleum-Contaminated Soil Projects
- SPOTS #14 - Site Assessments at Bulk Storage Facilities (August 1994)
- Spill Response Guidance Manual
- Permanent Closure of Petroleum Storage Tanks (July 1988)

- NYSDOH Environmental Health Manual CSFP-530 - “Individual Water Supplies - Activated Carbon Treatment Systems”
- 40 CFR Part 144 - Underground Injection Control Program
- 10 NYCRR Part 67 – Lead
- 12 NYCRR Part 56 - Industrial Code Rule 56 (Asbestos)
- 6 NYCRR Part 175 - Special Licenses and Permits--Definitions and Uniform Procedures
- 6 NYCRR Part 371 - Identification and Listing of Hazardous Wastes (November 1998)
- 6 NYCRR Part 372 - Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities (November 1998)
- 6 NYCRR Subpart 374-1 - Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities (November 1998)
- 6 NYCRR Subpart 374-3 - Standards for Universal Waste (November 1998)
- 6 NYCRR Part 608 - Use and Protection of Waters
- TAGM 4013 - Emergency Hazardous Waste Drum Removal/ Surficial Cleanup Procedures (March 1996)
- TAGM 4059 - Making Changes to Selected Remedies (May 1998)
- Groundwater Effluent Limitations
- TOGS 1.3.8 - New Discharges to Publicly Owned Treatment Works
- TOGS 2.1.2 - Underground Injection/Recirculation (UIR) at Groundwater Remediation Sites
- OSWER Directive 9200.4-17 - Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action, and Underground Storage Tank Sites (November 1997)
- Groundwater Monitoring Well Decommissioning Procedures (May 1995)
- Sampling, Analysis, and Assessment of Per-and-Polyfluoroalkyl Substances (April 2023).
- DER-10 – Technical Guidance for Site Investigation and Remediation (2010)
- DER-31 – Green Remediation (2010)
- The activity is a component of a program selected by a process complying with the public participation requirements of section 1.10, to the extent applicable.

2.8 ENVIRONMENTAL AND PUBLIC HEALTH ASSESSMENT

2.8.1 QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT

VOC, SVOC, pesticide, PCB, metal, and PFAS exceedances of the UUSCOs and RRSCOs in the Site soil that consist of contaminated fill pose a risk to human health. The exposure pathway to humans can be through direct dermal contact with the contaminated soils or incidental ingestion without the implementation of a remedial action. Excavation of all Site soil is being conducted in accordance with the IRMWP. As a result, the exposure risk associated with contaminated soil is being addressed.

Contamination in groundwater can be transported via groundwater flow or inhalation of vapors. The primary exposure points for human receptors points to impacted groundwater are direct ingestion or adsorption during excavation work and ingestion of impacted potable water. Migration of groundwater to surface water, wetlands, or other ecological receptors also represents an exposure point. During implementation of the IRMWP, groundwater was encountered during the removal of contaminated soils at the Site. Dewatering activities were carried out to manage, treat, and dispose of the impacted groundwater, as detailed in the IRMWP. In addition, an in situ chemical oxidation (ISCO) treatment for groundwater is proposed under this RAWP, aiming to remediate Site groundwater to concentrations below the AWQSs. Upon completion of the remediation activities, human exposure to contaminated groundwater is not expected.

The VOC levels in the Site soil vapors were found to exceed the NYSDOH Matrices lower threshold concentrations. The exposure route for soil vapor is through the inhalation of the contaminated soil vapor that may intrude into the enclosed spaces of any planned Site development. The executed soil excavation and planned groundwater remediation are expected to address future exposure risk to soil vapor and indoor air; however, vapor barriers and elements for a SSDS, such as vents, pipes and raisers, will be installed as part of the Site redevelopment as precautionary measures. An assessment of indoor air will be conducted post-construction to determine whether an active SSDS is necessary to mitigate the vapor intrusion pathway. If it is determined that there is no risk to exposure to vapor intrusion, the system will be left as is and will not be considered an engineering control (EC). If deemed necessary, the components of the SSDS will be connected to an external blower, converting it into an active system functioning as an EC.

2.8.2 FISH AND WILDLIFE IMPACT ANALYSIS

The Site does not contain any wildlife or fish ecologically sensitive resources and hence the Site

contamination is not expected to have any impacts on any fish or wildlife ecological resources. The closest surface water body, The Byram River, is located approximately 900 feet east of the Site. After groundwater remediation, it is unlikely the contaminated groundwater from the Site will reach the surface water of the Byram River. Per DER-10 Appendix 3C, no fish and wildlife impact analysis is needed.

2.9 REMEDIAL ACTION OBJECTIVES

Based on the results of the Remedial Investigation, the following Remedial Action Objectives (RAOs) have been identified for this Site.

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

2.9.2 SOIL

RAOs for Public Health Protection

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

RAOs for Environmental Protection

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

2.9.3 SOIL VAPOR RAOs

RAOs for Public Health Protection

- Mitigate impacts to public health resulting from potential present and future soil vapor intrusion into buildings at the site.

3.0 DESCRIPTION OF REMEDIAL ACTION PLAN

3.1 INTERIM REMEDIAL ACTIONS IMPLEMENTED

The following is a summary of the IRM actions implemented in accordance with the NYSDEC-approved IRMWP dated April 2023. The IRM was completed with the objective of preparing the Site for construction and removing all Site soils exceeding the NYSDEC UUSCOs, which serves as the remedial action for soil contamination at the Site. Details of the IRM implementation, including the final surveyed excavation and bedrock elevations that depict excavation depths to bedrock across the Site, are provided in the IRM CCR. A figure depicting final surveyed excavation depths and bedrock elevations across the Site is included as **Figure 3.1**.

The IRM actions in sequence are listed below:

- Demolition of existing site structures and features.
- Installation of support of excavation (SOE) along the sidewalls of the Site for structural stability of the excavation and to prevent impact to off-Site structures. The SOE acted as a support for the excavation of the on-Site contaminated soil.
- Excavation of all contaminated soils per the excavation plan. This excavation removed all contaminated fill, soil, and decomposed rock if impeding the path of SOE, excavation or dewatering requirements, and extended to the top of bedrock across the Site.
- Bedrock elevations were collected following excavation to document that excavation extended to the top of bedrock across the Site. No bottom or sidewall endpoint samples were collected, as the SOE was installed along the BCP boundaries and the excavation extended to the top of bedrock across the Site.
- Any groundwater encountered during the excavation was dewatered in accordance with the dewatering plan, with approximately 4,618 gallons treated prior to off-Site disposal.
- The Site remained secured at all times via the perimeter chain link fence with locking gates facing New Broad Street. Gates were locked at the end of each workday. Open excavations were secured at the end of each day with stakes and caution tape marking the edges of excavation.
- Documentation of all appropriate off-Site disposal of all material removed from the Site in accordance with all Federal, State and local rules and regulations for handling, transport, and disposal.
- All responsibilities associated with the Remedial Action, including permitting requirements and pretreatment requirements, were addressed in accordance with all applicable Federal,

State and local rules and regulations and overseen and certified by the SESI Remedial Engineer of Record described below.

The above activities were implemented with no material variation to the original plan. Details of the IRM implementation are presented in the IRM CCR.

3.2 EVALUATION OF REMEDIAL ALTERNATIVES

The objective of the remedy for the planned mixed-use residential and commercial development is to ultimately achieve a Track 1 cleanup, which is most protective of human health and the environment. Track 1 remedy will consist of remediation of soil to UUSCOs, groundwater to the AWQS or to asymptotic levels that are accepted by the NYSDEC and NYSDOH and with no soil vapor intrusion risk. However, if groundwater and soil vapor do not meet the Track 1 remediation objectives before the Certificate of Completion (COC), then a Track 2 remedy will be achieved. Additional groundwater remedies may be implemented post the COC under the SMP in order to attain an unconditional Track 1 for the Site including groundwater within five (5) years past issuance of the COC.

Track 1

A remedy pursuant to this track must achieve compliance with the UUSCOs set forth in 6 NYCRR Table 375-6.8(a).

For an unconditional Track 1 remedy, no institutional or engineering controls are allowed.
The depth of impacted soils identified during the RIR ranged from one (1) to four (4) feet below ground surface (ft-bgs), with metals exceedances detected up to nine (9) feet bgs during the Phase II ESA. Contaminants of concern in soil exceeding UUSCOs and/or RRSCOs at the Site include VOCs, PAHs, pesticides, metals, PCBs, and PFAS. All soils at the Site were excavated per the approved IRM to achieve the UUSCO and removed from the Site for off Site disposal, and therefore, achieving the requirements for Track 1. As documented in the IRM CCR, excavation extended to the top of bedrock across the Site at variable depths; therefore, no contaminated soil was left in place above bedrock to achieve the Track 1 cleanup. No bottom or sidewall endpoint samples were collected because the SOE was installed along the BCP boundaries and the

excavation extended to the top of bedrock across the Site. Appendix J of the IRM CCR depicts the excavation depths to bedrock across the Site, which are based on the final excavation survey.

Groundwater impacts identified at the Site are expected to be remediated using targeted low-pressure in-situ injection of ISCR/ERD amendments, including GEOFORM® and ZVI, into discrete transmissive bedrock intervals, with interval selection refined through hydraulic testing and packers used where appropriate to isolate treatment zones. A detailed remedial design plan with the extraction well placements, amendment volumes, reinjection wells, etc. is included as **Appendix A**. Groundwater sampling will be conducted to assess the effectiveness of the groundwater remedy. The groundwater treatment effectiveness will be assessed to determine the appropriateness of the issuance of the COC. If the treatment is deemed to be effective, but the AWQS or significant reduction acceptable by the NYSDEC/NYSDOH are not achieved, the remedy will achieve a Track 2. Groundwater quality monitoring, and potentially supplemental treatment, will be conducted under a SMP to continue to assess groundwater quality. If the AWQS levels or asymptotic levels are achieved within a 5-year period, the Track 1 remedy will be achieved for groundwater.

The VOCs detected in soil vapor are unlikely to pose a vapor intrusion risk to the future on-site building. Since all Site soils have been removed and groundwater will be treated as described above, the source of soil vapor will be remediated. Additionally, as a conservative engineering measure, a soil vapor barrier and waterproofing membrane were installed beneath the basement-level concrete slab within the building footprint in accordance with the approved project design and manufacturer specifications. The barrier is a 20-mil polyethylene-EVOH copolymer geomembrane designed to prevent vapor and moisture intrusion. Furthermore, the SSDS elements, including the venting layer, venting pipes, and risers, have been installed as a precautionary measure beneath the vapor barrier. A soil vapor intrusion (SVI) evaluation will be conducted during the heating season after the building construction is completed and prior to building occupancy to determine if an active SSDS is required as an engineering control for the proposed building. If necessary, based on the results of the SVI evaluation, the SSDS components can be converted into an active EC by connecting it to an external blower. If not required, the system components that are in place will remain, but will not be considered an EC.

If any of the ICs or ECs for groundwater or soil vapor are required to function post-COC period, a Track 1 remedy will not be achieved and revert to a Track 2 remedy.

Track 2

Track 2 consists of restricted use with generic soil cleanup objectives. This track requires the Volunteer implement a cleanup that achieves an SCO, which is based on the planned Site use, the lowest of restricted-residential or protection of groundwater water from tables in 6 NYCRR 375-6.7(b) that is consistent with the intended Site use for the top 15 feet of soil (or bedrock if less than 15 feet). Under a Track 2 remedy, the remedial program may include the use of long-term institutional or engineering controls to address contamination related to other media including, but not limited to groundwater and soil vapor. The Site remediation pursuant to Track 2 would still involve excavation and disposal of the contaminated soils to meet the RRSCOs.

The groundwater remedy for a Track 2 cleanup will be the same as described for Track 1 above. A detailed remedial design plan with the extraction well placements, amendment volumes, reinjection wells, etc. is included as **Appendix A**. If residual groundwater contamination is present when the COC is issued, it will be monitored as part of the SMP via periodic monitoring of the contaminant concentrations in the Site monitoring wells. Should levels require additional active remediation such as additional injections, the concentrations will be evaluated and addressed post-COC.

Long-term monitoring of groundwater, less than five (5) years, may be required at the Site, which would require temporary ICs/ECs. If the groundwater levels did not drop to the AWQS or to asymptotic levels accepted by the NYSDEC and NYSDOH, then a Track 2 remedy with permanent IC and ECs will be the fallback contingency remedy for the groundwater at the Site, until the groundwater levels are below the standards or it has been demonstrated to the NYSDEC's satisfaction that there has been a bulk reduction in groundwater contamination to asymptotic levels.

The same ICs and ECs for Site soil vapor (i.e. SSDS piping, vapor barrier and soil vapor evaluation sampling) will be implemented for a Track 2 remedy in the event that only Track 2 can be achieved on all or portions of the Site. An SMP and EE as institutional controls will be temporarily put in place to ensure that all of the ICs/ECs are maintained until no longer required

by NYSDEC and NYSDOH. If the soil vapor evaluation testing results indicate that that soil vapor EC (SSDS) are required beyond the 5-year post-COC term since the results exceed the mitigation levels, then a Track 2 remedy with the soil vapor EC will be the contingency remedy for the soil vapor at the Site until such time as future sampling deems the IC and EC unnecessary.

No Action Alternative

The no action alternative would leave existing sources of contamination in soil and groundwater and soil vapor. The no action alternative is thus unacceptable and has not been compared to the factors below.

Protection of human health and the environment:

Although all Tracks would provide adequate protection of human health and the environment, Track 1 is more protective than the other cleanup tracks because it would remove all soil contamination to meet the State's most stringent cleanup standards. Moreover, because this Track 1 remedy has been designed such that it requires no long-term ongoing institutional or engineering controls to manage contamination indefinitely into the future, the cleanup does not rely on human intervention or mechanical equipment to remain effective in protecting human health and the environment. A Track 2 remedy would also be protective of human health and the environment if the proper long-term engineering and institutional controls are put in place and managed in an SMP.

Compliance with standards, criteria, and guidelines (SCGs):

All cleanup Tracks will achieve applicable cleanup standards or remedies. However, a Track 1 cleanup achieves a more stringent set of standards than a Track 2 cleanup.

Short-term effectiveness and impacts:

Generally, Track 1 provides the best short-term effectiveness because it promptly removes the most contaminant mass from the Site and achieves the most permanent long-term remedy. Track 1 does create more short-term impacts because there are more truck trips since more soil is removed, but these impacts are offset by the more permanent nature of this remedy. Track 2 as described above will accomplish the same short-term effectiveness.

Long-term Effectiveness and Performance:

Because Tracks 1 and 2 would involve removal of the greatest amount of contaminated soil source removal that may be impacting groundwater and soil vapor, these remedial alternatives will provide the most long-term effectiveness. As already discussed above, this Track 1 cleanup will allow the Site to be used for any purpose without restriction and without reliance on the long-term employment of ICs or ECs (which can fail and require on-going monitoring and maintenance to remain effective over the long-term). The restricted-residential Track 2 clean-up allows the Site to be re-developed but may have longer-term ECs and ICs.

Reduction of toxicity, mobility, or volume of contaminated material:

Tracks 1 through 4 will reduce toxicity and mobility. The Track 1 remedy planned for this Site or back up Track 2 remedy would result in reduction or elimination in the volume of contaminated soils. Because all soil at the Site are being excavated and removed for off-site disposal in accordance with the IRMWP, achieving the requirements for Track 1.

Constructability:

Track 1 is a constructable remedy given the location and the planned use for the Site. While there are short term potential impacts from a Track 1 or 2 remedy, the Site is located in the middle of an urban area, and therefore disposal of the contaminated soils and truck access will not be a problem. Moreover, these short-term impacts are avoided through implementation of the CAMP and HASP, which employ truck washing and odor and dust control measures. Therefore, Track 1 or 2 are implementable remedies for this Site.

Cost Effectiveness:

The preferred alternative should provide optimal suitability of the eight (8) accompanying evaluation factors but also be cost effective. The contaminated soil/fill layer (USCO exceedances) extends from the surface to as deep as 9 ft-bgs. However, this mass removal results in long-term savings by eliminating (or, in the case of Track 2, significantly reducing) the need for indefinite cap monitoring and maintenance. Therefore, a Track 1 or 2 remedy for the Site is considered cost effective in the long term.

Community Acceptance:

A community outreach program will be incorporated into all remedial alternatives, per NYSDEC Brownfield Program law and regulations. The Site development includes a multi-story residential apartment complex, with commercial storefronts on the ground level and an underground parking

area near the Metro North train station. The community should accept any of the remedies, however, the Track 1 remedy is likely preferable to the community since it will eliminate most of the contamination and prevent future off-Site issues.

Land use:

All cleanup tracks would achieve remediation for the planned residential use of the Site, which is consistent with Port Chester's proposed plans for the area. Developing the Site will create short term construction impacts, but the creation of a new downtown housing project will provide significant community benefits.

Zoning: All of the proposed remedies under each track will facilitate the Site to be utilized for a proposed mixed commercial-residential development, which is consistent with applicable zoning laws, local Master Plan, and anticipated future use of the Site.

Applicable comprehensive community master plans or land use plans: Implementation of all Tracks (with institutional controls) cleanup will facilitate the proposed commercial-residential development, which is consistent with current local land use plan.

Surrounding property uses: Any cleanup approach is not expected to significantly impact land use of the surrounding properties as the truck traffic and access will be on public roads. There will be short term impacts from the remediation and construction project but these will result in long-term benefits of converting defunct, abandoned and contaminated property into new housing and commercial uses.

Citizen Participation: Citizen Participation during implementation of a remedial program will proceed in accordance with the Citizen Participation Plan included as **Appendix B** of this RAWP and as noted above will have minimal community impact. Any short-term impacts will be addressed by the CAMP and HASP.

Environmental justice concerns: There are no known environmental justice concerns associated with this project.

Land use designations: A Track 1 remedy will not restrict any current or future land use designations. A restricted residential Track 2 will have very minimal restrictions on the future land use of the property. A Track 2 will have restrictions that will be managed in the SMP.

Population growth patterns: Any of the proposed remedies will not impact reasonably anticipated population growth patterns in the area other than to better accommodate growth by providing for new downtown, transit-oriented housing.

Accessibility to existing infrastructure: Access to existing infrastructure is present in the surrounding area, and there is access to mass transit via the Metro North train station 0.1 miles away. Some on-site utility infrastructure will likely have to be demolished and removed as part of the remediation. However, new infrastructure will be installed subsequent to the remediation as part of the redevelopment. The sidewalks surrounding the Site are temporarily inaccessible during construction. Any potential sidewalk closures are outside of the BCP site boundary and purview and will be coordinated with the Village of Port Chester Building Department/Building Inspector regarding required sidewalk occupancy pedestrian protection, and/or related permits, as appropriate, to be obtained as part of the overall redevelopment construction.

Proximity to natural resources: The closest surface water body is the Byram River, which is located 900 feet to the east of the subject property and leads to the Long Island Sound. Storm water drainage patterns are generally consistent with the surrounding topography and primarily flow over paved surfaces into storm drains in the surrounding streets. The remediation activities are not anticipated to impact the local natural resources.

Off-Site groundwater impacts: The planned soil and groundwater remediation will eliminate any source material that has the potential to cause off-Site impacts.

Geography and geology of the Site: See Section 2.5 above.

Current Institutional Controls: There are no current institutional controls associated with the Site.

3.3 SELECTION OF THE PREFERRED METHOD

The remedial alternatives analysis determined that a Track 1 with the fallback Track 2 is the preferred remedy for the entire Site because it is the most permanent remedy with the goal of achieving an unconditional Track 1 remedy post COC with the implementation of temporary ICs and ECs as part of the remedy. An unconditional Track 1, which is the ultimate objective, will be attained if groundwater has achieved the AWQS or asymptotic levels and the soil vapor evaluation demonstrates that the soil vapor levels have been reduced such that no mitigation is required. A Track 2 remedy will be the contingency remedy if unconditional Track 1 cannot be achieved.

3.4 SUMMARY OF SELECTED REMEDIAL ACTIONS

The selected remedial actions include implementation of the IRM in accordance with the NYSDEC-approved IRMWP dated April 2023, which involves the excavation and off-site disposal of all contaminated soil to achieve the UUSCOs; implementation of a series of groundwater extraction, amendment and recirculation system and verification sampling; installation of SSDS components; performance of an SVI evaluation; establishment of an EE; and preparation of an SMP, as necessary.

A summary of the selected Track 1 or Track 2 remedial actions to address the impacts identified are discussed below.

Groundwater

Groundwater impacts identified at the Site will be remediated using targeted low-pressure in-situ injection of ISCR/ERD amendments, including GEOFORM® and ZVI, into discrete transmissive bedrock intervals, with interval selection refined through hydraulic testing and packers used where appropriate to isolate treatment zones. A detailed remedial design plan with the extraction well placements, amendment volumes, reinjection wells, etc. is included in the Groundwater Remedial Design Document provided as **Appendix A**. Groundwater sampling will be conducted to assess the effectiveness of the groundwater remedy. The groundwater treatment effectiveness will be assessed to determine the appropriateness of the issuance of the COC. If the treatment is deemed to be effective, but the AWQS are not achieved, the COC will be issued for a Track 2 remedy. Groundwater quality monitoring, and potentially supplemental treatment, will be conducted under an SMP to continue to assess groundwater quality. If the AWQS levels are achieved within a 5-year period, the Track 1 remedy will be complete. If not, the Site will receive

a Track 2 remedy. A groundwater monitoring well will be installed at the southwestern portion of the Site to a depth ranging up 250 ft-bgs to delineate the further delineate the groundwater contamination in the deep aquifer zone as shown in **Figure 3.2**.

Soil Vapor

Soil vapor impacts are being addressed by the installation of soil vapor barrier/waterproofing membrane sealing layer as an element of construction in the sub slab of the building footprint per NYCDOB requirements. Additionally, the elements of the SSDS were installed beneath the lowest level of the building, which has the potential to be an active engineering control based on the results of the SVI evaluation. An SVI Evaluation will be conducted after construction of the building has been completed to determine if an active SSDS is required as an engineering control for the proposed building based on a review of the data compared to the NYSDOH Guidance matrices.

Environmental Easement (EE) and Site Management Plan (SMP)

- Recording of an EE for the entire Site. The EE will remain effective until the EC and ICs are removed if a Track 1 is accomplished within 5 years. If the Track 1 remedy is not achieved in this timeframe because of any remaining on-Site conditions, the EE will continue under a Track 2 remedy for any residual groundwater and soil vapor contamination provided the vapor on Site is not still emanating from an off-site source.
- Preparation of an SMP, for the Track 2 remedy, for long term management of residual contamination as required by the Environmental Easement, particularly as they pertain to future phases of construction, including plans for: (1) Institutional and Engineering Controls, (2) groundwater and soil vapor monitoring, if required, and (3) reporting.

All responsibilities associated with the Remedial Action, including permitting requirements and pretreatment requirements, will be addressed in accordance with all applicable Federal, State and local rules and regulations and overseen and certified by the SESI Remedial Engineer of Record described below.

Remedial activities will be performed at the Site in accordance with this NYSDEC-approved RAWP. All deviations from the RAWP will be promptly reported to NYSDEC for approval and fully explained in the Final Engineering Report (FER).

4.0 REMEDIAL ACTION PROGRAM

4.1 GOVERNING DOCUMENTS

4.1.1 GREEN AND SUSTAINABLE REMEDIATION AND CLIMATE RESILIENCY

Green and Sustainable Remediation (GSR) was evaluated during remedy selection in accordance with DER-31. The selected remedy was assessed with consideration of waste generation, energy usage, air emissions, water usage, and other practicable measures to reduce the overall environmental footprint of the remedial program while maintaining remedy protectiveness and effectiveness. GSR considerations will continue to be incorporated, as practicable, during remedial design and implementation. In addition, an Environmental Footprint Analysis was completed and is presented as **Appendix C**.

4.1.2 SITE-SPECIFIC HEALTH AND SAFETY PLAN (HASP)

A copy of the SESI HASP is included as **Appendix D**. All remedial work performed under this plan will be in full compliance with governmental requirements, including Site and worker safety requirements mandated by Federal OSHA.

The Volunteer and associated parties preparing the remedial documents submitted to the State and those performing the construction work, are completely responsible for the preparation of an appropriate HASP and for the appropriate performance of work according to that plan and applicable laws.

The HASP and requirements defined in this RAWP pertain to all remedial and invasive work performed at the Site until the issuance of a Certificate of Completion.

4.1.3 QUALITY ASSURANCE PROJECT PLAN (QAPP)

A copy of SESI QAPP is included as **Appendix E**. All field sampling procedures and analytical methods will be implemented in accordance with this QAPP.

4.1.4 STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

A SWPPP is not required as the Site is less than one (1) acre in size.

4.1.5 COMMUNITY AIR MONITORING PLAN (CAMP)

As needed, community air monitoring will be conducted. A copy of the CAMP for the site is included as **Appendix F**.

4.2 GENERAL REMEDIAL CONSTRUCTION INFORMATION

4.2.1 PROJECT ORGANIZATION

Port Chester OZ Fund III QOZB, LLC is the BCP Volunteer and redeveloper of the Site. SESI is the environmental consultant for the Volunteer. A table summarizing the various personnel associated with the project is included as **Table 4.2** below.

Table 4.2 – Project Personnel

Name	Company	Project Position	Address	Phone Number
Nicholas Williams	Port Chester OZ Fund III QOZB, LLC	Volunteer Contacts	181 Westchester Avenue, Suite 301A, Port Chester, NY 10573	
Sheng Long	SESI Consulting Engineers, P.C.	Project Engineer	959 Rt 46 East, Parsippany, NJ 07054	(973) 808-9050
Andrew Schweitzer, PE	SESI Consulting Engineers, P.C.	Environmental Consultant's Project Manager	959 Rt 46 East, Parsippany, NJ 07054	(973) 808-9050
Andrew Schweitzer, PE	SESI Consulting Engineers, P.C.	Remedial Engineer	959 Rt 46 East, Parsippany, NJ 07054	(973) 808-9050
Greta Kowalski	NYSDEC	Project Manager	625 Broadway, Albany, NY 12233	518-402-2029

4.2.2 REMEDIAL ENGINEER

The Remedial Engineer for this project will be Andrew Schwietzer. Remedial Engineer is a registered professional engineer licensed by the State of New York. The Remedial Engineer will have primary direct responsibility for implementation of the remedial program for the Grand Union Hotel Bowling Alley Site (Site No. C360222). The Remedial Engineer will certify the FER that the remedial activities were observed by qualified environmental professionals under his supervision and that the remediation requirements set forth in the RAWP and any other relevant provisions of ECL 27-1419 have been achieved in full conformance with that Plan. Other Remedial Engineer certification requirements are listed later in this RAWP.

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

The Remedial Engineer will provide the certifications listed in the FER.

4.2.3 REMEDIAL ACTION SCHEDULE

A remedial action schedule is included as **Table 4.3** below. The schedule includes estimates of time required to complete the activities associated with the remedial action. It is based on elapsed time from receipt of NYSDEC approval. Once NYSDEC approves this RAWP, an updated schedule showing actual dates will be provided to the NYSDEC as an addendum to this plan.

Table 4.3 – Remedial Action Schedule

Activity	Date
RIR submission	May 2026
Completion of IRM for soil excavation	April 2025
RAWP submission	June 2026
CCR for IRM	May 2026
Start of RAWP Public Comment period	June 2026
Environmental Easement	June 2026
Submission SMP	August 2026
NYSDEC approves RAWP and issues decision document	August 2026
Groundwater remediation	August/September 2026
Groundwater sampling	September 2026
Submission of FER	October 2026
Certificate of Completion	December 2026

4.2.4 WORK HOURS

The hours for operation of remedial construction will conform to the City of Port Chester Department of Buildings construction code requirements or according to specific variances issued by that agency. NYSDEC will be notified by the Applicant of any variances issued by the Department of Buildings.

4.2.5 SITE SECURITY

The Site will be secured with fences and locked gates. Access to Site will be limited to authorized personnel.

4.2.6 NYSDEC BCP SIGNAGE

A project sign will be erected at the main entrance to the Site if required by NYSDEC to indicate that the project is being performed under the New York State Brownfield Cleanup Program.

4.2.7 PRECONSTRUCTION MEETING WITH NYSDEC

A pre-construction meeting was held with the NYSDEC case manager on August 21, 2024.

4.2.8 EMERGENCY CONTACT INFORMATION

An emergency contact sheet with names and phone numbers is included in **Table 4.4** below. That document will define the specific project contacts for use by NYSDEC and NYSDOH in case of a day or night emergency.

Table 4.4 - Emergency and Contact Numbers

Medical, Fire, and Police:	911
One Call Center:	(800) 272-4480 (3-day notice required for utility markout)
Poison Control Center:	(800) 222-1222
Pollution Toxic Chemical Oil Spills:	(800) 424-8802
NYSDEC Spills Hotline	(800) 457-7362
Andrew Schweitzer– Remedial Engineer (SESI Consulting Engineers)	(973) 808-9050
Director of Construction	(908)483-2639

* Note: Contact numbers subject to change and will be updated as necessary

4.3 SITE PREPARATION

4.3.1 MOBILIZATION

Mobilization tasks will include:

- Construction of temporary facilities and utilities;
- Set-up of construction equipment and facilities;
- Construction of fencing and barriers;
- Construction of erosion control measures; and
- Construction of decontamination and materials staging areas.

4.3.2 EROSION AND SEDIMENTATION CONTROLS

A SWPPP is not required as the Site is less than one (1) acre in size.

4.3.3 UTILITY MARKER AND EASEMENTS LAYOUT

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

4.3.4 SHEETING AND SHORING

An SOE system was installed in accordance with the approved IRMWP prior to the excavation activities as part of the Site preparation activities and is explained in detail in the IRMWP.

The Volunteer and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan and the implementation of safety measures (Sheeting and Shoring) as necessary to maintain safe working environment. The Volunteer and its contractors will obtain any local, State or Federal permits or approvals that may be required to perform work under this Plan. Further, the Volunteer and its contractors are solely responsible for the implementation of all required, appropriate, or necessary health and safety measures during performance of work under the approved Plan.

4.3.5 DEWATERING

Dewatering was conducted during soil excavation activities performed as part of the IRMWP. The dewatering plan is provided in Appendix C of the IRMWP. Groundwater was pumped into a frac tank and treated through an on-site treatment system. The treated groundwater was then discharged to the village storm sewer in accordance with the Village Engineer. Details are included in the CCR. No further dewatering is anticipated for the remaining remedial activities proposed under this RAWP.

4.3.6 EQUIPMENT AND MATERIAL STAGING

Equipment and material staging areas are expected to be relocated throughout the Site during remedial construction.

4.3.7 DECONTAMINATION AREA

The proposed activities include groundwater injection from a trailer. The equipment will be driven on hard surfaces; therefore, a decontamination pad will not be required. The injection equipment will be decontaminated and the wash-water will be disposed of properly.

4.3.8 SITE FENCING

A construction safety fence is installed around the entire perimeter of the Site. Access through gates will be provided at various points as required by the Volunteer and its contractors. These gates will be locked during non-activity hours.

4.3.9 DEMOBILIZATION

Demobilization will include the following:

- Equipment decontamination; and
- General refuse disposal.

4.4 REPORTING

4.4.1 WEEKLY REPORTS

Weekly reports will be submitted to NYSDEC and NYSDOH Project Managers on Monday following the end of the week of the reporting period and will include:

- Activities relative to the Site during the previous reporting period and those anticipated for the next reporting period, including a quantitative presentation of work performed (i.e. tons of material exported and imported, etc.);
- Description of approved activity modifications, including changes of work scope and/or schedule;
- Sampling results, if applicable, received following internal data review and validation, as applicable; and,
- An update of the remedial schedule including the percentage of project completion, unresolved delays encountered or anticipated that may affect the future schedule, and efforts made to mitigate such delays.
- A description of any CAMP exceedances recorded, and actions taken to remedy any exceedances. All CAMP results will be reported to NYSDEC and NYSDOH Project

Managers on a daily basis. Any CAMP exceedances, and the actions taken to address those exceedances, will be reported immediately to NYSDEC and NYSDOH by email or phone call.

- A description of CAMP noise, odor, and/or vibration complaints will be reported to the NYSDEC and NYSDOH project managers on a daily basis.

4.4.2 OTHER REPORTING

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

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

4.4.3 COMPLAINT MANAGEMENT PLAN

A public information board will be constructed at the perimeter of the Site. This information board will contain the phone number of the Volunteer where complaints may be directed. General information notices to the public will also be posted on this board for their benefit.

4.4.4 DEVIATIONS FROM THE REMEDIAL ACTION WORK PLAN

If there are any deviations from the RAWP, the following steps will be taken.

- Reasons for deviating from the approved RAWP will be identified and communicated directly to the NYSDEC Project Manager;
- All deviations will be communicated verbally and in writing (by letter or email) to the NYSDEC Project Manager;
- The deviations will be implemented based on verbal or written approval of the NYSDEC Project Manager. All verbal approvals will be followed-up in writing.
- The effect of the deviations on the overall remedy will be described/addressed in the FER.

5.0 REMEDIAL ACTION

Removal of all contaminated soils is being conducted in accordance with IRMWP dated April 2023.

Groundwater impacts identified at the Site are expected to be remediated using targeted low-pressure in-situ injection of ISCR/ERD amendments, including GEOFORM® and ZVI, into discrete transmissive bedrock intervals, with interval selection refined through hydraulic testing and packers used where appropriate to isolate treatment zones. Groundwater sampling will be conducted to assess the effectiveness of the groundwater remedy.

Finally, as a conservative engineering measure, a soil vapor barrier and waterproofing membrane will be installed beneath the basement-level concrete slab within the building footprint in accordance with the approved project design and manufacturer specifications. Additionally, components of a passive SSDS—which may be upgraded to an active system depending on the results of the SVI evaluation—are being installed. The SSDS layout is shown in **Figure 6.1**.

5.1 CLEANUP OBJECTIVES

The Soil Cleanup Objectives for this Site are the Track 1 UUSCOs as listed in **Appendix G** and explained in the IRMWP.

Groundwater cleanup objectives will be the NYSDEC TOGS AWQS, significant reduction of groundwater contaminant concentrations or asymptotic levels accepted by the NYSDEC and NYSDOH.

Soil vapor mitigation objectives will be the NYSDOH Guideline Values and Decision Matrices for specific contaminants of concern.

5.2 REMEDIAL PERFORMANCE EVALUATION

5.2.1 SOIL REMOVAL VERIFICATION

Soil removal verification was conducted in accordance with the IRMWP. Since all site soils are being excavated and transported offsite for disposal, verification will consist of a bedrock surface survey and photographic documentation of the exposed bedrock.

5.2.2 GROUNDWATER REMEDY VERIFICATION

Groundwater sampling will be conducted to evaluate the appropriateness of issuing the COC. As appropriate, monitoring wells will be installed in accordance with the approved RIWP, and a proposed monitoring well location plan included in the Groundwater Remedial Design Document provided as **Appendix A**. The wells will be sampled for VOCs, SVOCs, metals, and PFAS. The results will be presented in the FER.

If contaminant concentrations are reduced below the AWQS, the Site will qualify for an unconditional Track 1 remedy. If the treatment is deemed to be effective, but the AWQS are not achieved, the COC will be issued for a Track 2 remedy. Groundwater quality monitoring, and potentially supplemental treatment, will be conducted under an SMP to continue to assess groundwater quality. If the AWQS levels are achieved within a 5-year period, the Track 1 remedy will be complete. If not, the Site will receive a Track 2 remedy. An additional well will be installed during the remedial action at the southwestern side of the Site to further delineate the deep groundwater contamination.

5.2.3 SVI EVALUATION

An SVI evaluation will be conducted after construction of the building is complete. A vapor barrier/waterproofing membrane equipped with sampling ports, along with the components of a passive SSDS, has been installed beneath the lowest slab. The evaluation will involve collecting co-located sub-slab vapor and indoor air samples to assess soil vapor intrusion risk on Site.

If the evaluation indicates that there is no potential for soil vapor intrusion, the elements of SSDS will not be considered an EC. If the results suggest that vapor intrusion risk is present, the elements of SSDS will be activated and operated as an EC. At a minimum, the active system will include:

- A blower to induce sub-slab depressurization.
- The SMP will be updated to include the operation and maintenance of the active SSDS
- Vacuum gauges or equivalent monitoring devices to demonstrate that adequate vacuum is being maintained on each riser and within the system.

If mitigation is required, the system will be inspected, operated, maintained, and monitored in accordance with the SMP until NYSDEC determines that it is no longer required. The Environmental Easement and SMP will include requirements for operation, maintenance, monitoring, reporting, and notification of any system malfunction.

5.3 METHODOLOGY

Groundwater samples will be collected from monitoring wells using low-flow sampling methods in accordance with the QAPP. Soil vapor and indoor air samples will be collected in accordance with the QAPP using stainless steel Summa® canisters.

5.4 REPORTING OF RESULTS

The samples will be submitted to a NYSDOH Environmental Laboratory Accreditation Program (ELAP) certified laboratory. The results will be reported in accordance with NYSDEC requirements for Category B data deliverables (as outlined in DER-10).

5.5 QA/QC

Collection of quality assurance/quality control (QA/QC) samples to evaluate potential cross-contamination from sampling equipment and during shipment of samples and repeatability of laboratory analytical practices will be in accordance with the QAPP included as **Appendix E**. Field blanks, trip blanks and duplicate samples associated with daily sampling activities will be collected as a part of the QA/QC practices.

5.6 DUSR

To ensure that the field sampling and laboratory analytical practices are acceptable, the data associated with all the samples will be validated by a third party (in accordance with requirements of DER-10). The validation approach and results will be presented in a DUSR to be included in the FER.

5.7 REPORTING OF PERFORMANCE MONITORING DATA IN FER

To document the completion of the soil remediation, the bedrock surface survey and photo documentation will be included in the CCR and FER.

One (1) round of groundwater samples will be collected after implementation of the treatment plan. All injection and groundwater monitoring data will be reported in the FER.

5.8 MATERIAL REMOVAL QUANTITIES

Soil excavation and associated dewatering have been conducted in accordance with the IRMWP. The actual volume of soil and groundwater removed based on the tally of the manifests and tickets and documented pumping will be provided in the CCR.

Water to be generated during well installation and sampling will be pumped into 55-gallon drums for offsite disposal. All the drums will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. The Groundwater Remedial Design Document is provided as **Appendix A** and provides the anticipated remedial water volumes to be generated and removed from the Site.

5.9 SOIL/MATERIALS MANAGEMENT PLAN

The procedures for managing contaminated soils during excavation—including soil screening, stockpiling, excavation and load-out, off-site transport and disposal, fluids management, demarcation barriers, off-site backfill sourcing, and contingency planning—are outlined in the IRMWP. Soil excavation and backfilling were conducted in accordance with the IRMWP, and the details are documented in the CCR. As such, no additional soil or materials management activities are anticipated during the remedial action phase under this RAWP, other than those associated with the installation of remedial wells, including injection wells, or other subsurface remedial components, if applicable.

5.9.1 COMMUNITY AIR MONITORING PLAN

As needed, community air monitoring will be conducted. A copy of the CAMP for the Site is included as **Appendix F**. Exceedances observed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers and included in the Weekly Report.

5.9.2 ODOR, DUST, AND NUISANCE CONTROL PLAN

Odor, dust and nuisance control will be in accordance with the site-specific Health and Safety Plan included as **Appendix D** for any well installation or other invasive work performed under this RAWP.

The FER will include the following certification by the Remedial Engineer: "I certify that all invasive work during the remediation and all invasive development work were conducted in accordance with dust and odor suppression methodology defined in the Remedial Action Work Plan."

Odor Control Plan

This odor control plan is designed to control emissions of nuisance odors off-Site during well installation or other invasive remedial activities. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of all other complaints about the project. Implementation of all odor controls, including the halt of work, will be the responsibility of the Applicant's Remediation Engineer, who is responsible for certifying the Final Engineering Report.

All necessary means will be employed to prevent on- and off-Site nuisances. At a minimum, procedures will include: (a) limiting the extent and duration of invasive activities associated with well installation; (b) covering soil cuttings or other exposed materials, as appropriate; and (c) using odor suppression measures, as needed, during well installation activities. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) prompt containerization and off-Site disposal of soil cuttings or other odor-generating materials; (e) use of chemical deodorants in spray or misting systems; and (f) 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, as appropriate, by a combination of work stoppages, sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

Dust Control Plan

A dust suppression plan that addresses dust management during invasive on-Site work associated with well installation or other invasive remedial activities will include, at a minimum, the items listed below:

- Dust suppression will be achieved through the use of a dedicated on-Site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including active work areas and any temporary drill cuttings management areas.
- Well installation activities will be conducted in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-Site roads will be limited in total area to minimize the area required for water truck sprinkling.

Other Nuisances

A plan for rodent control will be developed and utilized by the contractor during any well installation activities performed under this RAWP.

A plan will be developed and utilized by the contractor for all remedial work and will conform, at a minimum, to local noise control standards.

6.0 ENGINEERING CONTROLS

After the remedy is complete, no soil contamination is anticipated to remain in place above the Track 1 SCOs, requiring no EC for soil. The ECs for groundwater and soil vapor are discussed below.

6.1 GROUNDWATER MONITORING SYSTEM

One (1) groundwater sampling round will be conducted after the completion of the remedial action to confirm the remedial activities reduced the groundwater concentrations to below the AWQS. Based on the groundwater results and if long term monitoring is needed, a network of groundwater monitoring wells will be utilized to monitor the groundwater quality and to demonstrate the reduction in groundwater contamination to asymptotic levels. The long-term groundwater monitoring protocol, if needed, will be described in the SMP. At least four (4) quarters of groundwater samples below ambient water quality standards are needed before declaring the groundwater remedy complete or proving contamination levels are asymptotic at levels accepted by the NYSDEC and NYSDOH.

6.2 SSDS PIPING AND VAPOR BARRIER

The components of a SSDS, including venting pipes and a vapor barrier, are currently being installed beneath the building slab (**Figure 6.1**). Following construction of the building, an SVI evaluation—consisting of sub-slab vapor and indoor air sampling—will be conducted. If vapor mitigation is not deemed necessary, the SSDS will not be considered an EC. However, if mitigation is required, the system will be connected to an external blower and function as an active SSDS, serving as an EC.

It is anticipated that soil vapor evaluation results will demonstrate that soil vapor-related EC will not be necessary beyond the five-year period following issuance of the COC, thereby achieving the objective of a Track 1 remedy for soil vapor. If this is not the case, a Track 2 remedy incorporating a soil vapor EC will serve as the contingency approach until future sampling indicates the EC is no longer required.

7.0 INSTITUTIONAL CONTROLS

After the remedy is complete, the Site may have residual groundwater and/or soil vapor contamination remaining in place. If no residual contamination is determined to be present, then Sections 7.1 and 7.2 below will not be applicable to this Site. Engineering Controls (ECs) for the residual contamination have been incorporated into the remedy to render the overall Site remedy protective of public health and the environment. Two elements have been designed to ensure continual and proper management of residual contamination in perpetuity: an Environmental Easement and a SMP.

All as-built drawings, diagrams, calculations and manufacturer documentation for treatment systems will be presented in the FER. A Site-specific Environmental Easement will be recorded with the Westchester County Clerk to provide an enforceable means of ensuring the continual and proper management of residual contamination and protection of public health and the environment in perpetuity or until released in writing by NYSDEC. It requires that the grantor of the Environmental Easement and the grantor's successors and assigns adhere to all Engineering and Institutional Controls (ECs/ICs) placed on this Site by this NYSDEC-approved remedy. ICs provide restrictions on Site usage and mandate operation, maintenance, monitoring and reporting measures for all ECs and ICs. The SMP describes appropriate methods and procedures to ensure compliance with all ECs and ICs that are required by the Environmental Easement. Once the SMP has been approved by the NYSDEC, compliance with the SMP is required by the grantor of the Environmental Easement and grantor's successors and assigns.

7.1 ENVIRONMENTAL EASEMENT

An Environmental Easement, as defined in Article 71 Title 36 of the Environmental Conservation Law, is required when residual contamination is left on-Site after the Remedial Action is complete. As part of this remedy, an Environmental Easement approved by NYSDEC will be filed and recorded with the NYC Office of the City Register. The Environmental Easement will be submitted as part of the Final Engineering Report.

The Environmental Easement renders the Site a Controlled Property. The Environmental Easement must be recorded Westchester County Clerk before the Certificate of Completion can be issued by NYSDEC. A series of Institutional Controls are required under this remedy to

implement, maintain and monitor these Engineering Control systems, prevent future exposure to residual contamination by controlling disturbances of the subsurface soil and restricting the use of the Site to restricted-residential, commercial, or industrial use(s) only. These Institutional Controls are requirements or restrictions placed on the Site that are listed in, and required by, the Environmental Easement. Institutional Controls can, generally, be subdivided between controls that support Engineering Controls, and those that place general restrictions on Site usage or other requirements. Institutional Controls in both of these groups are closely integrated with the SMP, which provides all of the methods and procedures to be followed to comply with this remedy.

The Institutional Controls that support Engineering Controls are:

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

If long-term engineering controls or institutional controls are no longer necessary within the 5-year post-COC period then the EE will no longer be necessary and a request will be made to the NYSDEC to remove the EE.

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

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

7.2 SITE MANAGEMENT PLAN

Site Management is the last phase of remediation and begins with the approval of the FER and issuance of the Certificate of Completion for the Remedial Action. The SMP will be submitted as part of the FER but will be written in a manner that allows its removal and use as a complete and independent document. Site Management continues in perpetuity or until released in writing by NYSDEC. The property owner is responsible to ensure that all Site Management responsibilities defined in the Environmental Easement and the SMP are performed.

The SMP should include methods to incorporate and track GSR. Measures should be taken to maintain a cost-effective, protective remedy that remains conscientious of the Site's environmental footprint. At a minimum, the following should be assessed: waste generation, energy usage, emissions, and water usage.

The SMP is intended to provide a detailed description of the procedures required to manage residual contamination left in place at the Site following completion of the Remedial Action in accordance with the BCA with the NYSDEC. This includes: (1) development, implementation, and management of all Engineering and Institutional Controls; (2) development and implementation of monitoring systems and a Monitoring Plan; (3) development of a plan to operate and maintain any treatment, collection, containment, or recovery systems (including, where appropriate, preparation of an Operation and Maintenance Manual); (4) submittal of Site Management Reports, performance of inspections and certification of results, and demonstration of proper communication of Site information to NYSDEC; and (5) defining criteria for termination of treatment system operation.

To address these needs, this SMP will include six (6) plans: (1) an Engineering and Institutional Control Plan for implementation and management of EC/ICs; (2) a Monitoring Plan for implementation of Site Monitoring; (3) an Operation and Maintenance Plan for implementation of remedial collection, containment, treatment, and recovery systems; and (4) a Site Management Reporting Plan for submittal of data, information, recommendations, and certifications to NYSDEC; (5) a Corrective Measure Work Plan, which will describe the procedures for evaluating, implementing, and documenting any corrective measures necessary to maintain the effectiveness of the remedy; and (6) an Excavation Work Plan, which will describe the procedures for managing future intrusive activities, including soil and materials handling, characterization, disposal, and documentation, as applicable. The SMP will be prepared in accordance with the requirements in NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation and the guidelines provided by NYSDEC.

Site management activities, reporting, and EC/IC certification will be scheduled on a certification period basis. The certification period will be annually. The SMP will be based on the certifying period relative to the date of issuance of the COC. The first submission will be due 16 months

after the issuance of the COC, and annually (or at another frequency as approved by NYSDEC) thereafter.

No exclusions for handling of residual contaminated soils will be provided in the SMP. All handling of residual contaminated material will be subject to provisions contained in the SMP.

8.0 FINAL ENGINEERING REPORT

A FER will be submitted to NYSDEC following implementation of the Remedial Action defined in this RAWP. The FER provides the documentation that the remedial work required under this RAWP has been completed and has been performed in compliance with this plan. The FER will provide a comprehensive account of the locations and characteristics of the Site preparation, SOE installation and all material removed from the Site including the surveyed map(s) of all sources. The FER will include as-built drawings for all constructed elements, calculations and manufacturer documentation for treatment systems, certifications, manifests, bills of lading as well as the complete Site Management Plan. The FER will provide a description of the changes in the Remedial Action from the elements provided in the RAWP and associated design documents. The FER will provide a tabular summary of all performance evaluation sampling results and all material characterization results and other sampling, and chemical analysis performed as part of the Remedial Action. The FER will be prepared in conformance with DER-10 and DER-31.

Where determined to be necessary by NYSDEC, a Financial Assurance Plan will be required to ensure the sufficiency of revenue to perform long-term operations, maintenance and monitoring tasks defined in the Site Management Plan and Environmental Easement. This determination will be made by NYSDEC in the context of the FER review.

The FER will include written and photographic documentation of all remedial work performed under this remedy.

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

The FER will provide a thorough summary of any residual contamination left on the Site after the remedy is complete. Residual contamination includes all contamination that exceeds the Track 1 USCO in 6NYCRR Part 375-6. A table that shows exceedances of Track 1 USCOs for any soil/fill remaining at the Site after the Remedial Action will be included in the FER, if Track 1 is not achieved. A map that shows the location and summarizes exceedances of Track 1 USCOs for any soil/fill remaining at the Site after the Remedial Action will be included in the FER.

The FER will provide a thorough summary of any residual contamination that exceeds the SCOs defined for the Site in the RAWP, if present, and must provide an explanation for why the material was not removed as part of the Remedial Action. A table that shows residual contamination in excess of Site SCOs and a map that shows residual contamination in excess of Site SCOs will be included in the FER.

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

The FER must include a discussion of the green remediation practices/technologies employed throughout the remedial program. A final footprint analysis should be prepared using a DER accepted model, and any tracking methods used through the construction including restoration activities. Before approval of a FER and issuance of a Certificate of Completion, all project reports must be submitted in digital form on electronic media (PDF).

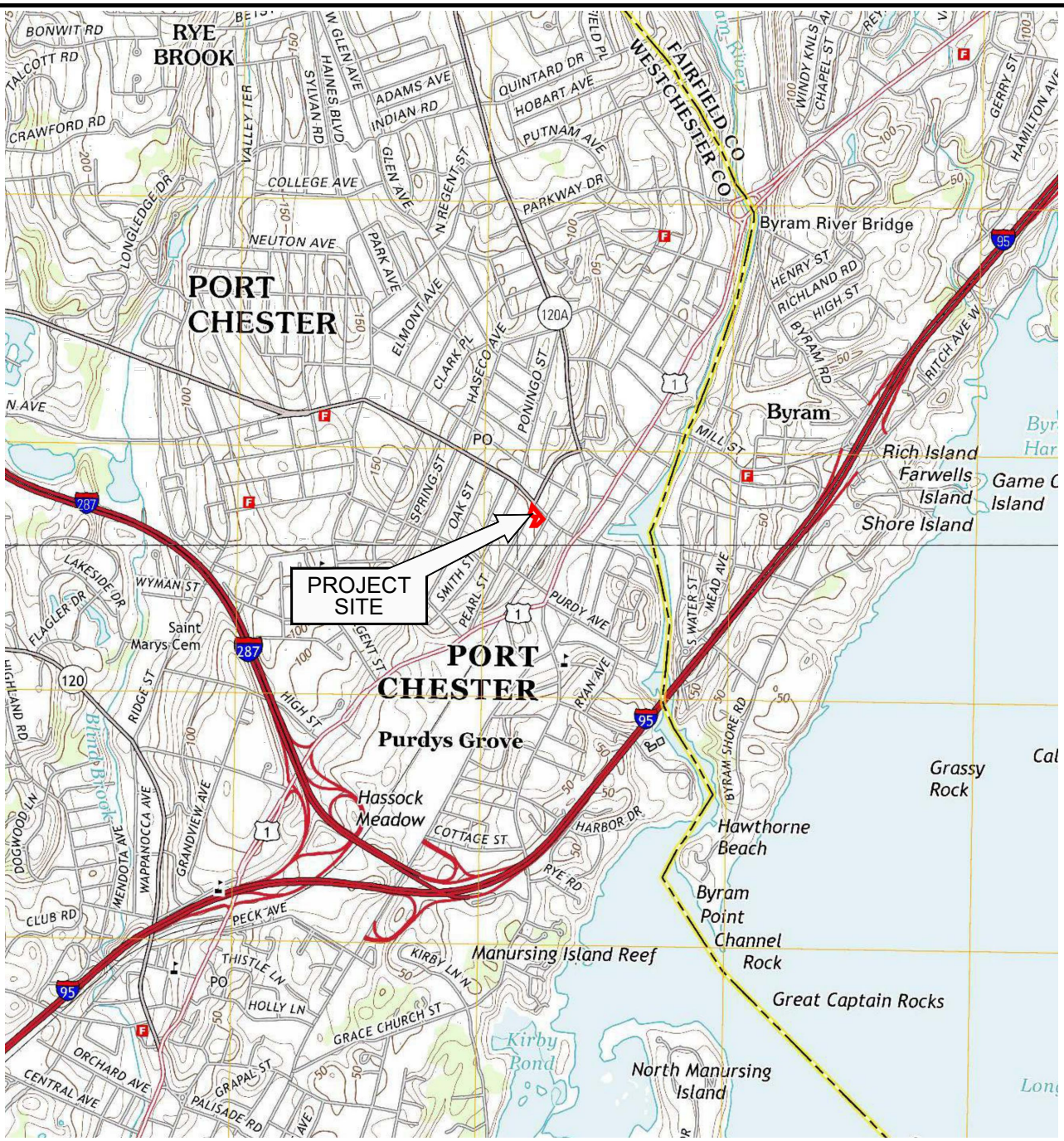
8.1 CERTIFICATIONS

I _____certify that I am currently a NYS registered professional engineer, I had primary direct responsibility for the implementation of the subject construction program, and I certify that the Remedial Work Plan was implemented and that all construction activities were completed in substantial conformance with the DER-approved Remedial Work Plan and in accordance with applicable DER-10 and DER-31 requirements.

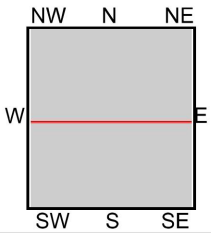
I certify that all use restrictions, institutional controls, engineering controls and/or any operation and maintenance requirements applicable to the site are contained in an environmental easement created and recorded pursuant to ECL 71-3605 and that any affected local governments, as defined in ECL 71-3603, have been notified that such easement has been recorded.

I certify that a Site Management Plan has been submitted for the continual and proper operation, maintenance, and monitoring of any engineering controls employed at the site including the proper maintenance of any remaining monitoring wells, and that such plan has been approved by DER.

Figures



This report includes information from the following map sheet(s).



TP, Glenville, 2012, 7.5-minute
S, Mamaroneck, 2013, 7.5-minute

PHASE II INVESTIGATION
140, 148-150 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

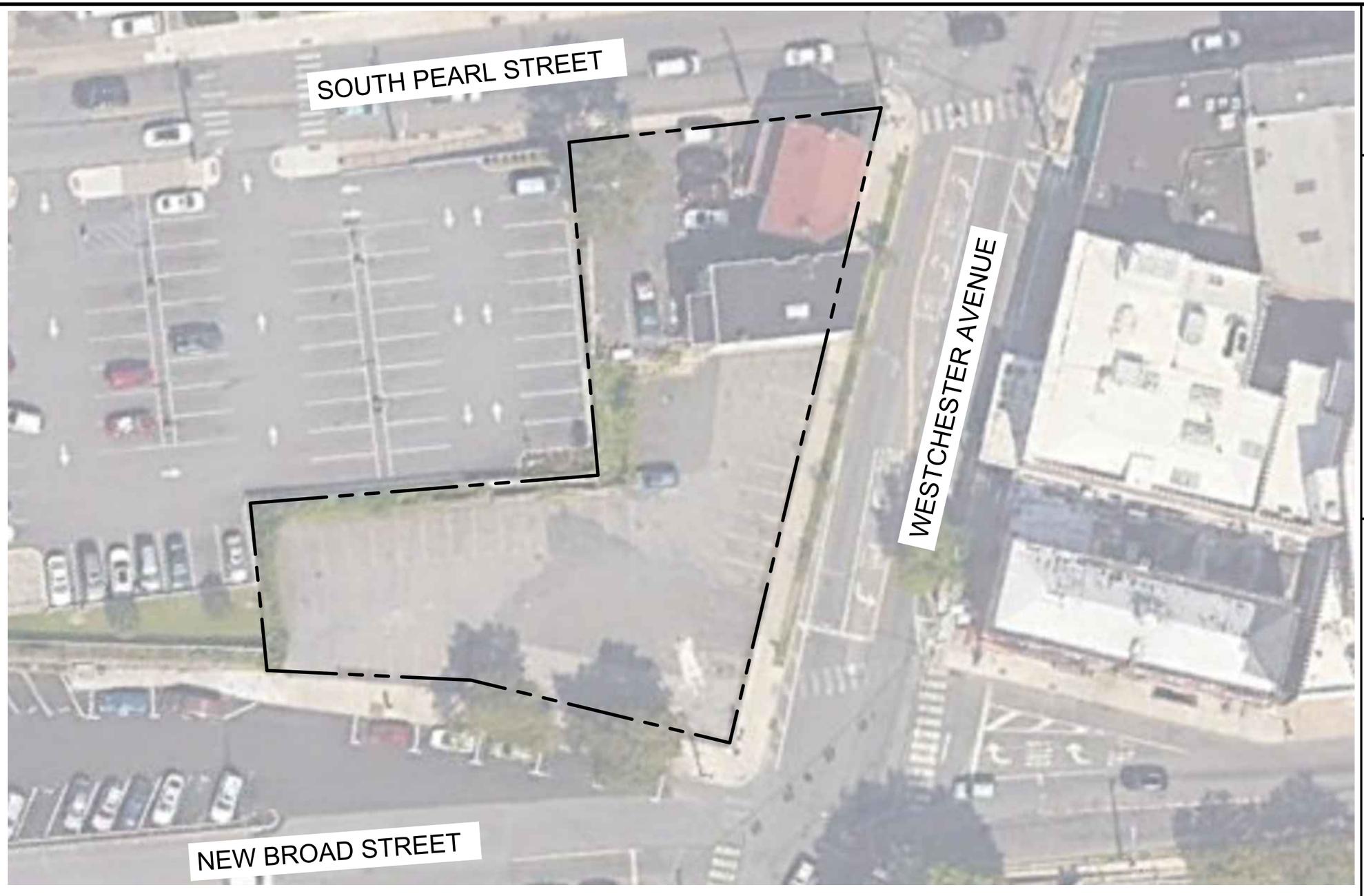
SITE LOCATION MAP

SESI CONSULTING ENGINEERS
SOILS / FOUNDATIONS
SITE DESIGN
ENVIRONMENTAL
12A MAPLE AVE. PINE BROOK, N.J. 07058 PH: 973-808-9050

FIG-1.1

DRAWN BY: yy
CHECKED BY: RW
SCALE: N.T.S.
DATE: 06/17/2021
JOB NO.: 11895

N:\ACAD\11895\11895 – FIG–1 – SITE LOCATION MAP.DWG 06/17/21 09:16:56AM, jenny, LAYOUT:FIG–1.1



NYS Education Law
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REFERENCE
SITE SURVEY PREPARED BY RICHARD J. DOMATO, DATED MARCH 5, 2021.

NOTE:
THIS PLAN IS FOR LOCATING SOIL BORINGS ONLY.
OTHER SITE WORK SHOWN HERE IS NOT INTENDED FOR CONSTRUCTION.

LEGEND:
- - - - BCP SITE BOUNDARY

Scale 1"=40'
0 40 80

dwg by: AW
chk by: JS
scale: AS NOTED
date: 05/14/2024

SESI CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | SITE CIVIL
959 ROUTE 46E, 3RD FLOOR, PARSIPPANY, NJ 07054 PH: 973.808.9050

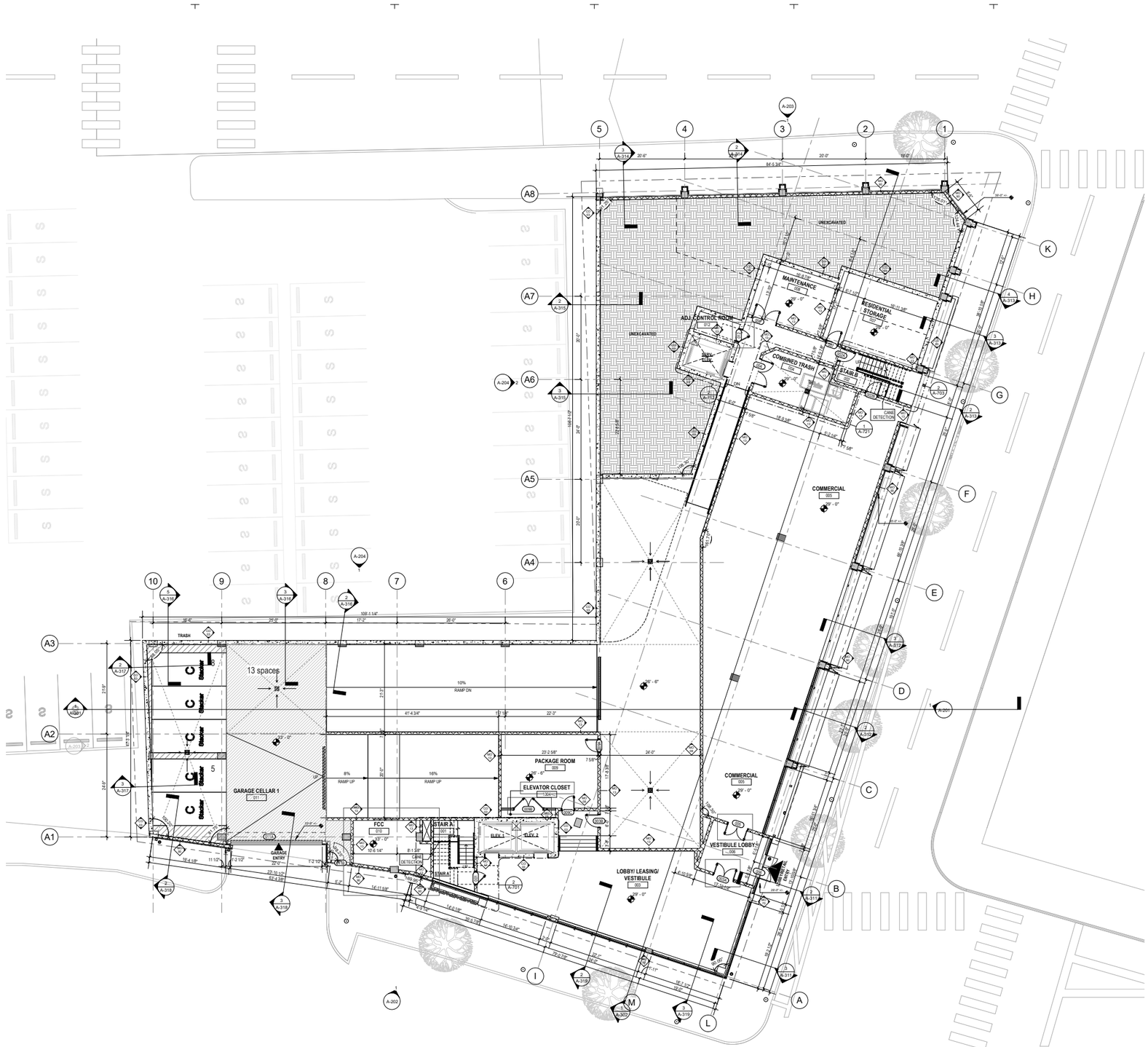
project: REMEDIAL ACTION WORK PLAN
140, 148-150 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

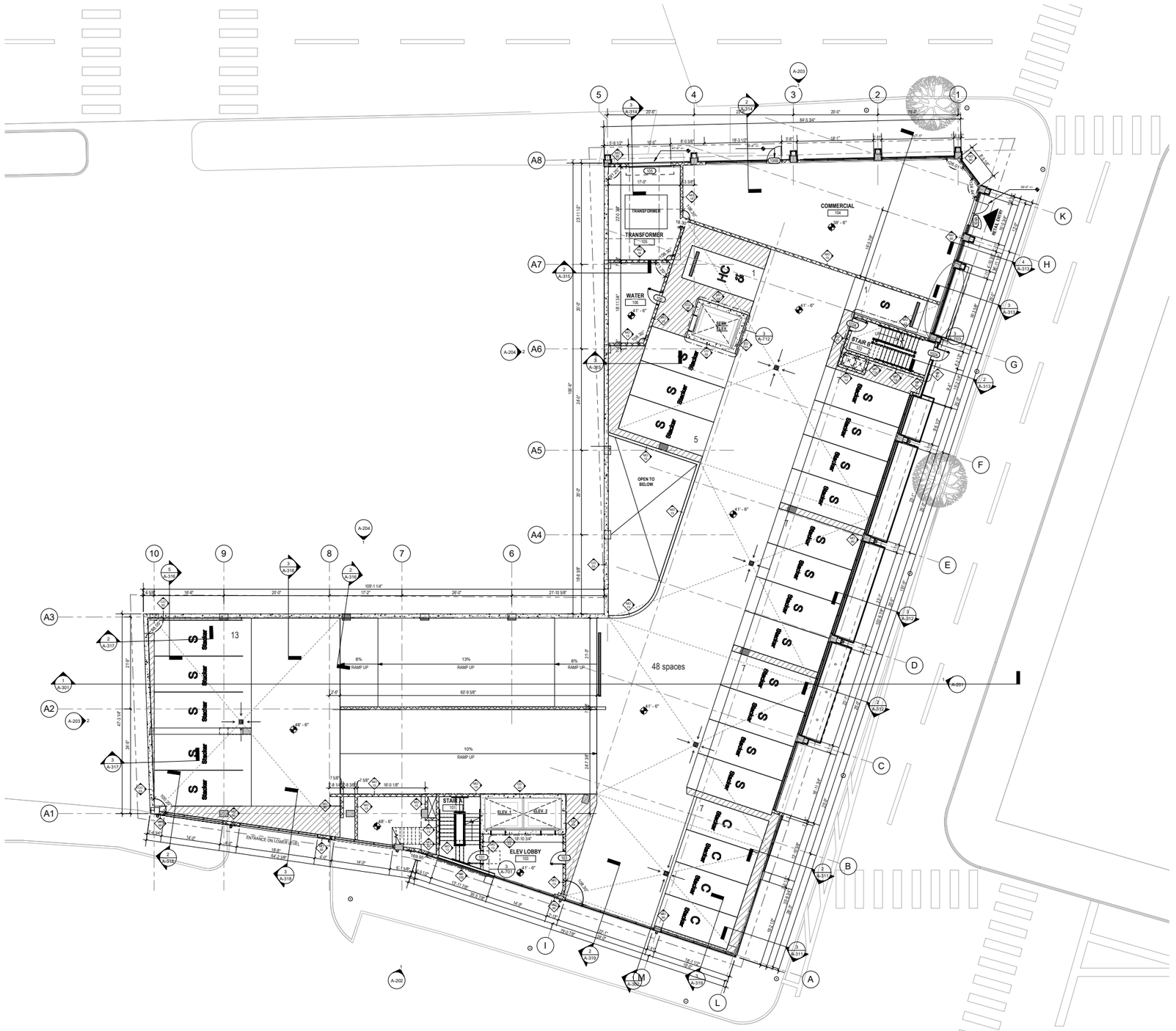
title: BCP BOUNDARY MAP

job no: 11895A
drawing no:

FIG-1.2

N:\ACAD\11895A\CAD\ENVIRONMENTAL\RAWP\11895 – FIG-1.2 – BCP BOUNDARY MAP.DWG 05/14/24 08:37:51AM, alan.ward, LAYOUT:FIG-3.1 SAMPLE LOC PLAN


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1ST FLOOR PLAN

Scale: 1/8" = 1'-0"

PARKING NOTES

1. THE PARKING AREAS OF ALL BUILDINGS AND FACILITIES, INCLUDING THE BUILDINGS AND FACILITIES OF STATE AND LOCAL GOVERNMENT, SHALL IDENTIFY EACH ACCESSIBLE PARKING PACE BY A SIGN.
2. IF THE SIGN IN D(1) OF THIS REGULATION IS:
2.A. NOT PLACED FLUSH AGAINST A BUILDING, STRUCTURE, OR OTHER LOCATION THAT DOES NOT OBSTRUCT VEHICLE OR PEDESTRIAN TRAFFIC, IT SHALL BE AT LEAST 7 FEET ABOVE THE GROUND;
2.B. PLACED FLUSH AGAINST A BUILDING STRUCTURE OR OTHER LOCATION THAT DOES NOT OBSTRUCT VEHICLE OR PEDESTRIAN TRAFFIC, IT SHALL BE AT LEAST 6 FEET, AND NOT MORE THAN 10 FEET, ABOVE THE GROUND;

PARKING LEGEND

S	STANDARD PARKING
C	COMPACT PARKING
HC	HANDICAP PARKING
HC VAN	VAN HANDICAP PARKING

KEY NOTES

1. BOLLARDS
2. BIKE RACKS
3. BIKE RACKS - WALL MOUNTED
4. LIGHT FIXTURE (REFER TO MEP/ID DWGS)
5. EXHAUST VENT AND LOUVERS (REFER TO ELEVATION AND MEP DWGS)
6. STORAGE UNITS
7. SUNSHADE (REFER TO ELEVATION AND DETAILS)
8. GAS METER
9. TWO STAGE DRAIN

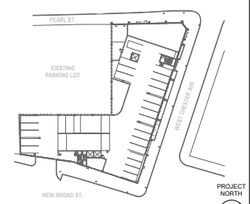
LEGEND

FCO	FLOOR CLEAN OUT (SEE PLUMBING DWGS)
FD	FLOOR DRAIN (SEE PLUMBING DWGS)
GD	GARAGE DRAIN (SEE PLUMBING DWGS)
HP	HIGH POINT
LP	LOW POINT
RD	ROOF DRAIN
OD	OVERFLOW DRAIN
FDC	FREE STANDING FIRE DEPARTMENT CONNECTION
DS	DOWNSPOUT
OS	OVERFLOW SCUPPER
EJ	EXPANSION JOINT
FOP	FACE OF METAL PANEL
FOB	FACE OF BRICK
FOD	FACE OF DRYVIT FINISH
FOC	FACE OF CONCRETE
FOS	FACE OF STONE
FEC	FIRE EXTINGUISHER CABINET
TD	TRENCH DRAIN (SEE PLUMBING DWGS)

WALL TYPE LEGEND

- CONCRETE WALL (REFER TO STRUCTURAL DWGS)
- BEARING WALL (REFER TO STRUCTURAL DWGS)
- SHEAR WALL (REFER TO STRUCTURAL DWGS)
- DEMISING WALL

KEYPLAN



ARCHITECT:
lessard DESIGN INC. P.C.
8521 Leesburg Pike | Suite 700 | Vienna, VA 22182
P-571.830.1800 | F-571.830.1801
www.LessardDesign.com

SEAL & SIGNATURE:

OWNER:
SAXUM REAL ESTATE
359 Springfield Ave - 2nd Fl.
Summit, NJ 07901

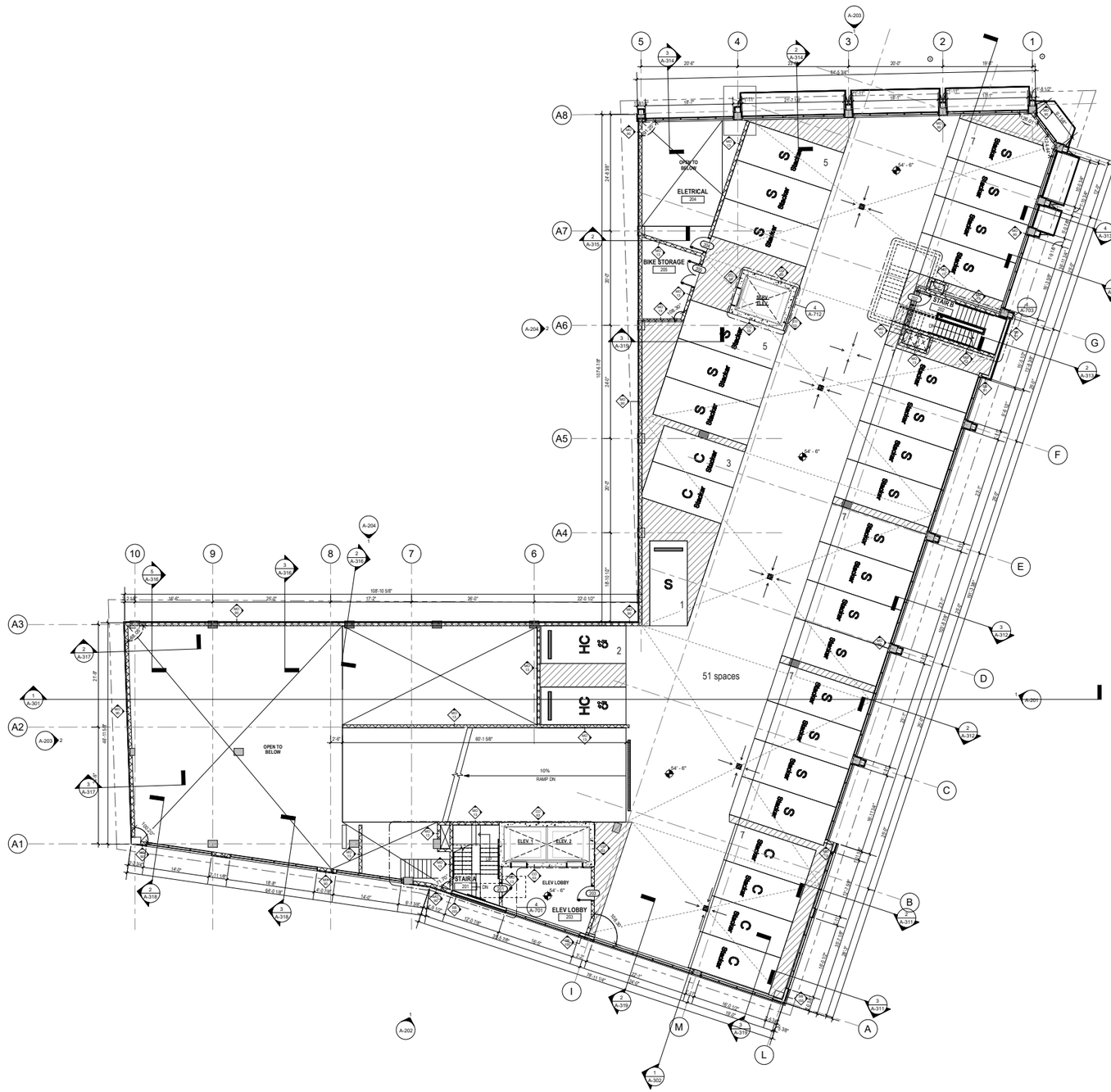
150 WESTCHESTER

1ST FLOOR PLAN

NO.	DESCRIPTION	DATE
PROJECT No:		SAX.002
DRAWN BY:		Author
CHECKED BY:		Checker
PLOT DATE:		1/19/2023 4:15:47 PM
FILE NAME:		

1.3B

N:\Saxum Real Estate\SAX.002A.000 - 140-150 Westchester\01 Project\Current\SAX.002A.02D - 140-150 Westchester_CENTRAL.rvt



1 A-102 2ND FLOOR PLAN
Scale: 1/8" = 1'-0"

PARKING NOTES

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PARKING LEGEND

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C	COMPACT PARKING
HC	HANDICAP PARKING
HC VAN	VAN HANDICAP PARKING

KEY NOTES

1. BOLLARDS
2. BIKE RACKS
3. BIKE RACKS - WALL MOUNTED
4. LIGHT FIXTURE (REFER TO MEP/ID DWGS)
5. EXHAUST VENT AND LOUVERS (REFER TO ELEVATION AND MEP DWGS)
6. STORAGE UNITS
7. SUNSHADE (REFER TO ELEVATION AND DETAILS)
8. GAS METER
9. TWO STAGE DRAIN

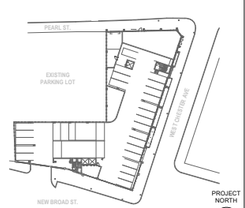
LEGEND

FCO	FLOOR CLEAN OUT (SEE PLUMBING DWGS)
FD	FLOOR DRAIN (SEE PLUMBING DWGS)
GD	GARAGE DRAIN (SEE PLUMBING DWGS)
HP	HIGH POINT
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DS	DOWNSPOUT
OS	OVERFLOW SCUPPER
EJ	EXPANSION JOINT
FOP	FACE OF METAL PANEL
FOB	FACE OF BRICK
FOD	FACE OF DRYVIT FINISH
FOC	FACE OF CONCRETE
FOS	FACE OF STONE
FEC	FIRE EXTINGUISHER CABINET
TD	TRENCH DRAIN (SEE PLUMBING DWGS)

WALL TYPE LEGEND

- CONCRETE WALL (REFER TO STRUCTURAL DWGS)
- BEARING WALL (REFER TO STRUCTURAL DWGS)
- SHEAR WALL (REFER TO STRUCTURAL DWGS)
- DEMISING WALL

KEYPLAN



ARCHITECT:
lessard DESIGN INC. P.C.
8521 Leesburg Pike | Suite 700 | Vienna, VA 22182
P:571.830.1800 | F:571.830.1801
www.LessardDesign.com

SEAL & SIGNATURE:

OWNER:
SAXUM REAL ESTATE
359 Springfield Ave - 2nd Fl.
Summit, NJ 07901

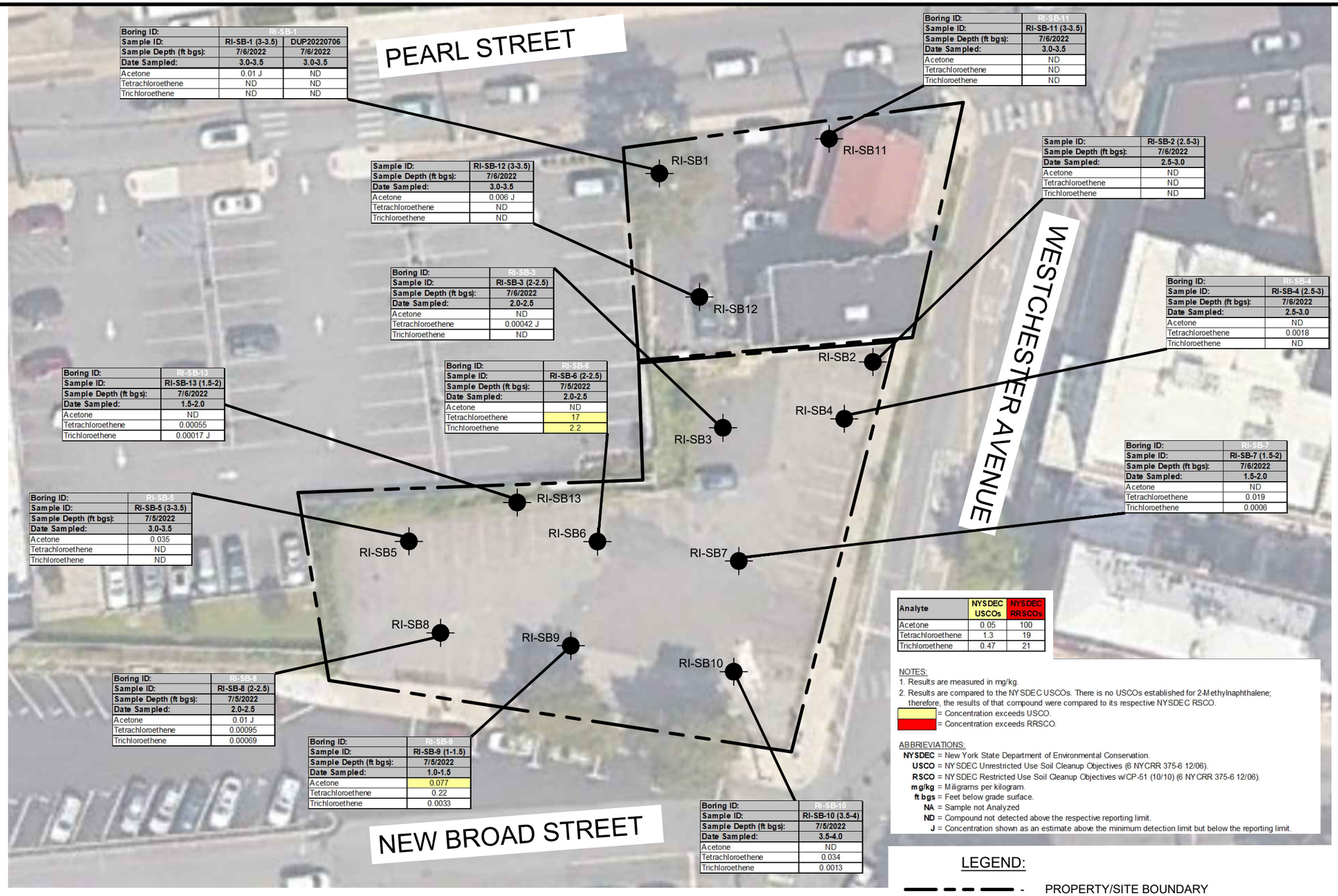
150 WESTCHESTER

2ND FLOOR PLAN

NO.	DESCRIPTION	DATE
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DRAWN BY:		Author
CHECKED BY:		Checker
PLOT DATE:		1/19/2023 4:15:58 PM
FILE NAME:		

1.3C

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Boring ID:	RI-SB-1	
Sample ID:	RI-SB-1 (3-3.5)	DUP20220706
Sample Depth (ft bgs):	7/6/2022	7/6/2022
Date Sampled:	3.0-3.5	3.0-3.5
Acetone	0.01 J	ND
Tetrachloroethene	ND	ND
Trichloroethene	ND	ND

Boring ID:	RI-SB-11
Sample ID:	RI-SB-11 (3-3.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	3.0-3.5
Acetone	ND
Tetrachloroethene	ND
Trichloroethene	ND

Sample ID:	RI-SB-12 (3-3.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	3.0-3.5
Acetone	0.006 J
Tetrachloroethene	ND
Trichloroethene	ND

Sample ID:	RI-SB-2 (2.5-3)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.5-3.0
Acetone	ND
Tetrachloroethene	ND
Trichloroethene	ND

Boring ID:	RI-SB-3
Sample ID:	RI-SB-3 (2-2.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.0-2.5
Acetone	ND
Tetrachloroethene	0.00042 J
Trichloroethene	ND

Boring ID:	RI-SB-4
Sample ID:	RI-SB-4 (2.5-3)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.5-3.0
Acetone	ND
Tetrachloroethene	0.0018
Trichloroethene	ND

Boring ID:	RI-SB-6
Sample ID:	RI-SB-6 (2-2.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	2.0-2.5
Acetone	ND
Tetrachloroethene	17
Trichloroethene	2.2

Boring ID:	RI-SB-13
Sample ID:	RI-SB-13 (1.5-2)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	1.5-2.0
Acetone	ND
Tetrachloroethene	0.00055
Trichloroethene	0.00017 J

Boring ID:	RI-SB-7
Sample ID:	RI-SB-7 (1.5-2)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	1.5-2.0
Acetone	ND
Tetrachloroethene	0.019
Trichloroethene	0.0006

Boring ID:	RI-SB-5
Sample ID:	RI-SB-5 (3-3.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	3.0-3.5
Acetone	0.035
Tetrachloroethene	ND
Trichloroethene	ND

Boring ID:	RI-SB-8
Sample ID:	RI-SB-8 (2-2.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	2.0-2.5
Acetone	0.01 J
Tetrachloroethene	0.00095
Trichloroethene	0.00069

Boring ID:	RI-SB-9
Sample ID:	RI-SB-9 (1-1.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	1.0-1.5
Acetone	0.077
Tetrachloroethene	0.22
Trichloroethene	0.0033

Boring ID:	RI-SB-10
Sample ID:	RI-SB-10 (3.5-4)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	3.5-4.0
Acetone	ND
Tetrachloroethene	0.034
Trichloroethene	0.0013

Analyte	NYSDEC USCOs	NYSDEC RRSCOs
Acetone	0.05	100
Tetrachloroethene	1.3	19
Trichloroethene	0.47	21

NOTES:
1. Results are measured in mg/kg.
2. Results are compared to the NYSDEC USCOs. There is no USCOs established for 2-Methylnaphthalene; therefore, the results of that compound were compared to its respective NYSDEC RSCO.

= Concentration exceeds USCO.
= Concentration exceeds RRSCO.

ABBREVIATIONS:
NYSDEC = New York State Department of Environmental Conservation.
USCO = NYSDEC Unrestricted Use Soil Cleanup Objectives (6 NYCRR 375-6 12/06).
RSCO = NYSDEC Restricted Use Soil Cleanup Objectives w/CP-51 (10/10) (6 NYCRR 375-6 12/06).
mg/kg = Miligrams per kilogram.
ft bgs = Feet below grade surface.
NA = Sample not Analyzed
ND = Compound not detected above the respective reporting limit.
J = Concentration shown as an estimate above the minimum detection limit but below the reporting limit.

LEGEND:

- PROPERTY/SITE BOUNDARY

RI-SB3 - SOIL SAMPLE NUMBER & APPROX. LOCATION

Scale 1"=40'
0 40 80

REFERENCE
SITE SURVEY PREPARED BY RICHARD J. DOMATO, DATED MARCH 5, 2021.

NOTE:
THIS PLAN IS FOR LOCATING SOIL BORINGS ONLY.
OTHER SITE WORK SHOWN HERE IS NOT INTENDED FOR CONSTRUCTION.

NYS Education Law
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dwg by: aas
chk by: FL
scale: AS NOTED
date: 08/25/2022

SESI CONSULTING ENGINEERS
SOILS / FOUNDATIONS
SITE DESIGN
ENVIRONMENTAL
12A MAPLE AVE. PINE BROOK, N.J. 07058 PH: 973-808-9050

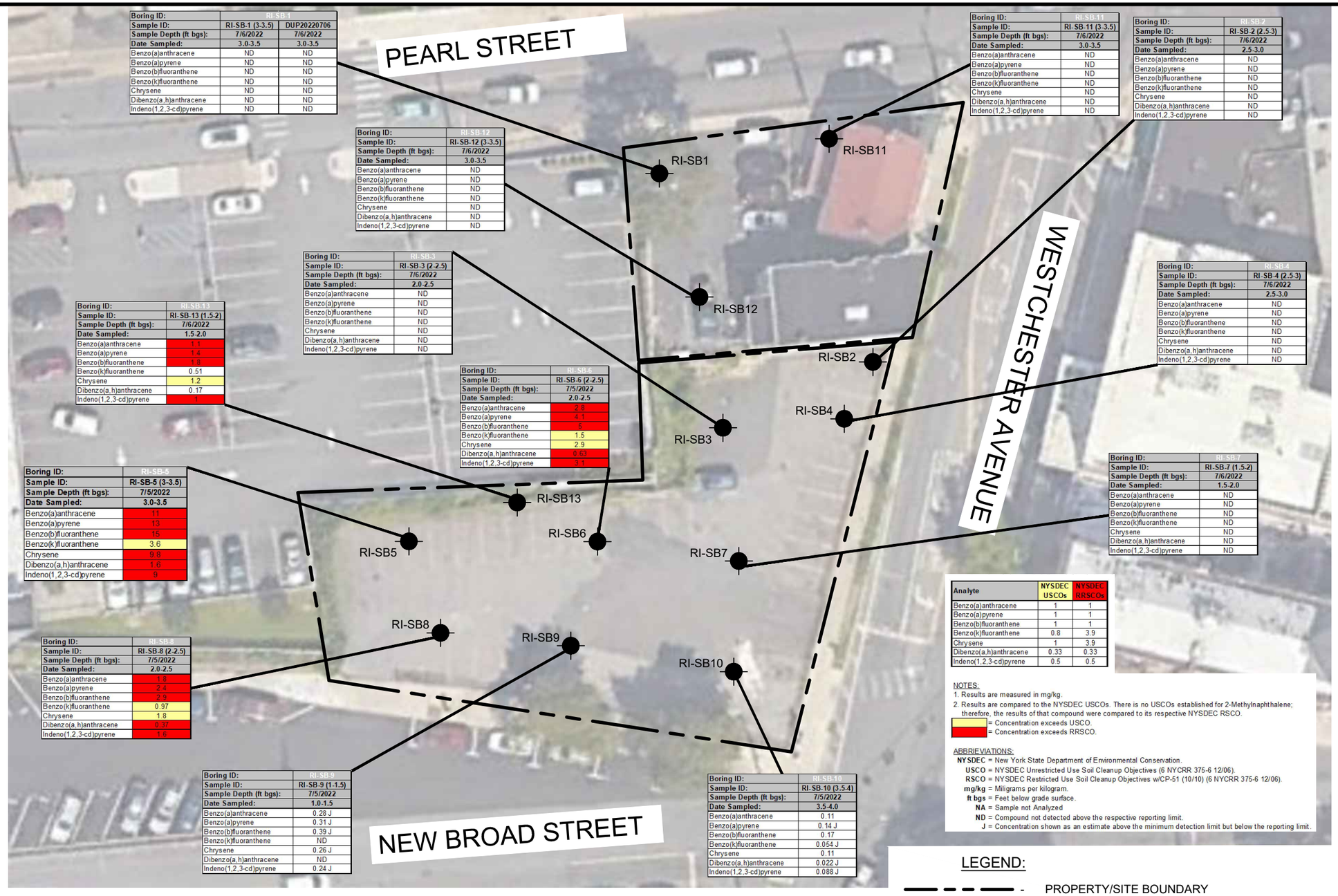
project: REMEDIAL INVESTIGATION REPORT
140, 148-150 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title: VOC EXCEEDANCES IN SOIL

job no: 11895
drawing no:

FIG-2.1A

N:\ACAD\11895\RI\11895 – FIG–5.1A–5.1F – EXCEEDANCES IN SOIL.DWG 08/25/22 11:34:28AM, yelena.zolotovo, LAYOUT:FIG–5.1A



Boring ID:	RI-SB-1	
Sample ID:	RI-SB-1 (3-3.5)	DUP20220706
Sample Depth (ft bgs):	7/6/2022	7/6/2022
Date Sampled:	3.0-3.5	3.0-3.5
Benzo(a)anthracene	ND	ND
Benzo(a)pyrene	ND	ND
Benzo(b)fluoranthene	ND	ND
Benzo(k)fluoranthene	ND	ND
Chrysene	ND	ND
Dibenzo(a,h)anthracene	ND	ND
Indeno(1,2,3-cd)pyrene	ND	ND

Boring ID:	RI-SB-12
Sample ID:	RI-SB-12 (3-3.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	3.0-3.5
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
Benzo(b)fluoranthene	ND
Benzo(k)fluoranthene	ND
Chrysene	ND
Dibenzo(a,h)anthracene	ND
Indeno(1,2,3-cd)pyrene	ND

Boring ID:	RI-SB-3
Sample ID:	RI-SB-3 (2-2.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.0-2.5
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
Benzo(b)fluoranthene	ND
Benzo(k)fluoranthene	ND
Chrysene	ND
Dibenzo(a,h)anthracene	ND
Indeno(1,2,3-cd)pyrene	ND

Boring ID:	RI-SB-13
Sample ID:	RI-SB-13 (1.5-2)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	1.5-2.0
Benzo(a)anthracene	1.1
Benzo(a)pyrene	1.4
Benzo(b)fluoranthene	1.8
Benzo(k)fluoranthene	0.51
Chrysene	1.2
Dibenzo(a,h)anthracene	0.17
Indeno(1,2,3-cd)pyrene	1

Boring ID:	RI-SB-6
Sample ID:	RI-SB-6 (2-2.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	2.0-2.5
Benzo(a)anthracene	2.6
Benzo(a)pyrene	4.1
Benzo(b)fluoranthene	5
Benzo(k)fluoranthene	1.5
Chrysene	2.9
Dibenzo(a,h)anthracene	0.63
Indeno(1,2,3-cd)pyrene	3.1

Boring ID:	RI-SB-5
Sample ID:	RI-SB-5 (3-3.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	3.0-3.5
Benzo(a)anthracene	11
Benzo(a)pyrene	13
Benzo(b)fluoranthene	15
Benzo(k)fluoranthene	3.6
Chrysene	9.8
Dibenzo(a,h)anthracene	1.6
Indeno(1,2,3-cd)pyrene	9

Boring ID:	RI-SB-8
Sample ID:	RI-SB-8 (2-2.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	2.0-2.5
Benzo(a)anthracene	1.8
Benzo(a)pyrene	2.4
Benzo(b)fluoranthene	2.9
Benzo(k)fluoranthene	0.97
Chrysene	1.8
Dibenzo(a,h)anthracene	0.37
Indeno(1,2,3-cd)pyrene	1.6

Boring ID:	RI-SB-9
Sample ID:	RI-SB-9 (1-1.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	1.0-1.5
Benzo(a)anthracene	0.28 J
Benzo(a)pyrene	0.31 J
Benzo(b)fluoranthene	0.39 J
Benzo(k)fluoranthene	ND
Chrysene	0.26 J
Dibenzo(a,h)anthracene	ND
Indeno(1,2,3-cd)pyrene	0.24 J

Boring ID:	RI-SB-10
Sample ID:	RI-SB-10 (3.5-4)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	3.5-4.0
Benzo(a)anthracene	0.11
Benzo(a)pyrene	0.14 J
Benzo(b)fluoranthene	0.17
Benzo(k)fluoranthene	0.054 J
Chrysene	0.11
Dibenzo(a,h)anthracene	0.022 J
Indeno(1,2,3-cd)pyrene	0.088 J

Boring ID:	RI-SB-11
Sample ID:	RI-SB-11 (3-3.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	3.0-3.5
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
Benzo(b)fluoranthene	ND
Benzo(k)fluoranthene	ND
Chrysene	ND
Dibenzo(a,h)anthracene	ND
Indeno(1,2,3-cd)pyrene	ND

Boring ID:	RI-SB-2
Sample ID:	RI-SB-2 (2.5-3)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.5-3.0
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
Benzo(b)fluoranthene	ND
Benzo(k)fluoranthene	ND
Chrysene	ND
Dibenzo(a,h)anthracene	ND
Indeno(1,2,3-cd)pyrene	ND

Boring ID:	RI-SB-4
Sample ID:	RI-SB-4 (2.5-3)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.5-3.0
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
Benzo(b)fluoranthene	ND
Benzo(k)fluoranthene	ND
Chrysene	ND
Dibenzo(a,h)anthracene	ND
Indeno(1,2,3-cd)pyrene	ND

Boring ID:	RI-SB-7
Sample ID:	RI-SB-7 (1.5-2)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	1.5-2.0
Benzo(a)anthracene	ND
Benzo(a)pyrene	ND
Benzo(b)fluoranthene	ND
Benzo(k)fluoranthene	ND
Chrysene	ND
Dibenzo(a,h)anthracene	ND
Indeno(1,2,3-cd)pyrene	ND

Analyte	NYSDEC USCOs	NYSDEC RRSCOs
Benzo(a)anthracene	1	1
Benzo(a)pyrene	1	1
Benzo(b)fluoranthene	1	1
Benzo(k)fluoranthene	0.8	3.9
Chrysene	1	3.9
Dibenzo(a,h)anthracene	0.33	0.33
Indeno(1,2,3-cd)pyrene	0.5	0.5

NOTES:
1. Results are measured in mg/kg.
2. Results are compared to the NYSDEC USCOs. There is no USCOs established for 2-Methylnaphthalene; therefore, the results of that compound were compared to its respective NYSDEC RSCO.

= Concentration exceeds USCO.
= Concentration exceeds RRSCO.

ABBRIEVIATIONS:
NYSDEC = New York State Department of Environmental Conservation.
USCO = NYSDEC Unrestricted Use Soil Cleanup Objectives (6 NYCRR 375-6 12/06).
RSCO = NYSDEC Restricted Use Soil Cleanup Objectives w/CP-51 (10/10) (6 NYCRR 375-6 12/06).
mg/kg = Miligrams per kilogram.
ft bgs = Feet below grade surface.
NA = Sample not Analyzed
ND = Compound not detected above the respective reporting limit.
J = Concentration shown as an estimate above the minimum detection limit but below the reporting limit.

LEGEND:

- PROPERTY/SITE BOUNDARY

RI-SB3 - SOIL SAMPLE NUMBER & APPROX. LOCATION

Scale 1"=40'

0 40 80

REFERENCE
SITE SURVEY PREPARED BY RICHARD J. DOMATO, DATED MARCH 5, 2021.

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dwg by: aas
chk by: FL
scale: AS NOTED
date: 09/08/2022

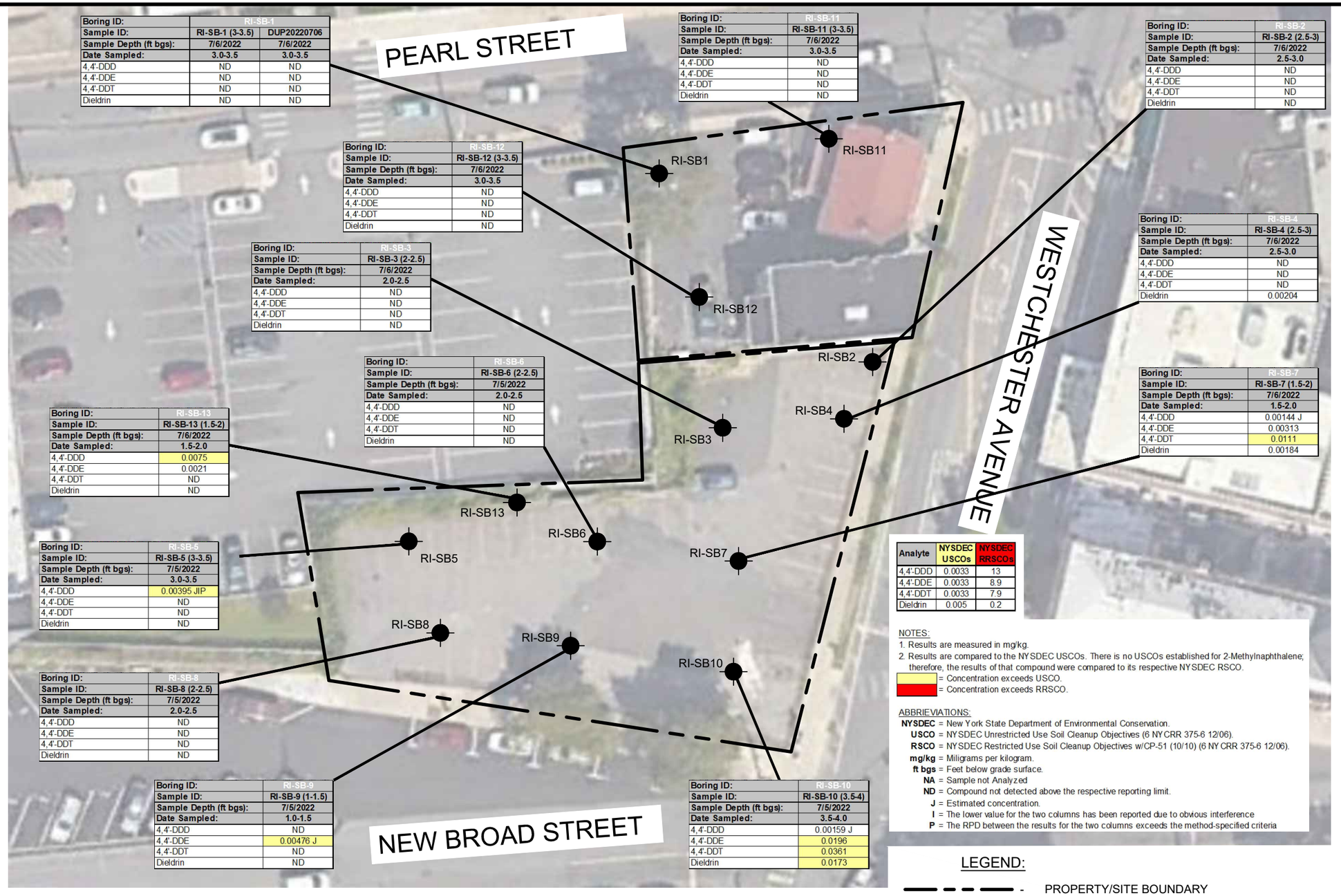
project: REMEDIAL INVESTIGATION REPORT
140, 148-150 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title: SVOC EXCEEDANCES IN SOIL

job no: 11895
drawing no:

FIG-2.1B

N:\ACAD\11895\RI\11895 – FIG–5.1A–5.1F – EXCEEDANCES IN SOIL.DWG 09/08/22 10:22:32AM, yelena.zolotova, LAYOUT:FIG–5.1B



Boring ID:	RI-SB-1	
Sample ID:	RI-SB-1 (3-3.5)	DUP20220706
Sample Depth (ft bgs):	7/6/2022	7/6/2022
Date Sampled:	3.0-3.5	3.0-3.5
4,4'-DDD	ND	ND
4,4'-DDE	ND	ND
4,4'-DDT	ND	ND
Dieldrin	ND	ND

Boring ID:	RI-SB-11
Sample ID:	RI-SB-11 (3-3.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	3.0-3.5
4,4'-DDD	ND
4,4'-DDE	ND
4,4'-DDT	ND
Dieldrin	ND

Boring ID:	RI-SB-2
Sample ID:	RI-SB-2 (2.5-3)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.5-3.0
4,4'-DDD	ND
4,4'-DDE	ND
4,4'-DDT	ND
Dieldrin	ND

Boring ID:	RI-SB-12
Sample ID:	RI-SB-12 (3-3.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	3.0-3.5
4,4'-DDD	ND
4,4'-DDE	ND
4,4'-DDT	ND
Dieldrin	ND

Boring ID:	RI-SB-3
Sample ID:	RI-SB-3 (2-2.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.0-2.5
4,4'-DDD	ND
4,4'-DDE	ND
4,4'-DDT	ND
Dieldrin	ND

Boring ID:	RI-SB-4
Sample ID:	RI-SB-4 (2.5-3)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.5-3.0
4,4'-DDD	ND
4,4'-DDE	ND
4,4'-DDT	ND
Dieldrin	0.00204

Boring ID:	RI-SB-6
Sample ID:	RI-SB-6 (2-2.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	2.0-2.5
4,4'-DDD	ND
4,4'-DDE	ND
4,4'-DDT	ND
Dieldrin	ND

Boring ID:	RI-SB-7
Sample ID:	RI-SB-7 (1.5-2)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	1.5-2.0
4,4'-DDD	0.00144 J
4,4'-DDE	0.00313
4,4'-DDT	0.0111
Dieldrin	0.00184

Boring ID:	RI-SB-13
Sample ID:	RI-SB-13 (1.5-2)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	1.5-2.0
4,4'-DDD	0.0075
4,4'-DDE	0.0021
4,4'-DDT	ND
Dieldrin	ND

Boring ID:	RI-SB-5
Sample ID:	RI-SB-5 (3-3.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	3.0-3.5
4,4'-DDD	0.00395 JIP
4,4'-DDE	ND
4,4'-DDT	ND
Dieldrin	ND

Boring ID:	RI-SB-8
Sample ID:	RI-SB-8 (2-2.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	2.0-2.5
4,4'-DDD	ND
4,4'-DDE	ND
4,4'-DDT	ND
Dieldrin	ND

Boring ID:	RI-SB-9
Sample ID:	RI-SB-9 (1-1.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	1.0-1.5
4,4'-DDD	ND
4,4'-DDE	0.00476 J
4,4'-DDT	ND
Dieldrin	ND

Boring ID:	RI-SB-10
Sample ID:	RI-SB-10 (3.5-4)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	3.5-4.0
4,4'-DDD	0.00159 J
4,4'-DDE	0.0196
4,4'-DDT	0.0361
Dieldrin	0.0173

Analyte	NYSDEC USCOs	NYSDEC RRSCOs
4,4'-DDD	0.0033	13
4,4'-DDE	0.0033	8.9
4,4'-DDT	0.0033	7.9
Dieldrin	0.005	0.2

NOTES:
1. Results are measured in mg/kg.
2. Results are compared to the NYSDEC USCOs. There is no USCOs established for 2-Methylnaphthalene; therefore, the results of that compound were compared to its respective NYSDEC RSCO.

= Concentration exceeds USCO.
= Concentration exceeds RRSCO.

ABBREVIATIONS:
NYSDEC = New York State Department of Environmental Conservation.
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RSCO = NYSDEC Restricted Use Soil Cleanup Objectives w/CP-51 (10/10) (6 NYCRR 375-6 12/06).
mg/kg = Miligrams per kilogram.
ft bgs = Feet below grade surface.
NA = Sample not Analyzed
ND = Compound not detected above the respective reporting limit.
J = Estimated concentration.
I = The lower value for the two columns has been reported due to obvious interference
P = The RPD between the results for the two columns exceeds the method-specified criteria

LEGEND:

- PROPERTY/SITE BOUNDARY

RI-SB3 - SOIL SAMPLE NUMBER & APPROX. LOCATION

Scale 1"=40'

0 40 80

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dwg by: aas
chk by: FL
scale: AS NOTED
date: 08/25/2022

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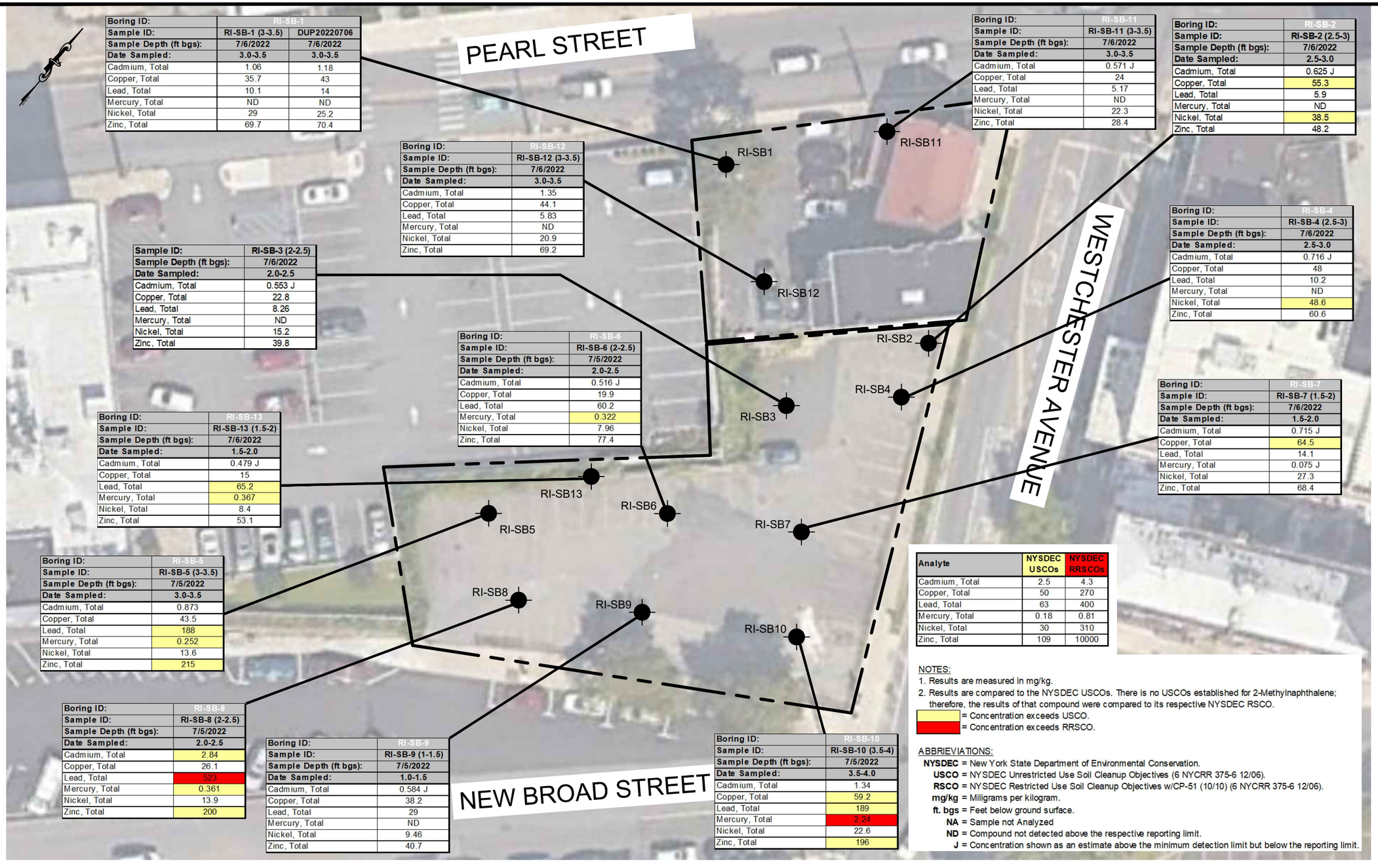
project:
REMEDIAL INVESTIGATION REPORT
140, 148-150 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title:
PESTICIDE EXCEEDANCES IN SOIL

job no: 11895
drawing no:

FIG-2.1C

N:\ACAD\11895\RI\11895 – FIG–5.1A–5.1F – EXCEEDANCES IN SOIL.DWG 08/25/22 12:50:16PM, yelena.zolotova, LAYOUT:FIG–5.1C



Boring ID:	RI-SB-1	
Sample ID:	RI-SB-1 (3-3.5)	DUP20220706
Sample Depth (ft bgs):	7/6/2022	7/6/2022
Date Sampled:	3.0-3.5	3.0-3.5
Cadmium, Total	1.06	1.18
Copper, Total	35.7	43
Lead, Total	10.1	14
Mercury, Total	ND	ND
Nickel, Total	29	25.2
Zinc, Total	69.7	70.4

Boring ID:	RI-SB-11
Sample ID:	RI-SB-11 (3-3.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	3.0-3.5
Cadmium, Total	0.571 J
Copper, Total	24
Lead, Total	5.17
Mercury, Total	ND
Nickel, Total	22.3
Zinc, Total	28.4

Boring ID:	RI-SB-2
Sample ID:	RI-SB-2 (2.5-3)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.5-3.0
Cadmium, Total	0.625 J
Copper, Total	55.3
Lead, Total	5.9
Mercury, Total	ND
Nickel, Total	38.5
Zinc, Total	48.2

Boring ID:	RI-SB-12
Sample ID:	RI-SB-12 (3-3.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	3.0-3.5
Cadmium, Total	1.35
Copper, Total	44.1
Lead, Total	5.83
Mercury, Total	ND
Nickel, Total	20.9
Zinc, Total	69.2

Sample ID:	RI-SB-3 (2-2.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.0-2.5
Cadmium, Total	0.553 J
Copper, Total	22.8
Lead, Total	8.26
Mercury, Total	ND
Nickel, Total	15.2
Zinc, Total	39.8

Boring ID:	RI-SB-4
Sample ID:	RI-SB-4 (2.5-3)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.5-3.0
Cadmium, Total	0.716 J
Copper, Total	48
Lead, Total	10.2
Mercury, Total	ND
Nickel, Total	48.6
Zinc, Total	60.6

Boring ID:	RI-SB-6
Sample ID:	RI-SB-6 (2-2.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	2.0-2.5
Cadmium, Total	0.516 J
Copper, Total	19.9
Lead, Total	60.2
Mercury, Total	0.322
Nickel, Total	7.96
Zinc, Total	77.4

Boring ID:	RI-SB-7
Sample ID:	RI-SB-7 (1.5-2)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	1.5-2.0
Cadmium, Total	0.715 J
Copper, Total	64.5
Lead, Total	14.1
Mercury, Total	0.075 J
Nickel, Total	27.3
Zinc, Total	68.4

Boring ID:	RI-SB-13
Sample ID:	RI-SB-13 (1.5-2)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	1.5-2.0
Cadmium, Total	0.479 J
Copper, Total	15
Lead, Total	65.2
Mercury, Total	0.367
Nickel, Total	8.4
Zinc, Total	53.1

Boring ID:	RI-SB-5
Sample ID:	RI-SB-5 (3-3.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	3.0-3.5
Cadmium, Total	0.873
Copper, Total	43.5
Lead, Total	188
Mercury, Total	0.252
Nickel, Total	13.6
Zinc, Total	215

Boring ID:	RI-SB-8
Sample ID:	RI-SB-8 (2-2.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	2.0-2.5
Cadmium, Total	2.84
Copper, Total	26.1
Lead, Total	523
Mercury, Total	0.361
Nickel, Total	13.9
Zinc, Total	200

Boring ID:	RI-SB-9
Sample ID:	RI-SB-9 (1-1.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	1.0-1.5
Cadmium, Total	0.584 J
Copper, Total	38.2
Lead, Total	29
Mercury, Total	ND
Nickel, Total	9.46
Zinc, Total	40.7

Boring ID:	RI-SB-10
Sample ID:	RI-SB-10 (3.5-4)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	3.5-4.0
Cadmium, Total	1.34
Copper, Total	59.2
Lead, Total	189
Mercury, Total	2.24
Nickel, Total	22.6
Zinc, Total	196

Analyte	NYSDEC USCOs	NYSDEC RRSCOs
Cadmium, Total	2.5	4.3
Copper, Total	50	270
Lead, Total	63	400
Mercury, Total	0.18	0.81
Nickel, Total	30	310
Zinc, Total	109	10000

NOTES:
1. Results are measured in mg/kg.
2. Results are compared to the NYSDEC USCOs. There is no USCOs established for 2-Methylnaphthalene; therefore, the results of that compound were compared to its respective NYSDEC RSCO.

= Concentration exceeds USCO.
= Concentration exceeds RRSCO.

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mg/kg = Miligrams per kilogram.
ft. bgs = Feet below ground surface.
NA = Sample not Analyzed
ND = Compound not detected above the respective reporting limit.
J = Concentration shown as an estimate above the minimum detection limit but below the reporting limit.

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LEGEND:
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RI-SB3 - SOIL SAMPLE NUMBER & APPROX. LOCATION

Scale 1"=40'
0 40 80

dwg by: aas
chk by: FL
scale: AS NOTED
date: 08/25/2022

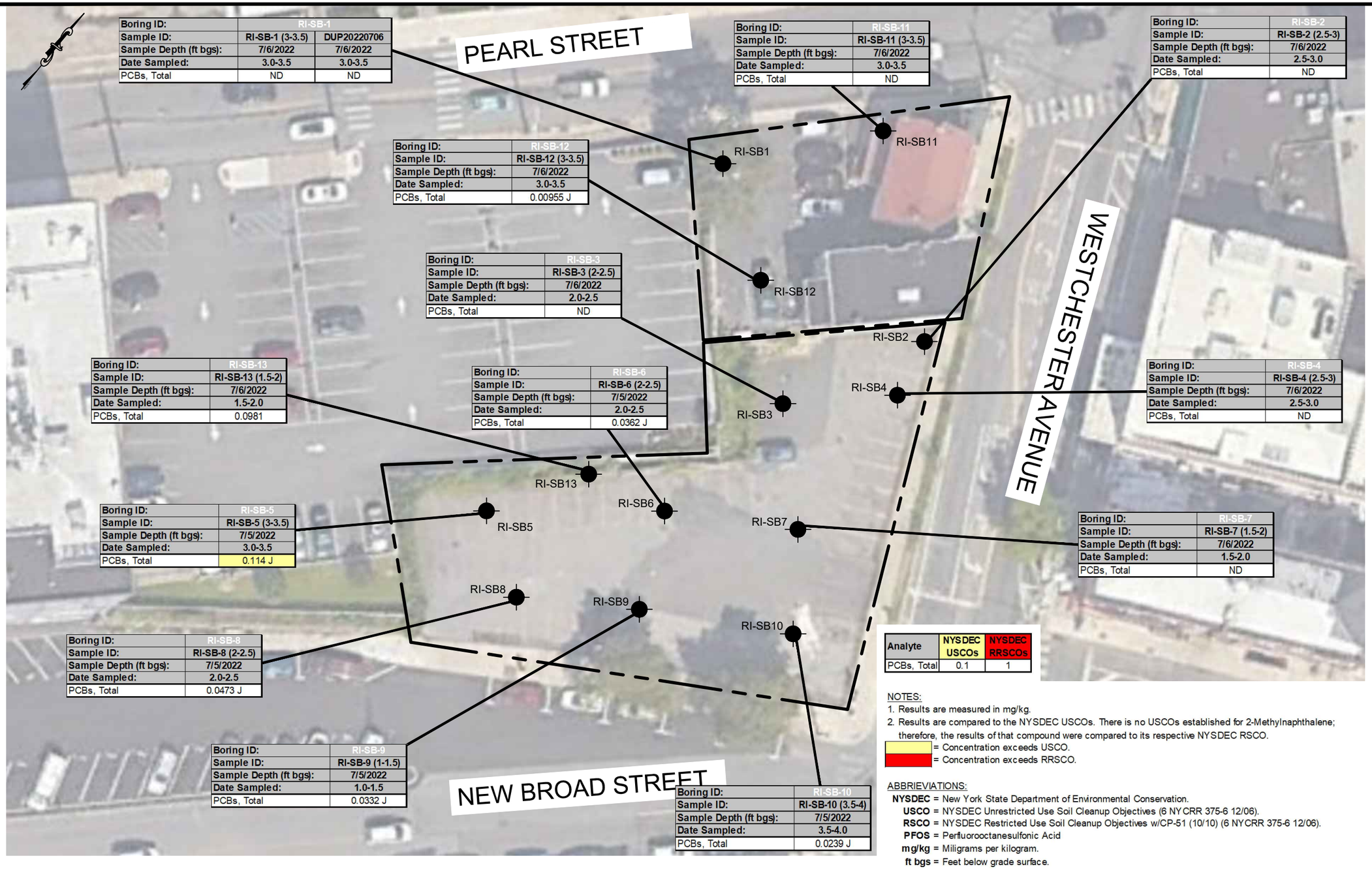
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project:
REMEDIAL INVESTIGATION REPORT
140, 148-150 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title:
METALS EXCEEDANCES IN SOIL

job no: 11895
drawing no:
FIG-2.1D

N:\ACAD\11895\R\11895 – FIG–5.1A–5.1F – EXCEEDANCES IN SOIL.DWG 08/25/22 01:09:44PM, yelena.zolotova, LAYOUT:FIG–5.1D



Boring ID:	RI-SB-1	
Sample ID:	RI-SB-1 (3-3.5)	DUP20220706
Sample Depth (ft bgs):	7/6/2022	7/6/2022
Date Sampled:	3.0-3.5	3.0-3.5
PCBs, Total	ND	ND

Boring ID:	RI-SB-11
Sample ID:	RI-SB-11 (3-3.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	3.0-3.5
PCBs, Total	ND

Boring ID:	RI-SB-2
Sample ID:	RI-SB-2 (2.5-3)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.5-3.0
PCBs, Total	ND

Boring ID:	RI-SB-12
Sample ID:	RI-SB-12 (3-3.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	3.0-3.5
PCBs, Total	0.00955 J

Boring ID:	RI-SB-3
Sample ID:	RI-SB-3 (2-2.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.0-2.5
PCBs, Total	ND

Boring ID:	RI-SB-13
Sample ID:	RI-SB-13 (1.5-2)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	1.5-2.0
PCBs, Total	0.0981

Boring ID:	RI-SB-6
Sample ID:	RI-SB-6 (2-2.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	2.0-2.5
PCBs, Total	0.0362 J

Boring ID:	RI-SB-4
Sample ID:	RI-SB-4 (2.5-3)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.5-3.0
PCBs, Total	ND

Boring ID:	RI-SB-5
Sample ID:	RI-SB-5 (3-3.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	3.0-3.5
PCBs, Total	0.114 J

Boring ID:	RI-SB-7
Sample ID:	RI-SB-7 (1.5-2)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	1.5-2.0
PCBs, Total	ND

Boring ID:	RI-SB-8
Sample ID:	RI-SB-8 (2-2.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	2.0-2.5
PCBs, Total	0.0473 J

Boring ID:	RI-SB-9
Sample ID:	RI-SB-9 (1-1.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	1.0-1.5
PCBs, Total	0.0332 J

Boring ID:	RI-SB-10
Sample ID:	RI-SB-10 (3.5-4)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	3.5-4.0
PCBs, Total	0.0239 J

Analyte	NYSDEC USCOs	NYSDEC RRSCOs
PCBs, Total	0.1	1

NOTES:
1. Results are measured in mg/kg.
2. Results are compared to the NYSDEC USCOs. There is no USCOs established for 2-Methylnaphthalene; therefore, the results of that compound were compared to its respective NYSDEC RSCO.

= Concentration exceeds USCO.
= Concentration exceeds RRSCO.

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RSCO = NYSDEC Restricted Use Soil Cleanup Objectives w/CP-51 (10/10) (6 NYCRR 375-6 12/06).
PFOS = Perfluorooctanesulfonic Acid
mg/kg = Miligrams per kilogram.
ft bgs = Feet below grade surface.
NA = Sample not Analyzed
ND = Compound not detected above the respective reporting limit.
J = Concentration shown as an estimate above the minimum detection limit but below the reporting limit.

LEGEND:
- PROPERTY/SITE BOUNDARY
RI-SB3 - SOIL SAMPLE NUMBER & APPROX. LOCATION

SCALE: 1"=40'
0 40 80

REFERENCE
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dwg by: aas
chk by: FL
scale: AS NOTED
date: 08/25/2022

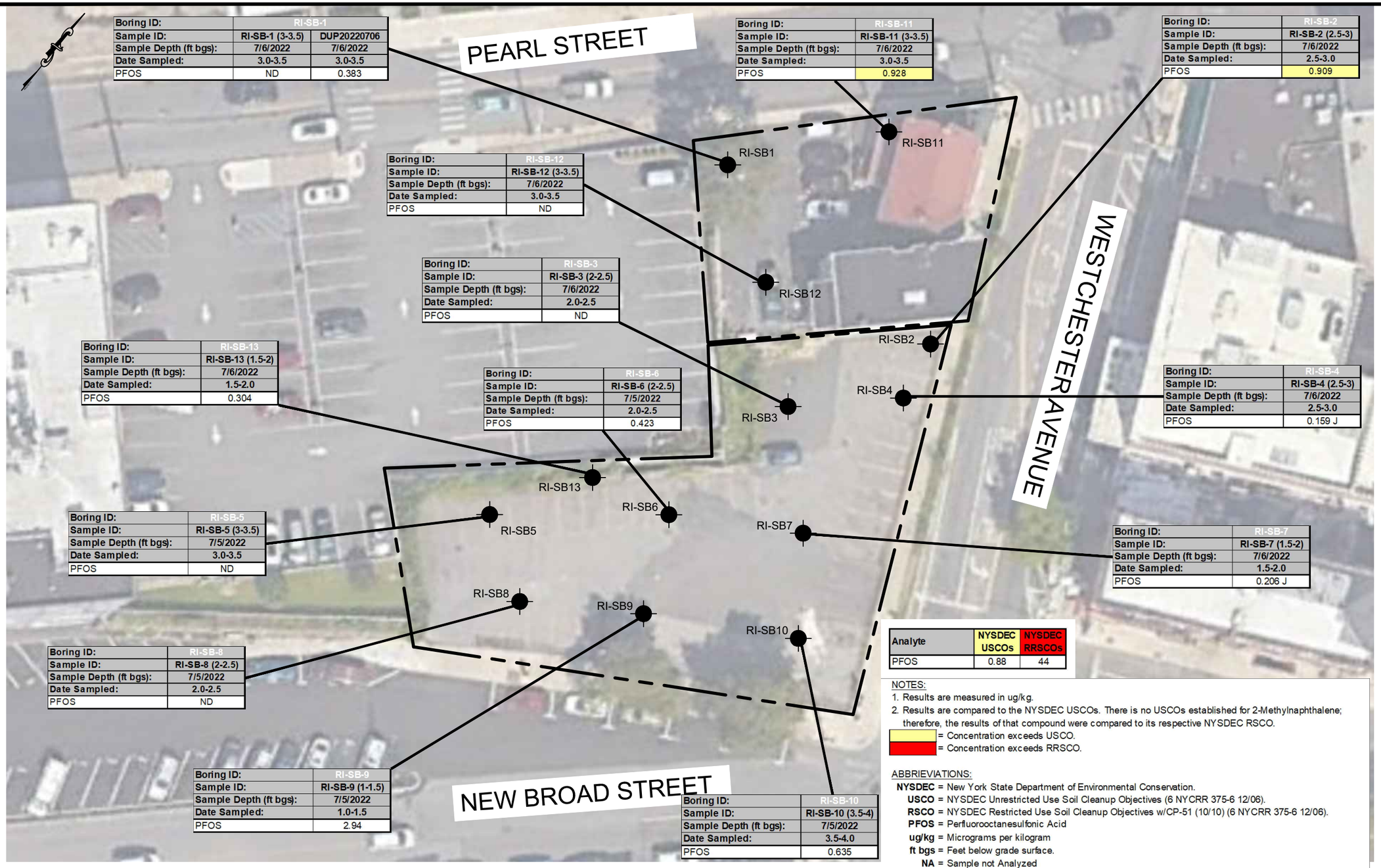
project: REMEDIAL INVESTIGATION REPORT
140, 148-150 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title: PCB EXCEEDANCES IN SOIL

job no: 11895
drawing no:

FIG-2.1E

N:\ACAD\11895\RI\11895 – FIG–5.1A–5.1F – EXCEEDANCES IN SOIL.DWG 08/25/22 01:39:29PM, yelena.zolotova, LAYOUT:FIG–5.1E



Boring ID:	RI-SB-1	
Sample ID:	RI-SB-1 (3-3.5)	DUP20220706
Sample Depth (ft bgs):	7/6/2022	7/6/2022
Date Sampled:	3.0-3.5	3.0-3.5
PFOS	ND	0.383

Boring ID:	RI-SB-11
Sample ID:	RI-SB-11 (3-3.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	3.0-3.5
PFOS	0.928

Boring ID:	RI-SB-2
Sample ID:	RI-SB-2 (2.5-3)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.5-3.0
PFOS	0.909

Boring ID:	RI-SB-12
Sample ID:	RI-SB-12 (3-3.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	3.0-3.5
PFOS	ND

Boring ID:	RI-SB-3
Sample ID:	RI-SB-3 (2-2.5)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.0-2.5
PFOS	ND

Boring ID:	RI-SB-13
Sample ID:	RI-SB-13 (1.5-2)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	1.5-2.0
PFOS	0.304

Boring ID:	RI-SB-6
Sample ID:	RI-SB-6 (2-2.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	2.0-2.5
PFOS	0.423

Boring ID:	RI-SB-4
Sample ID:	RI-SB-4 (2.5-3)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	2.5-3.0
PFOS	0.159 J

Boring ID:	RI-SB-5
Sample ID:	RI-SB-5 (3-3.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	3.0-3.5
PFOS	ND

Boring ID:	RI-SB-7
Sample ID:	RI-SB-7 (1.5-2)
Sample Depth (ft bgs):	7/6/2022
Date Sampled:	1.5-2.0
PFOS	0.206 J

Boring ID:	RI-SB-8
Sample ID:	RI-SB-8 (2-2.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	2.0-2.5
PFOS	ND

Boring ID:	RI-SB-9
Sample ID:	RI-SB-9 (1-1.5)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	1.0-1.5
PFOS	2.94

Boring ID:	RI-SB-10
Sample ID:	RI-SB-10 (3.5-4)
Sample Depth (ft bgs):	7/5/2022
Date Sampled:	3.5-4.0
PFOS	0.635

Analyte	NYSDEC USCOs	NYSDEC RRSCOs
PFOS	0.88	44

NOTES:
1. Results are measured in ug/kg.
2. Results are compared to the NYSDEC USCOs. There is no USCOs established for 2-Methylnaphthalene; therefore, the results of that compound were compared to its respective NYSDEC RSCO.

= Concentration exceeds USCO.
= Concentration exceeds RRSCO.

ABBRIEVIATIONS:
NYSDEC = New York State Department of Environmental Conservation.
USCO = NYSDEC Unrestricted Use Soil Cleanup Objectives (6 NYCRR 375-6 12/06).
RSCO = NYSDEC Restricted Use Soil Cleanup Objectives w/CP-51 (10/10) (6 NYCRR 375-6 12/06).
PFOS = Perfluorooctanesulfonic Acid
ug/kg = Micrograms per kilogram
ft bgs = Feet below grade surface.
NA = Sample not Analyzed
ND = Compound not detected above the respective reporting limit.
J = Concentration shown as an estimate above the minimum detection limit but below the reporting limit.

NYS Education Law
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REFERENCE
SITE SURVEY PREPARED BY RICHARD J. DOMATO, DATED MARCH 5, 2021.

NOTE:
THIS PLAN IS FOR LOCATING SOIL BORINGS ONLY.
OTHER SITE WORK SHOWN HERE IS NOT INTENDED FOR CONSTRUCTION.

LEGEND:
- PROPERTY/SITE BOUNDARY
RI-SB3 - SOIL SAMPLE NUMBER & APPROX. LOCATION

SCALE: 1"=40'
0 40 80

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SOILS / FOUNDATIONS
SITE DESIGN
ENVIRONMENTAL
12A MAPLE AVE. PINE BROOK, N.J. 07058 PH: 973-808-9050

dwg by: aas
chk by: FL
scale: AS NOTED
date: 09/08/2022

project: REMEDIAL INVESTIGATION REPORT
140, 148-150 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title: PFAS EXCEEDANCES IN SOIL

job no: 11895
drawing no:

FIG-2.1F

N:\ACAD\11895\RI\11895 – FIG–5.1A–5.1F – EXCEEDANCES IN SOIL.DWG 09/08/22 10:30:34AM, yelena.zolotova, LAYOUT:FIG–5.1F

Well ID	Installation Date	Drilling Method	Steel Casing Interval (ft-bgs)	Screen interval (ft-bgs)	Total Well Depth (ft-bgs)	Well Status
RI-MW-1	7/8/2022	Direct Push/Air Rotary	NA	10-25	25	Decommissioned
RI-MW-2	7/7/2022	Direct Push/Air Rotary	NA	5-15	15	Decommissioned
RI-MW-3	7/8/2022	Direct Push/Air Rotary	NA	2-12	12	Decommissioned
RI-MW-4	7/72022	Direct Push/Air Rotary	NA	5-15	15	Decommissioned
MW-5	3/24/2023	Direct Push/Air Rotary	NA	5-15	15	Decommissioned
MW-6	3/24/2023	Direct Push/Air Rotary	NA	2.6-7.6	7.6	Decommissioned
MW-7D	3/24/2023	Direct Push/Air Rotary	3.5-8.5	24-29	29	Decommissioned
MW-8D	3/24/2023	Direct Push/Air Rotary	4-9	22.5-28.5	28.5	Decommissioned
MW-9D	3/24/2023	Direct Push/Air Rotary	2.5-7.5	25-30	30	Decommissioned
MW-10D	7/25/2023	Direct Push/Air Rotary	8-13	NA*	29.1	Decommissioned
MW-11D	7/25/2023	Direct Push/Air Rotary	10-15	NA*	29.1	Decommissioned
MW-11DD	7/25/2023	Direct Push/Air Rotary	0-30	NA*	55.1	Decommissioned
MW-12D	7/25/2023	Direct Push/Air Rotary	2-7	NA*	29.6	Decommissioned
MW-12DD	7/25/2023	Direct Push/Air Rotary	0-30	NA*	57.9	Decommissioned
MW-13D	7/25/2023	Direct Push/Air Rotary	2-7	NA*	28.5	Decommissioned
MW-13DD	7/25/2023	Direct Push/Air Rotary	0-30	NA*	59.2	Decommissioned
MW-13R	7/3/2025	Coring	0-5	44-54	54	Active
MW-14	2/12/2025	Air Hammer and Roller Bit	0-5	180-200	200	Active
MW-15	3/18/2026	Air Hammer and Roller Bit	0-5	75-90	90	Active
MW-16	2/27/2026	Air Hammer and Roller Bit	0-5	135-150	150	Active
MW-17	2/24/2026	Air Hammer and Roller Bit	0-5	40-55	55	Active
MW-18	1/30/2026	Air Hammer and Roller Bit	0-5	75-90	90	Active
MW-19	1/20/2026	Air Hammer and Roller Bit	0-5	135-150	150	Active
MW-20	2/3/2026	Air Hammer and Roller Bit	0-5	75-90	90	Active
MW-21	2/24/2026	Air Hammer and Roller Bit	0-5	135-150	150	Active

*: Well was constructed a an open borehole. No Screen was installed. Sampling of the well was conducted through passive diffusion bags(PDBs) at depths specified on the sample results table.

Analyte	Units	NYSDEC AWQS
VOCs		
cis-1,2-Dichloroethene	ug/l	5
Tetrachloroethene	ug/l	5
Trichloroethene	ug/l	5
Vinyl chloride	ug/l	2
Acetone	ug/l	50
PFAS		
PFOA	ng/l	6.7
PFOS	ng/l	2.7
SVOCs		
Benzo(a)anthracene	ug/l	0.002
Benzo(a)pyrene	ug/l	0.002
Benzo(b)fluoranthene	ug/l	0.002
Benzo(k)fluoranthene	ug/l	0.002
Chrysene	ug/l	0.002
Indeno(1,2,3-cd)pyrene	ug/l	0.002
Metals		
Iron, Total	ug/l	300
Magnesium, Total	ug/l	35000
Manganese, Total	ug/l	300
Sodium, Total	ug/l	20000

NOTES:
1. Screen interval is measured in ft-bgs.
2. Samples MW-16D through MW-13DD were collected from PDBs and were only analyzed for VOCs.
Orange highlight indicates the compound concentration exceeds the NYSDEC AWQS.

ABBREVIATIONS:
NYSDEC = New York State Department of Environmental Conservation
PFAS = Per and Polyfluoroalkyl substances
PFAS = Per and Polyfluoroalkyl substances
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
VOC = Volatile Organic Compound
SVOC = Semi-Volatile Organic Compound
ng/l = Nanograms per liter
ug/l = Micrograms per liter
ft-bgs = Feet below ground surface
ft = Feet
BG = Background concentration

LEGEND:

- MW-1R — SRIWP MONITORING WELL LOCATION (MARCH 2026)
- (200') — DEPTH OF WELL (FT. BGS)
- RI-MW1 — MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2022) (DECOMMISSIONED)
- MW-5 — MW-5 MONITORING WELL NUMBER & APPROX. LOCATION (MARCH 2023) (DECOMMISSIONED)
- MW-8D — MW-8D (28.5-30 ft bgs) MONITORING WELL NUMBER & APPROX. LOCATION (MARCH AND JULY 2023) (DECOMMISSIONED)
- MW-11DD — MW-1DD (55-59' bgs) MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2023) (DECOMMISSIONED)

NYS Education Law
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REFERENCE:
EXIST CONDITIONS & BOUNDARY ARE TAKEN FROM FOUNDATION PLAN PREPARED BY LESSARD DESIGN INC. P.C., DATED NOVEMBER 8, 2024.

SCALE: 1"=30'
0 30 60

dwg by: EC
chk by: SL
scale: AS NOTED
date: 06/11/26

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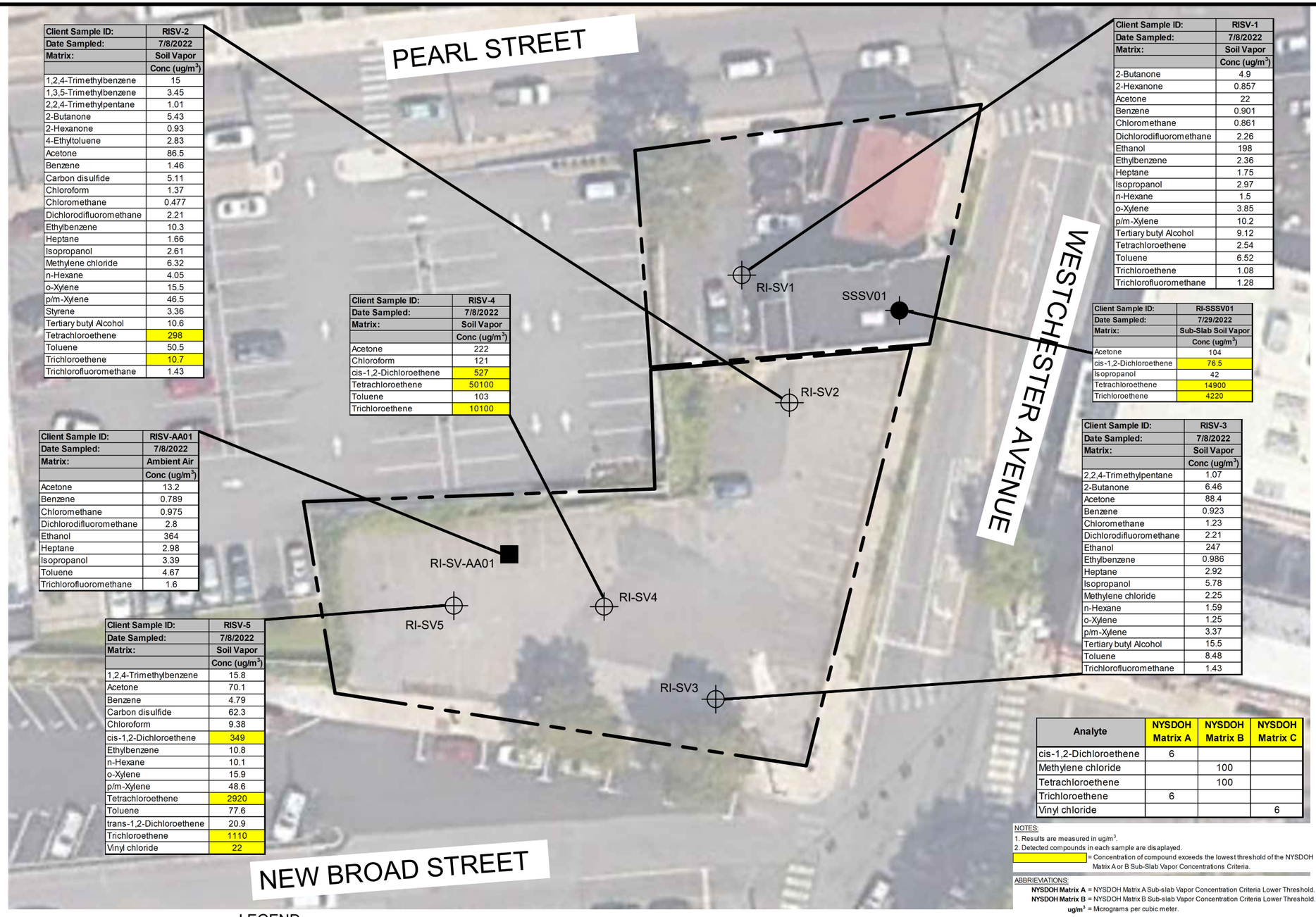
project: 146 WESTCHESTER AVENUE PORT CHESTER, NY

title: MONITORING LOCATION PLAN AND GROUNDWATER SAMPLE RESULTS SUMMARY

job no: 11895
drawing no: FIG-2.2

1 of 1

N:\ACAD\11895\11895.DWG.INJ & MON WELL LOCATION PLAN_REV2.DWG 06/12/26 03:00:19PM, pinnacle, LAYOUT:FIG-2.2



Client Sample ID:	RISV-2
Date Sampled:	7/8/2022
Matrix:	Soil Vapor
	Conc (ug/m^3)
1,2,4-Trimethylbenzene	15
1,3,5-Trimethylbenzene	3.45
2,2,4-Trimethylpentane	1.01
2-Butanone	5.43
2-Hexanone	0.93
4-Ethyltoluene	2.83
Acetone	86.5
Benzene	1.46
Carbon disulfide	5.11
Chloroform	1.37
Chloromethane	0.477
Dichlorodifluoromethane	2.21
Ethylbenzene	10.3
Heptane	1.66
Isopropanol	2.61
Methylene chloride	6.32
n-Hexane	4.05
o-Xylene	15.5
p/m-Xylene	46.5
Styrene	3.36
Tertiary butyl Alcohol	10.6
Tetrachloroethene	298
Toluene	50.5
Trichloroethene	10.7
Trichlorofluoromethane	1.43

Client Sample ID:	RISV-4
Date Sampled:	7/8/2022
Matrix:	Soil Vapor
	Conc (ug/m^3)
Acetone	222
Chloroform	121
cis-1,2-Dichloroethene	527
Tetrachloroethene	50100
Toluene	103
Trichloroethene	10100

Client Sample ID:	RISV-AA01
Date Sampled:	7/8/2022
Matrix:	Ambient Air
	Conc (ug/m^3)
Acetone	13.2
Benzene	0.789
Chloromethane	0.975
Dichlorodifluoromethane	2.8
Ethanol	364
Heptane	2.98
Isopropanol	3.39
Toluene	4.67
Trichlorofluoromethane	1.6

Client Sample ID:	RISV-5
Date Sampled:	7/8/2022
Matrix:	Soil Vapor
	Conc (ug/m^3)
1,2,4-Trimethylbenzene	15.8
Acetone	70.1
Benzene	4.79
Carbon disulfide	62.3
Chloroform	9.38
cis-1,2-Dichloroethene	349
Ethylbenzene	10.8
n-Hexane	10.1
o-Xylene	15.9
p/m-Xylene	48.6
Tetrachloroethene	2920
Toluene	77.6
trans-1,2-Dichloroethene	20.9
Trichloroethene	1110
Vinyl chloride	22

Client Sample ID:	RISV-1
Date Sampled:	7/8/2022
Matrix:	Soil Vapor
	Conc (ug/m^3)
2-Butanone	4.9
2-Hexanone	0.857
Acetone	22
Benzene	0.901
Chloromethane	0.861
Dichlorodifluoromethane	2.26
Ethanol	198
Ethylbenzene	2.36
Heptane	1.75
Isopropanol	2.97
n-Hexane	1.5
o-Xylene	3.85
p/m-Xylene	10.2
Tertiary butyl Alcohol	9.12
Tetrachloroethene	2.54
Toluene	6.52
Trichloroethene	1.08
Trichlorofluoromethane	1.28

Client Sample ID:	RI-SSSV01
Date Sampled:	7/29/2022
Matrix:	Sub-Slab Soil Vapor
	Conc (ug/m^3)
Acetone	104
cis-1,2-Dichloroethene	76.5
Isopropanol	42
Tetrachloroethene	14900
Trichloroethene	4220

Client Sample ID:	RISV-3
Date Sampled:	7/8/2022
Matrix:	Soil Vapor
	Conc (ug/m^3)
2,2,4-Trimethylpentane	1.07
2-Butanone	6.46
Acetone	88.4
Benzene	0.923
Chloromethane	1.23
Dichlorodifluoromethane	2.21
Ethanol	247
Ethylbenzene	0.986
Heptane	2.92
Isopropanol	5.78
Methylene chloride	2.25
n-Hexane	1.59
o-Xylene	1.25
p/m-Xylene	3.37
Tertiary butyl Alcohol	15.5
Toluene	8.48
Trichlorofluoromethane	1.43

Analyte	NYSDOH Matrix A	NYSDOH Matrix B	NYSDOH Matrix C
cis-1,2-Dichloroethene	6		
Methylene chloride		100	
Tetrachloroethene		100	
Trichloroethene	6		
Vinyl chloride			6

NOTES:
1. Results are measured in ug/m^3.
2. Detected compounds in each sample are disaplayed.
   = Concentration of compound exceeds the lowest threshold of the NYSDOH Matrix A or B Sub-Slab Vapor Concentrations Criteria.

ABBRIEVIATIONS:
NYSDOH Matrix A = NYSDOH Matrix A Sub-slab Vapor Concentration Criteria Lower Threshold.
NYSDOH Matrix B = NYSDOH Matrix B Sub-slab Vapor Concentration Criteria Lower Threshold.
ug/m^3 = Micrograms per cubic meter.

LEGEND:

- PROPERTY/SITE BOUNDARY
- RI-SV5 - SOIL VAPOR SAMPLING LOCATIONS AND NUMBERS
- RI-SV-AA01 - AMBIENT AIR SAMPLE NUMBER & APPROX. LOCATION
- SSSV01 - SUB-SLAB SOIL VAPOR SAMPLING LOCATIONS AND NUMBERS

REFERENCE
SITE SURVEY PREPARED BY RICHARD J. DOMATO, DATED MARCH 5, 2021.

NOTE:
THIS PLAN IS FOR LOCATING SOIL VAPOR POINTS ONLY.
OTHER SITE WORK SHOWN HERE IS NOT INTENDED FOR CONSTRUCTION.

Scale 1"=40'
0 40 80

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N: \ACAD\11895\R\11895 – FIG–5.3 – SOIL VAPOR AND AMBIENT AIR SAMPLE RESULTS PLAN – WC.DWG 04/09/24 03:52:14PM, alan.ward, LAYOUT:FIG–5.3

dwg by: aas
chk by: FL
scale: N.T.S.
date: 07/29/2022

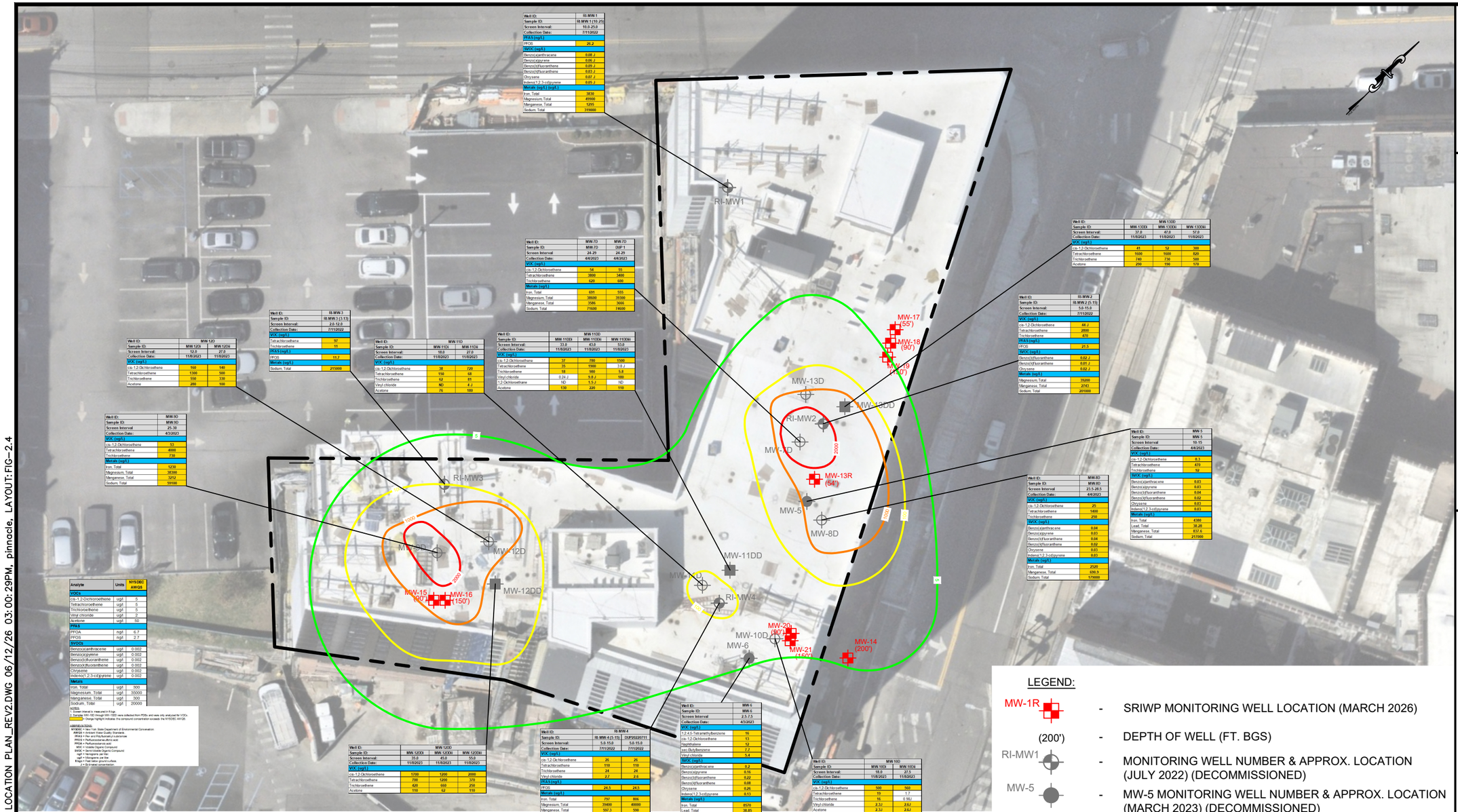
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project:
REMEDIAL INVESTIGATION REPORT
140, 148-150 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title:
SOIL VAPOR AND AMBIENT AIR SAMPLE RESULTS PLAN

job no: 11895
drawing no:

FIG-2.3



Well ID:	RI-MW 1
Sample ID:	RI MW 1 (15-25)
Screen Interval:	15.0-25.0
Collection Date:	7/11/2022
PFAS (ng/L)	
PFOS	25.2
SVOC (ug/L)	
Benzo(a)anthracene	0.08 J
Benzo(a)pyrene	0.06 J
Benzo(b)fluoranthene	0.09 J
Benzo(k)fluoranthene	0.03 J
Chrysene	0.07 J
Indeno(1,2,3-cd)pyrene	0.05 J
Metals (ug/L) qt gt 1	
Iron, Total	3830
Magnesium, Total	49900
Manganese, Total	5295
Sodium, Total	315000

Well ID:	MW-7D	MW-7D
Sample ID:	MW-7D	DUP 1
Screen Interval:	24-25	24-25
Collection Date:	4/4/2023	4/4/2023
VOC (ug/L)		
cis-1,2-Dichloroethene	54	55
Tetrachloroethene	3800	3400
Trichloroethene	520	500
Metals (ug/L)		
Iron, Total	691	555
Magnesium, Total	38500	35300
Manganese, Total	3586	3666
Sodium, Total	71500	74600

Well ID:	RI-MW 3
Sample ID:	RI-MW-3 (13)
Screen Interval:	2.0-12.0
Collection Date:	7/11/2022
VOC (ug/L)	
Tetrachloroethene	37
Trichloroethene	11
PFAS (ng/L)	
PFOS	11.7
Metals (ug/L)	
Sodium, Total	251000

Well ID:	MW-12D		
Sample ID:	MW-12D	MW-12DD	MW-12DDI
Screen Interval:	35.0	45.0	55.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	1700	1200	2000
Tetrachloroethene	700	1200	370
Trichloroethene	420	560	250
Acetone	110	62	110

Well ID:	MW-13D		
Sample ID:	MW-13DD	MW-13DDI	MW-13DDDI
Screen Interval:	37.0	47.0	57.0
Collection Date:	11/9/2023	11/9/2023	11/9/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	41	52	200
Tetrachloroethene	1600	1600	820
Trichloroethene	140	730	500
Acetone	200	100	170

Well ID:	RI-MW 2
Sample ID:	RI-MW-2 (5.15)
Screen Interval:	5.0-15.0
Collection Date:	7/11/2022
VOC (ug/L)	
cis-1,2-Dichloroethene	44 J
Tetrachloroethene	2800
Trichloroethene	470
PFAS (ng/L)	
PFOS	21.5
SVOC (ug/L)	
Benzo(k)fluoranthene	0.02 J
Benzo(k)fluoranthene	0.01 J
Chrysene	0.02 J
Metals (ug/L)	
Magnesium, Total	15200
Manganese, Total	2743
Sodium, Total	201000

Well ID:	MW-5
Sample ID:	MW-5
Screen Interval	10-15
Collection Date:	4/4/2023
VOC (ug/L)	
cis-1,2-Dichloroethene	8.3
Tetrachloroethene	470
Trichloroethene	52
SVOC (ug/L)	
Benzo(a)anthracene	0.03
Benzo(a)pyrene	0.03
Benzo(b)fluoranthene	0.04
Benzo(k)fluoranthene	0.02
Chrysene	0.03
Indeno(1,2,3-cd)pyrene	0.03
Metals (ug/L)	
Iron, Total	4380
Lead, Total	38.28
Manganese, Total	837.8
Sodium, Total	217000

Well ID:	MW-8D
Sample ID:	MW-8D
Screen Interval	23.5-28.5
Collection Date:	4/4/2023
VOC (ug/L)	
cis-1,2-Dichloroethene	25
Tetrachloroethene	1400
Trichloroethene	250
SVOC (ug/L)	
Benzo(a)anthracene	0.04
Benzo(a)pyrene	0.03
Benzo(b)fluoranthene	0.04
Benzo(k)fluoranthene	0.02
Chrysene	0.03
Indeno(1,2,3-cd)pyrene	0.03
Metals (ug/L)	
Iron, Total	2520
Manganese, Total	690.5
Sodium, Total	175000

Well ID:	MW-9D
Sample ID:	MW-9D
Screen Interval	25-35
Collection Date:	4/5/2023
VOC (ug/L)	
cis-1,2-Dichloroethene	53
Tetrachloroethene	4000
Trichloroethene	730
Metals (ug/L)	
Iron, Total	1230
Magnesium, Total	36300
Manganese, Total	1212
Sodium, Total	59100

Well ID:	MW-10D		
Sample ID:	MW-10D	MW-10DI	MW-10DDI
Screen Interval:	33.0	43.0	53.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	37	780	1000
Tetrachloroethene	35	1900	3.8 J
Trichloroethene	16	980	5.8
Vinyl chloride	0.24 J	5.8 J	180
1,2-Dichloroethene	ND	1.5 J	ND
Acetone	130	220	110

Well ID:	MW-11D		
Sample ID:	MW-11DI	MW-11DDI	MW-11DDDI
Screen Interval:	18.0	27.0	
Collection Date:	11/8/2023	11/8/2023	
VOC (ug/L)			
cis-1,2-Dichloroethene	38	720	
Tetrachloroethene	150	68	
Trichloroethene	62	81	
Vinyl chloride	ND	4 J	
Acetone	76	160	

Well ID:	RI MW-4	
Sample ID:	RI MW-4 (5-15)	DUP0022711
Screen Interval:	5.0-15.0	5.0-15.0
Collection Date:	7/11/2022	7/11/2022
VOC (ug/L)		
cis-1,2-Dichloroethene	25	25
Tetrachloroethene	110	110
Trichloroethene	24	24
Vinyl chloride	2.2	2.4
PFAS (ng/L)		
PFOS	24.5	24.5
Metals (ug/L)		
Iron, Total	797	806
Magnesium, Total	39400	40000
Manganese, Total	557.3	590
Sodium, Total	276000	275000

Well ID:	MW-6
Sample ID:	MW-6
Screen Interval	2.5-7.5
Collection Date:	4/3/2023
VOC (ug/L)	
1,2,4,5-Tetramethylbenzene	15
cis-1,2-Dichloroethene	13
Naphthalene	12
sec-Butylbenzene	7.7
Vinyl chloride	5.4
SVOC (ug/L)	
Benzo(a)anthracene	0.2
Benzo(a)pyrene	0.16
Benzo(b)fluoranthene	0.22
Benzo(k)fluoranthene	0.08
Chrysene	0.26
Indeno(1,2,3-cd)pyrene	0.13
Metals (ug/L)	
Iron, Total	8570
Lead, Total	38.85
Manganese, Total	3212
Sodium, Total	158000

Well ID:	MW-10D	
Sample ID:	MW-10DI	MW-10DII
Screen Interval:	58.0	27.5
Collection Date:	11/8/2023	11/8/2023
VOC (ug/L)		
cis-1,2-Dichloroethene	560	560
Tetrachloroethene	19	17
Trichloroethene	16	0.16J
Vinyl chloride	2.3J	2.6J
Acetone	2.3J	2.6J

Analyte	Units	NYSDEC AWQS
VOCs		
cis-1,2-Dichloroethene	ug/l	5
Tetrachloroethene	ug/l	5
Trichloroethene	ug/l	5
Vinyl chloride	ug/l	2
Acetone	ug/l	50
PFAS		
PFOA	ng/l	6.7
PFOS	ng/l	2.7
SVOCs		
Benzo(a)anthracene	ug/l	0.002
Benzo(a)pyrene	ug/l	0.002
Benzo(b)fluoranthene	ug/l	0.002
Benzo(k)fluoranthene	ug/l	0.002
Chrysene	ug/l	0.002
Indeno(1,2,3-cd)pyrene	ug/l	0.002
Metals		
Iron, Total	ug/l	300
Magnesium, Total	ug/l	35000
Manganese, Total	ug/l	300
Sodium, Total	ug/l	20000

NOTES:
1. Screen interval in meters bgs.
2. Only VOCs, PFAS, SVOCs and Metals collected from PDBs and were only analyzed for VOCs.
3. Orange highlight indicates the compound concentration exceeds the NYSDEC AWQS.

ABBREVIATIONS:
NYSDEC = New York State Department of Environmental Conservation
AWQS = Ambient Water Quality Standards
PFAS = Per- and Polyfluoroalkyl substances
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
VOC = Volatile Organic Compound
SVOC = Semi-Volatile Organic Compound
ug/l = Micrograms per liter
ng/l = Nanograms per liter
ft bgs = Feet below ground surface
J = Estimated concentration.

LEGEND:

- MW-1R - SRIWP MONITORING WELL LOCATION (MARCH 2026)
- (200') - DEPTH OF WELL (FT. BGS)
- RI-MW1 - MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2022) (DECOMMISSIONED)
- MW-5 - MW-5 MONITORING WELL NUMBER & APPROX. LOCATION (MARCH 2023) (DECOMMISSIONED)
- MW-8D - MW-8D (28.5-30 ft bgs) MONITORING WELL NUMBER & APPROX. LOCATION (MARCH AND JULY 2023) (DECOMMISSIONED)
- MW-11DD - MW-1DD (55-59' bgs) MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2023) (DECOMMISSIONED)
- 5 - CONCENTRATION ISOPLETH 5 Ug/L
- 100 - CONCENTRATION ISOPLETH 100 Ug/L
- 1000 - CONCENTRATION ISOPLETH 1000 Ug/L
- 2000 - CONCENTRATION ISOPLETH 2000 Ug/L

SCALE: 1"=30'
0 30 60

NYS Education Law
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dwg by: EC
chk by: SL
scale: AS NOTED
date: 06/11/26

project: 146 WESTCHESTER AVENUE PORT CHESTER, NY

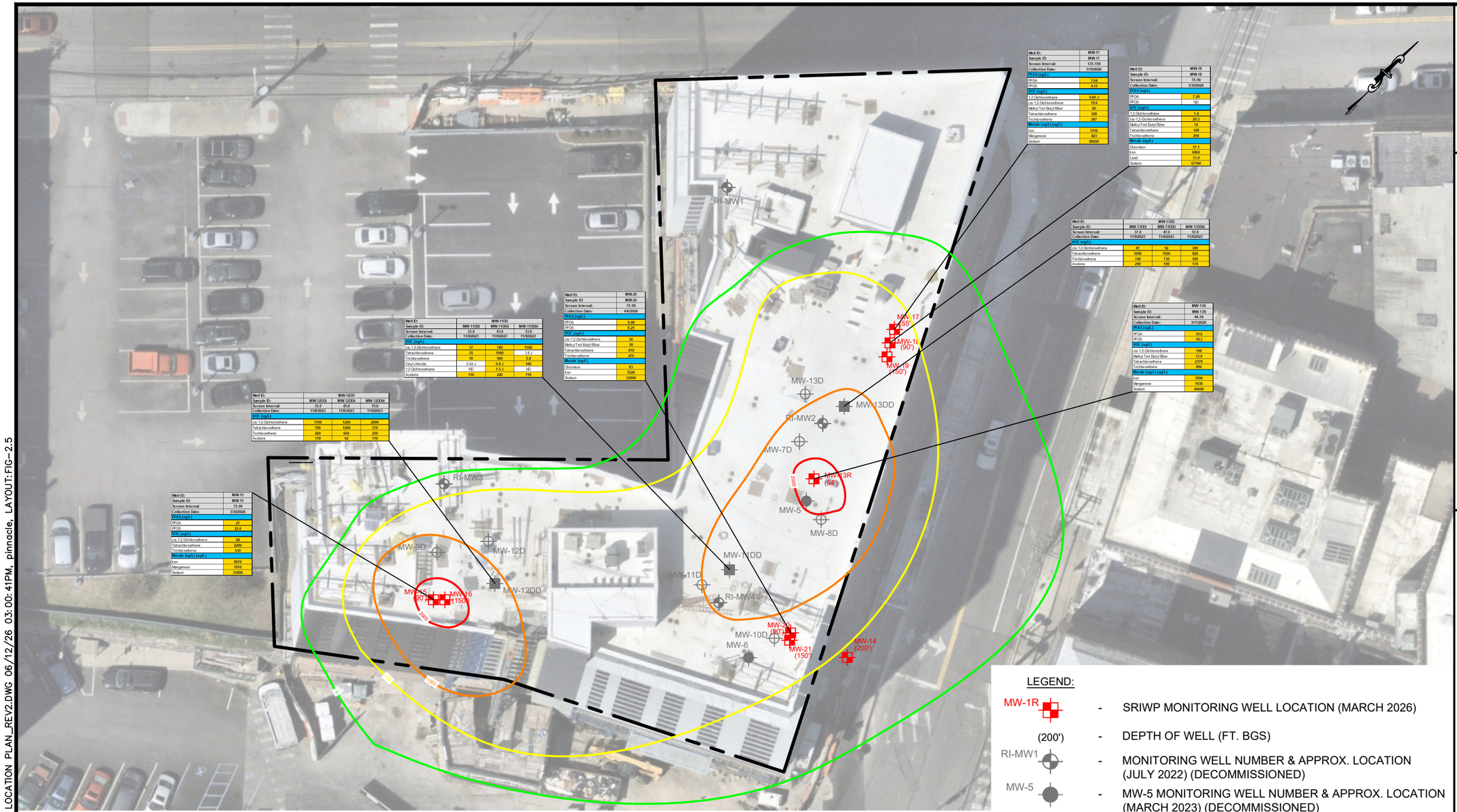
title: TETRACHLOROETHENE CONCENTRATION ISOPLETHS - SHALLOW (GROUND TO 0 ft EL)

job no: 11895
drawing no:

FIG-2.4

1 of 1

N:\ACAD\11895\11895.DWG.INJ & MON WELL LOCATION PLAN_REV2.DWG 06/12/26 03:00:29PM, pinnacle, LAYOUT:FIG-2.4



Well ID:	MW-11D		
Sample ID:	MW-11D	MW-11DDi	MW-11DDii
Screen Interval:	33.0	43.0	53.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	37	780	1500
Tetrachloroethene	35	1900	3.9 J
Trichloroethene	18	980	5.8
Vinyl chloride	0.24 J	9.8 J	180
1,2-Dichloroethane	ND	1.5 J	ND
Acetone	130	220	110

Well ID:	MW-12D		
Sample ID:	MW-12Di	MW-12Dii	MW-12Diii
Screen Interval:	35.0	45.0	55.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	1700	1200	2000
Tetrachloroethene	700	1200	320
Trichloroethene	420	660	250
Acetone	110	62	110

Well ID:	MW-15
Sample ID:	MW-15
Screen Interval:	75-90
Collection Date:	3/30/2026
PFAS (ng/L)	
PFOA	31
PFOS	22.6
VOC (ug/L)	
cis-1,2-Dichloroethene	44
Tetrachloroethene	2200
Trichloroethene	630
Metals (ug/L) (ug/L)	
Iron	8970
Manganese	1810
Sodium	51000

Well ID:	MW-20
Sample ID:	MW-20
Screen Interval:	75-90
Collection Date:	4/6/2026
PFAS (ng/L)	
PFOA	9.68
PFOS	8.25
VOC (ug/L)	
cis-1,2-Dichloroethene	36
Methyl Tert Butyl Ether	18
Tetrachloroethene	410
Trichloroethene	470
Metals (ug/L)	
Chromium	83
Iron	9530
Sodium	52900

Well ID:	MW-17
Sample ID:	MW-17
Screen Interval:	135-150
Collection Date:	3/30/2026
PFAS (ng/L)	
PFOA	7.64
PFOS	4.55
VOC (ug/L)	
1,2-Dichloroethane	0.89 J
cis-1,2-Dichloroethene	19.6
Methyl Tert Butyl Ether	20
Tetrachloroethene	388
Trichloroethene	287
Metals (ug/L) (ug/L)	
Iron	5150
Manganese	423
Sodium	88600

Well ID:	MW-18
Sample ID:	MW-18
Screen Interval:	75-90
Collection Date:	3/30/2026
PFAS (ng/L)	
PFOA	7.25
PFOS	ND
VOC (ug/L)	
1,2-Dichloroethane	1.4
cis-1,2-Dichloroethene	20.5
Methyl Tert Butyl Ether	14
Tetrachloroethene	128
Trichloroethene	254
Metals (ug/L)	
Chromium	51.1
Iron	6850
Lead	33.9
Sodium	67100

Well ID:	MW-13DD		
Sample ID:	MW-13DDi	MW-13DDii	MW-13DDiii
Screen Interval:	37.0	47.0	57.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	41	52	200
Tetrachloroethene	1600	1600	820
Trichloroethene	140	730	500
Acetone	200	190	170

Well ID:	MW-13R
Sample ID:	MW-13R
Screen Interval:	44-54
Collection Date:	3/11/2026
PFAS (ng/L)	
PFOA	19.3
PFOS	18.3
VOC (ug/L)	
cis-1,2-Dichloroethene	198
Methyl Tert Butyl Ether	13.5
Tetrachloroethene	2370
Trichloroethene	896
Metals (ug/L) (ug/L)	
Iron	3090
Manganese	1930
Sodium	89000

LEGEND:

- MW-1R — SRIWP MONITORING WELL LOCATION (MARCH 2026)
- (200') — DEPTH OF WELL (FT. BGS)
- RI-MW1 — MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2022) (DECOMMISSIONED)
- MW-5 — MW-5 MONITORING WELL NUMBER & APPROX. LOCATION (MARCH 2023) (DECOMMISSIONED)
- MW-8D — MW-8D (28.5-30 ft bgs) MONITORING WELL NUMBER & APPROX. LOCATION (MARCH AND JULY 2023) (DECOMMISSIONED)
- MW-11DD — MW-1DD (55-59' bgs) MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2023) (DECOMMISSIONED)
- 5 — CONCENTRATION ISOPLETH 5 Ug/L
- 100 — CONCENTRATION ISOPLETH 100 Ug/L
- 1000 — CONCENTRATION ISOPLETH 1000 Ug/L
- 2000 — CONCENTRATION ISOPLETH 2000 Ug/L

SCALE: 1"=30'

0 30 60

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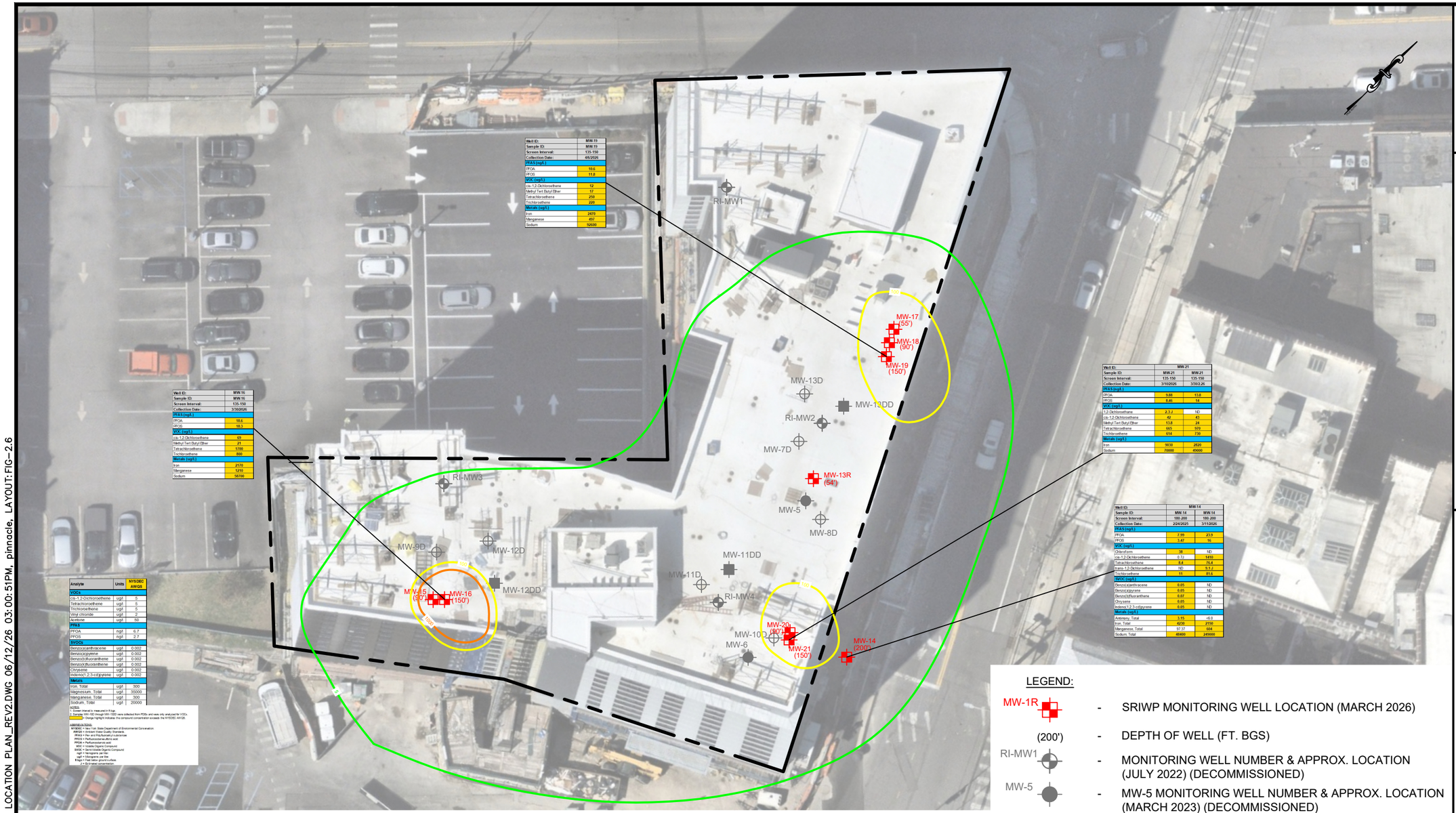
project: 146 WESTCHESTER AVENUE PORT CHESTER, NY

title: TETRACHLOROETHENE CONCENTRATION ISOPLETHS - INTERMEDIATE (0 ft EL TO -50 ft EL)

job no: 11895
drawing no: FIG-2.5

1 of 1

N:\ACAD\11895\11895.DWG,INJ & MON WELL LOCATION PLAN_REV2.DWG 06/12/26 03:00:41PM, pinnacle, LAYOUT:FIG-2.5



Well ID:	MW-19
Sample ID:	MW-19
Screen Interval:	135-150
Collection Date:	4/6/2026
PFAS (ng/L)	
PFOA	10.6
PFOS	11.8
VOC (ug/L)	
cis-1,2-Dichloroethene	12
Methyl Tert Butyl Ether	17
Tetrachloroethene	250
Trichloroethene	220
Metals (ug/L)	
Iron	2470
Manganese	457
Sodium	52600

Well ID:	MW-16
Sample ID:	MW-16
Screen Interval:	135-150
Collection Date:	3/30/2026
PFAS (ng/L)	
PFOA	18.6
PFOS	18.3
VOC (ug/L)	
cis-1,2-Dichloroethene	69
Methyl Tert Butyl Ether	21
Tetrachloroethene	1700
Trichloroethene	880
Metals (ug/L)	
Iron	2170
Manganese	1210
Sodium	58700

Well ID:	MW-21	
Sample ID	MW-21	MW-21
Screen Interval:	135-150	135-150
Collection Date:	3/19/2026	3/30/26
PFAS (ng/L)		
PFOA	9.88	13.8
PFOS	8.45	14
VOC (ug/L)		
1,2-Dichloroethane	2.1 J	ND
cis-1,2-Dichloroethene	42	43
Methyl Tert Butyl Ether	13.8	24
Tetrachloroethene	665	970
Trichloroethene	614	730
Metals (ug/L)		
Iron	3630	2520
Sodium	70000	49000

Well ID:	MW-14	
Sample ID:	MW-14	MW-14
Screen Interval:	180-200	180-200
Collection Date:	2/24/2025	3/11/2026
PFAS (ng/L)		
PFOA	7.99	23.9
PFOS	3.47	16
VOC (ug/L)		
Chloroform	36	ND
cis-1,2-Dichloroethene	0.71	1410
Tetrachloroethene	8.4	76.4
trans-1,2-Dichloroethene	ND	9.1 J
Trichloroethene	11	81.6
SVOC (ug/L)		
Benz(a)anthracene	0.05	ND
Benzo(a)pyrene	0.05	ND
Benzo(b)fluoranthene	0.07	ND
Chrysene	0.05	ND
Indeno(1,2,3-cd)pyrene	0.05	ND
Metals (ug/L)		
Antimony, Total	3.55	<3.0
Iron, Total	4230	2750
Manganese, Total	97.37	604
Sodium, Total	48400	249000

Analyte	Units	NYSDEC AWQS
VOCs		
cis-1,2-Dichloroethene	ug/l	5
Tetrachloroethene	ug/l	5
Trichloroethene	ug/l	5
Vinyl chloride	ug/l	2
Acetone	ug/l	50
PFAS		
PFOA	ng/l	6.7
PFOS	ng/l	2.7
SVOCs		
Benzo(a)anthracene	ug/l	0.002
Benzo(a)pyrene	ug/l	0.002
Benzo(b)fluoranthene	ug/l	0.002
Benzo(k)fluoranthene	ug/l	0.002
Chrysene	ug/l	0.002
Indeno(1,2,3-cd)pyrene	ug/l	0.002
Metals		
Iron, Total	ug/l	300
Magnesium, Total	ug/l	35000
Manganese, Total	ug/l	300
Sodium, Total	ug/l	20000

1. Screen interval is measured in ft bgs.
2. Samples MW-19D through MW-10DD were collected from PDBs and were only analyzed for VOCs.
Orange highlight indicates the compound concentration exceeds the NYSDEC AWQS.

ABBREVIATIONS:
NYSDEC = New York State Department of Environmental Conservation
AWQS = Ambient Water Quality Standards
VOCs = Volatile Organic Compounds
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
SVOCs = Semi-Volatile Organic Compound
NVOC = Semi-Volatile Organic Compound
ng/l = Nanograms per liter
ug/l = Micrograms per liter
ft bgs = Feet below ground surface
J = Estimated concentration

LEGEND:

- MW-1R (200') - SRIWP MONITORING WELL LOCATION (MARCH 2026)
- (200') - DEPTH OF WELL (FT. BGS)
- RI-MW1 - MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2022) (DECOMMISSIONED)
- MW-5 - MW-5 MONITORING WELL NUMBER & APPROX. LOCATION (MARCH 2023) (DECOMMISSIONED)
- MW-8D - MW-8D (28.5-30 ft bgs) MONITORING WELL NUMBER & APPROX. LOCATION (MARCH AND JULY 2023) (DECOMMISSIONED)
- MW-11DD - MW-1DD (55-59' bgs) MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2023) (DECOMMISSIONED)
- 5 - CONCENTRATION ISOPLETH 5 Ug/L
- 100 - CONCENTRATION ISOPLETH 100 Ug/L
- 1000 - CONCENTRATION ISOPLETH 1000 Ug/L
- 2000 - CONCENTRATION ISOPLETH 2000 Ug/L

SCALE: 1"=30'
0 30 60

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chk by: SL
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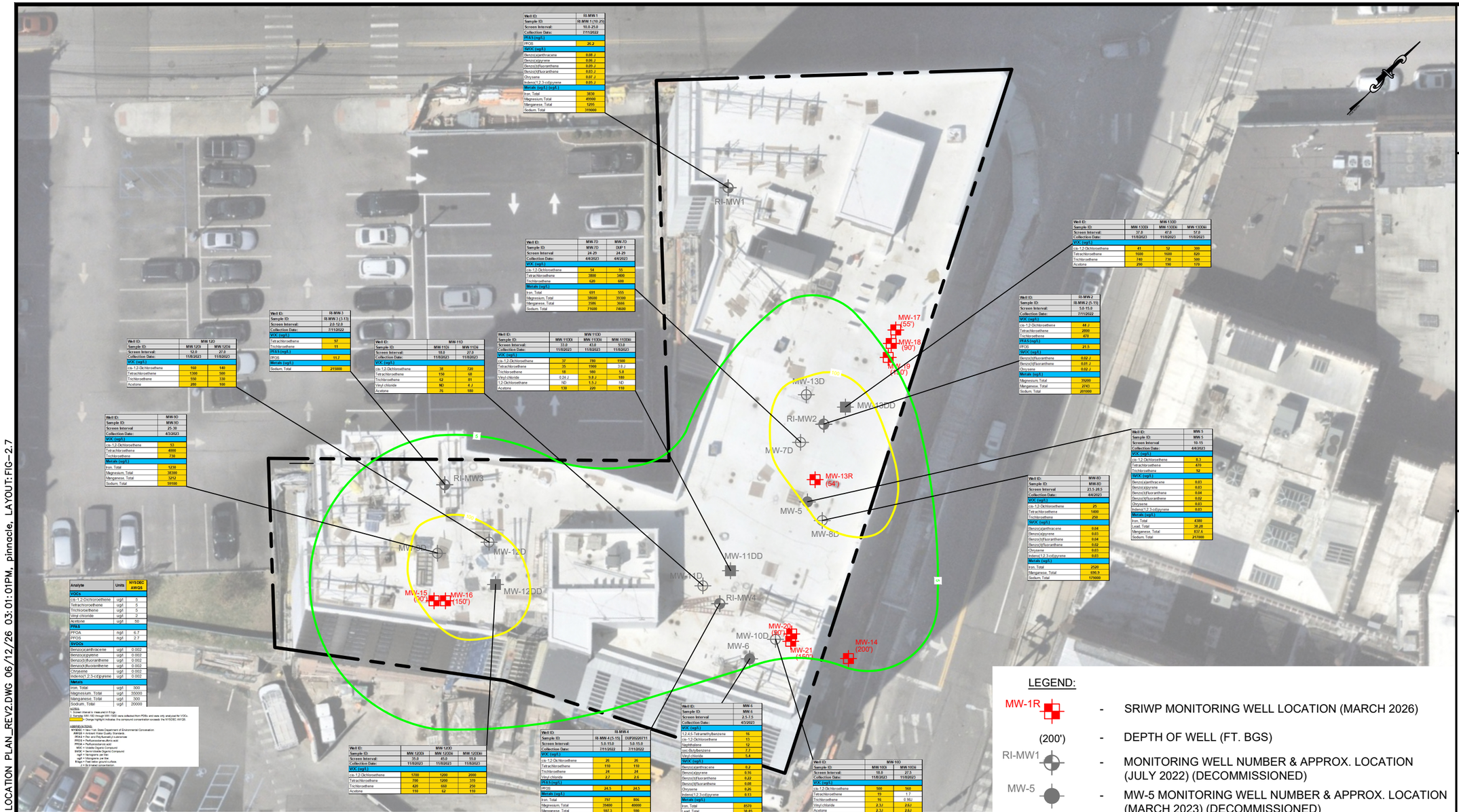
project: 146 WESTCHESTER AVENUE PORT CHESTER, NY

title: TETRACHLOROETHENE CONCENTRATION ISOPLETHS - DEEP (-50 ft EL TO -150 ft EL)

job no: 11895
drawing no: FIG-2.6

1 of 1

N:\ACAD\11895\11895.DWG.INJ & MON WELL LOCATION PLAN_REV2.DWG 06/12/26 03:00:51PM, pinnacle, LAYOUT:FIG-2.6



LEGEND:

- MW-1R (200') - SRIWP MONITORING WELL LOCATION (MARCH 2026)
- (200') - DEPTH OF WELL (FT. BGS)
- RI-MW1 - MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2022) (DECOMMISSIONED)
- MW-5 - MW-5 MONITORING WELL NUMBER & APPROX. LOCATION (MARCH 2023) (DECOMMISSIONED)
- MW-8D - MW-8D (28.5-30 ft bgs) MONITORING WELL NUMBER & APPROX. LOCATION (MARCH AND JULY 2023) (DECOMMISSIONED)
- MW-11DD - MW-1DD (55-59' bgs) MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2023) (DECOMMISSIONED)
- 5 - CONCENTRATION ISOPLETH 5 Ug/L
- 100 - CONCENTRATION ISOPLETH 100 Ug/L
- 1000 - CONCENTRATION ISOPLETH 1000 Ug/L
- 2000 - CONCENTRATION ISOPLETH 2000 Ug/L

SCALE: 1"=30'

0 30 60

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project: 146 WESTCHESTER AVENUE PORT CHESTER, NY

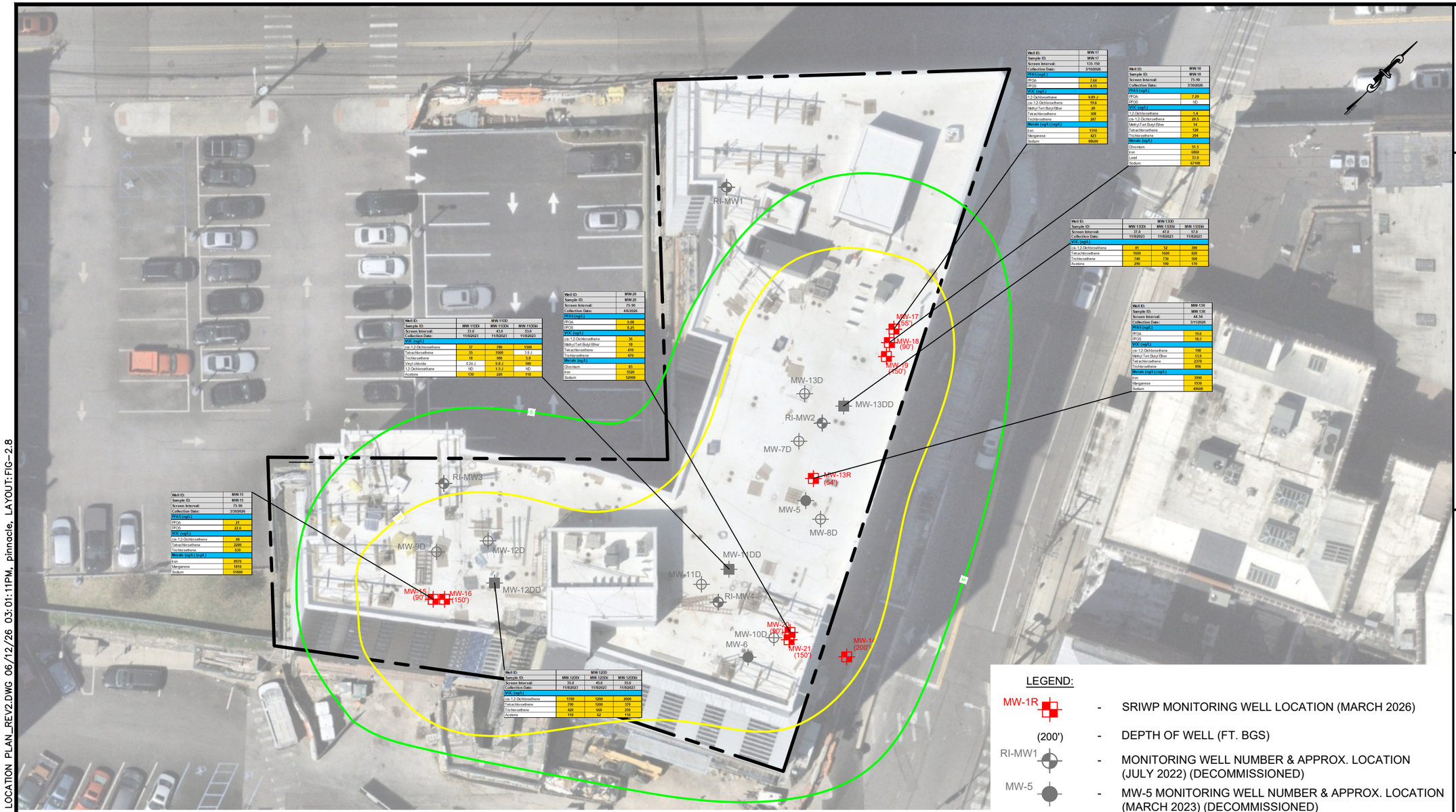
title: TRICHLOROETHENE CONCENTRATION ISOPLETHS - SHALLOW (GROUND TO 0 ft EL)

job no: 11895
drawing no:

FIG-2.7

1 of 1

N:\ACAD\11895\11895.DWG.INJ & MON WELL LOCATION PLAN_REV2.DWG 06/12/26 03:01:01PM, pinnacle, LAYOUT:FIG-2.7



Well ID:	MW-11D		
Sample ID:	MW-11D	MW-11DDi	MW-11DDii
Screen Interval:	33.0	43.0	53.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	37	780	1500
Tetrachloroethene	35	1900	3.9 J
Trichloroethene	18	980	5.8
Vinyl chloride	0.24 J	9.8 J	189
1,2-Dichloroethane	ND	1.5 J	ND
Acetone	130	220	110

Well ID:	MW-20
Sample ID:	MW-20
Screen Interval:	75-90
Collection Date:	4/6/2026
PFAS (ng/L)	
PFOA	9.68
PFOS	8.25
VOC (ug/L)	
cis-1,2-Dichloroethene	36
Methyl Tert Butyl Ether	18
Tetrachloroethene	410
Trichloroethene	470
Metals (ug/L) (ug/L)	
Chromium	83
Iron	9530
Sodium	52900

Well ID:	MW-17
Sample ID:	MW-17
Screen Interval:	135-150
Collection Date:	3/10/2026
PFAS (ng/L)	
PFOA	7.64
PFOS	4.55
VOC (ug/L)	
1,2-Dichloroethane	0.89 J
cis-1,2-Dichloroethene	19.6
Methyl Tert Butyl Ether	20
Tetrachloroethene	388
Trichloroethene	287
Metals (ug/L) (ug/L)	
Iron	5150
Manganese	423
Sodium	88600

Well ID:	MW-18
Sample ID:	MW-18
Screen Interval:	75-90
Collection Date:	3/30/2026
PFAS (ng/L)	
PFOA	7.25
PFOS	ND
VOC (ug/L)	
1,2-Dichloroethane	1.4
cis-1,2-Dichloroethene	20.5
Methyl Tert Butyl Ether	14
Tetrachloroethene	128
Trichloroethene	254
Metals (ug/L)	
Chromium	51.1
Iron	6850
Lead	33.9
Sodium	67100

Well ID:	MW-13DD	MW-13DDi	MW-13DDii
Sample ID:	MW-13DD	MW-13DDi	MW-13DDii
Screen Interval:	37.0	47.0	57.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	41	52	200
Tetrachloroethene	1600	1600	820
Trichloroethene	740	730	500
Acetone	200	190	170

Well ID:	MW-13R
Sample ID:	MW-13R
Screen Interval:	44-54
Collection Date:	3/11/2026
PFAS (ng/L)	
PFOA	19.6
PFOS	18.5
VOC (ug/L)	
cis-1,2-Dichloroethene	198
Methyl Tert Butyl Ether	13.5
Tetrachloroethene	2370
Trichloroethene	896
Metals (ug/L) (ug/L)	
Iron	3090
Manganese	1930
Sodium	49000

Well ID:	MW-15
Sample ID:	MW-15
Screen Interval:	75-90
Collection Date:	3/30/2026
PFAS (ng/L)	
PFOA	31
PFOS	22.6
VOC (ug/L)	
cis-1,2-Dichloroethene	44
Tetrachloroethene	2200
Trichloroethene	530
Metals (ug/L) (ug/L)	
Iron	8920
Manganese	1810
Sodium	51800

Well ID:	MW-12DD		
Sample ID:	MW-12DDi	MW-12DDii	MW-12DDiii
Screen Interval:	31.0	41.0	51.0
Collection Date:	11/9/2023	11/9/2023	11/9/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	1700	5200	2000
Tetrachloroethene	700	5200	320
Trichloroethene	420	910	250
Acetone	110	62	110

LEGEND:

- MW-1R (200') - SRIWP MONITORING WELL LOCATION (MARCH 2026); DEPTH OF WELL (FT. BGS)
- RI-MW1 - MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2022) (DECOMMISSIONED)
- MW-5 - MW-5 MONITORING WELL NUMBER & APPROX. LOCATION (MARCH 2023) (DECOMMISSIONED)
- MW-8D - MW-8D (28.5-30 ft bgs) MONITORING WELL NUMBER & APPROX. LOCATION (MARCH AND JULY 2023) (DECOMMISSIONED)
- MW-11DD - MW-1DD (55-59' bgs) MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2023) (DECOMMISSIONED)
- 5 - CONCENTRATION ISOPLETH 5 Ug/L
- 100 - CONCENTRATION ISOPLETH 100 Ug/L
- 1000 - CONCENTRATION ISOPLETH 1000 Ug/L
- 2000 - CONCENTRATION ISOPLETH 2000 Ug/L

SCALE: 1"=30'

0 30 60

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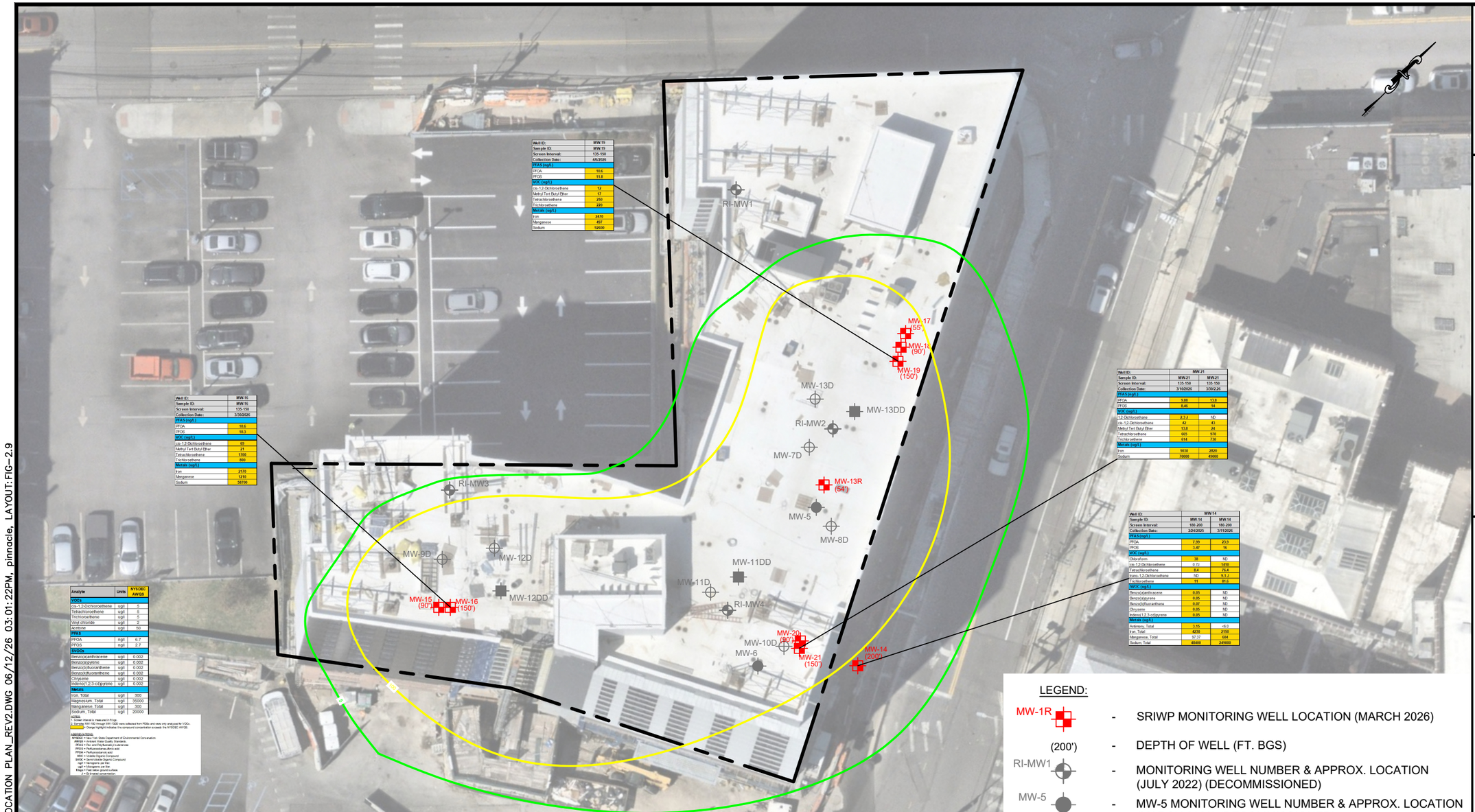
project: 146 WESTCHESTER AVENUE PORT CHESTER, NY

title: TRICHLOROETHENE CONCENTRATION ISOPLETHS - INTERMEDIATE (0 ft EL TO -50 ft EL)

job no: 11895
drawing no: FIG-2.8

1 of 1

N:\ACAD\11895\11895.DWG.INJ & MON WELL LOCATION PLAN_REV2.DWG 06/12/26 03:01:11PM, pinnacle, LAYOUT:FIG-2.8



LEGEND:

- MW-1R — SRIWP MONITORING WELL LOCATION (MARCH 2026)
- (200') — DEPTH OF WELL (FT. BGS)
- RI-MW1 — MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2022) (DECOMMISSIONED)
- MW-5 — MW-5 MONITORING WELL NUMBER & APPROX. LOCATION (MARCH 2023) (DECOMMISSIONED)
- MW-8D — MW-8D (28.5-30 ft bgs) MONITORING WELL NUMBER & APPROX. LOCATION (MARCH AND JULY 2023) (DECOMMISSIONED)
- MW-11DD — MW-1DD (55-59' bgs) MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2023) (DECOMMISSIONED)
- 5 — CONCENTRATION ISOPLETH 5 Ug/L
- 100 — CONCENTRATION ISOPLETH 100 Ug/L
- 1000 — CONCENTRATION ISOPLETH 1000 Ug/L
- 2000 — CONCENTRATION ISOPLETH 2000 Ug/L

SCALE: 1"=30'

0 30 60

NYS Education Law

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REFERENCE:

EXIST CONDITIONS & BOUNDARY ARE TAKEN FROM FOUNDATION PLAN PREPARED BY LESSARD DESIGN INC. P.C., DATED NOVEMBER 8, 2024.

dwg by: EC
chk by: SL
scale: AS NOTED
date: 06/11/26

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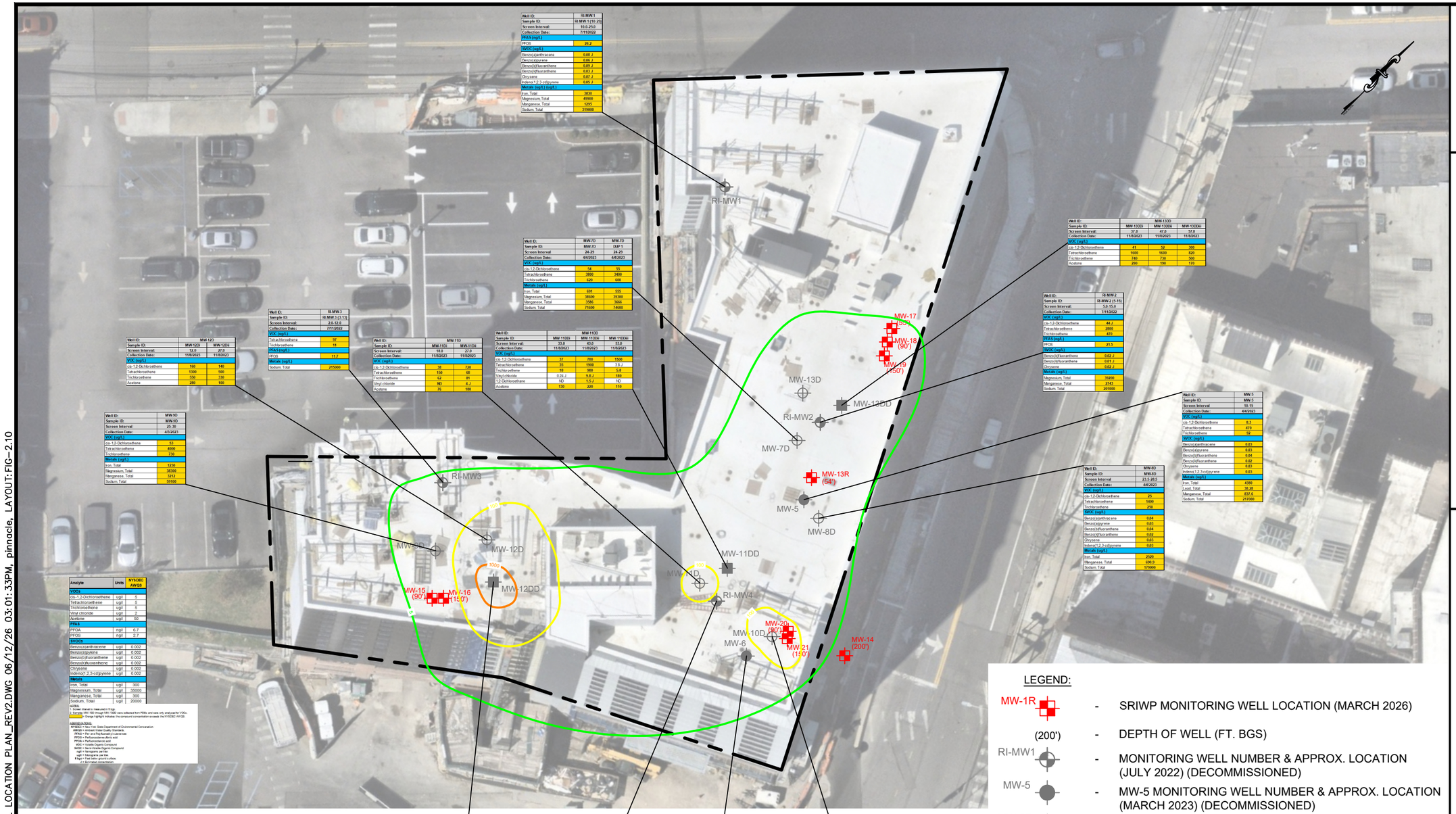
project: 146 WESTCHESTER AVENUE PORT CHESTER, NY

title: TRICHLOROETHENE CONCENTRATION ISOPLETHS - DEEP (-50 ft EL TO -150 ft EL)

job no: 11895
drawing no: FIG-2.9

1 of 1

N:\ACAD\11895\11895.DWG.INJ & MON WELL LOCATION PLAN_REV2.DWG 06/12/26 03:01:22PM, pinnacle, LAYOUT:FIG-2.9



Well ID:	RI-MW 1
Sample ID:	RI MW 1 (10.25)
Screen Interval:	10.0-25.0
Collection Date:	7/11/2022
PFAS (ng/L)	
PFOS	25.2
SVOC (ug/L)	
Benzo(a)anthracene	0.08 J
Benzo(a)pyrene	0.06 J
Benzo(b)fluoranthene	0.09 J
Benzo(k)fluoranthene	0.03 J
Chrysene	0.07 J
Indeno(1,2,3-cd)pyrene	0.05 J
Metals (ug/L)	
Iron, Total	3830
Magnesium, Total	49900
Manganese, Total	5295
Sodium, Total	315000

Well ID:	MW-7D	MW-7D
Sample ID:	MW-7D	DUP 1
Screen Interval:	24-25	24-25
Collection Date:	4/4/2023	4/4/2023
VOC (ug/L)		
cis-1,2-Dichloroethene	54	55
Tetrachloroethene	3800	3400
Trichloroethene	520	500
Metals (ug/L)		
Iron, Total	691	555
Magnesium, Total	38500	39300
Manganese, Total	3586	3666
Sodium, Total	71500	74600

Well ID:	MW-13DD	MW-13DD	MW-13DDi
Sample ID:	MW-13DD	MW-13DDi	MW-13DDii
Screen Interval:	37.0	47.0	57.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	41	52	200
Tetrachloroethene	1600	1600	820
Trichloroethene	740	730	500
Acetone	250	150	170

Well ID:	RI-MW-2
Sample ID:	RI-MW-2 (5.15)
Screen Interval:	5.0-15.0
Collection Date:	7/11/2022
VOC (ug/L)	
cis-1,2-Dichloroethene	44.0
Tetrachloroethene	2800
Trichloroethene	470
PFAS (ng/L)	
PFOS	21.5
SVOC (ug/L)	
Benzo(b)fluoranthene	0.02 J
Benzo(k)fluoranthene	0.01 J
Chrysene	0.02 J
Metals (ug/L)	
Magnesium, Total	39200
Manganese, Total	3743
Sodium, Total	285000

Well ID:	MW-5
Sample ID:	MW-5
Screen Interval:	10-15
Collection Date:	4/4/2023
VOC (ug/L)	
cis-1,2-Dichloroethene	8.3
Tetrachloroethene	670
Trichloroethene	52
SVOC (ug/L)	
Benzo(a)anthracene	0.03
Benzo(a)pyrene	0.03
Benzo(b)fluoranthene	0.04
Benzo(k)fluoranthene	0.02
Chrysene	0.03
Indeno(1,2,3-cd)pyrene	0.03
Metals (ug/L)	
Iron, Total	4380
Lead, Total	38.98
Manganese, Total	8156
Sodium, Total	217000

Well ID:	MW-8D
Sample ID:	MW-8D
Screen Interval	27.5-28.5
Collection Date:	4/4/2023
VOC (ug/L)	
cis-1,2-Dichloroethene	25
Tetrachloroethene	1600
Trichloroethene	250
SVOC (ug/L)	
Benzo(a)anthracene	0.04
Benzo(a)pyrene	0.03
Benzo(b)fluoranthene	0.04
Benzo(k)fluoranthene	0.02
Chrysene	0.03
Indeno(1,2,3-cd)pyrene	0.03
Metals (ug/L)	
Iron, Total	2520
Manganese, Total	606.9
Sodium, Total	137000

Well ID:	MW-9D
Sample ID:	MW-9D
Screen Interval	25-35
Collection Date:	4/5/2023
VOC (ug/L)	
cis-1,2-Dichloroethene	53
Tetrachloroethene	4000
Trichloroethene	720
Metals (ug/L)	
Iron, Total	1230
Magnesium, Total	38300
Manganese, Total	1252
Sodium, Total	59100

Well ID:	MW-9D	MW-9D
Sample ID:	MW-9D	DUP 2
Screen Interval:	25-35	25-35
Collection Date:	11/8/2023	11/8/2023
VOC (ug/L)		
cis-1,2-Dichloroethene	160	140
Tetrachloroethene	1300	500
Trichloroethene	550	330
Acetone	280	100

Well ID:	RI-MW-3
Sample ID:	RI-MW-3 (13.73)
Screen Interval:	2.0-12.0
Collection Date:	7/11/2022
VOC (ug/L)	
Tetrachloroethene	37
Trichloroethene	11
PFAS (ng/L)	
PFOS	11.7
Metals (ug/L)	
Sodium, Total	211000

Well ID:	MW-11D	MW-11D
Sample ID:	MW-11D	MW-11DDi
Screen Interval:	18.0	27.0
Collection Date:	11/8/2023	11/8/2023
VOC (ug/L)		
cis-1,2-Dichloroethene	38	720
Tetrachloroethene	150	68
Trichloroethene	62	81
Vinyl chloride	ND	4 J
Acetone	76	160

Well ID:	MW-11DDi	MW-11DDii	MW-11DDiii
Sample ID:	MW-11DDi	MW-11DDii	MW-11DDiii
Screen Interval:	33.0	43.0	53.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	37	780	1500
Tetrachloroethene	35	1900	3.8 J
Trichloroethene	16	380	5.8
Vinyl chloride	0.24 J	5.8 J	180
1,2-Dichloroethane	ND	1.5 J	ND
Acetone	130	220	110

Analyte	Units	NYSDEC AWQS
VOCs		
cis-1,2-Dichloroethene	ug/l	5
Tetrachloroethene	ug/l	5
Trichloroethene	ug/l	5
Vinyl chloride	ug/l	2
Acetone	ug/l	50
PFAS		
PFOA	ng/l	6.7
PFOS	ng/l	2.7
SVOCs		
Benzo(a)anthracene	ug/l	0.002
Benzo(a)pyrene	ug/l	0.002
Benzo(b)fluoranthene	ug/l	0.002
Benzo(k)fluoranthene	ug/l	0.002
Chrysene	ug/l	0.002
Indeno(1,2,3-cd)pyrene	ug/l	0.002
Metals		
Iron, Total	ug/l	300
Magnesium, Total	ug/l	35000
Manganese, Total	ug/l	300
Sodium, Total	ug/l	20000

NOTES:
1. Screen interval is measured in ft bgs
2. Samples MW-19D through MW-13DD were collected from PDBs and were only analyzed for VOCs.

Orange highlight indicates the compound concentration exceeds the NYSDEC AWQS.

ABBREVIATIONS:
NYSDEC = New York State Department of Environmental Conservation
AWQS = Ambient Water Quality Standards
PFAS = Per and Polyfluoroalkyl substances
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
VOC = Volatile Organic Compound
SVOC = Semi-Volatile Organic Compound
ng/l = Nanograms per liter
ug/l = Micrograms per liter
ft bgs = Feet below ground surface
J = Estimated concentration

Well ID:	MW-12DD		
Sample ID:	MW-12DDi	MW-12DDii	MW-12DDiii
Screen Interval:	33.0	43.0	53.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	1200	1200	2000
Tetrachloroethene	700	1200	370
Trichloroethene	420	650	250
Acetone	110	42	110

Well ID:	RI-MW-4	
Sample ID:	RI-MW-4 (5.15)	DUP20220711
Screen Interval:	5.0-15.0	5.0-15.0
Collection Date:	7/11/2022	7/11/2022
VOC (ug/L)		
cis-1,2-Dichloroethene	25	25
Tetrachloroethene	110	110
Trichloroethene	24	24
Vinyl chloride	2.7	2.6
PFAS (ng/L)		
PFOS	24.5	24.5
Metals (ug/L)		
Iron, Total	797	806
Magnesium, Total	39400	40000
Manganese, Total	597.3	590
Sodium, Total	276000	279000

Well ID:	MW-6	
Sample ID:	MW-6	
Screen Interval	2.5-7.5	
Collection Date:	4/3/2023	
VOC (ug/L)		
1,2,4,5-Tetramethylbenzene	16	
cis-1,2-Dichloroethene	13	
Naphthalene	12	
sec-Butylbenzene	7.7	
Vinyl chloride	5.4	
SVOC (ug/L)		
Benzo(a)anthracene	0.2	
Benzo(a)pyrene	0.16	
Benzo(b)fluoranthene	0.22	
Benzo(k)fluoranthene	0.08	
Chrysene	0.25	
Indeno(1,2,3-cd)pyrene	0.13	
Metals (ug/L)		
Iron, Total	8570	
Lead, Total	36.85	
Manganese, Total	1212	
Sodium, Total	158000	

Well ID:	MW-10D	MW-10D
Sample ID:	MW-10D	MW-10Di
Screen Interval:	10.0	27.5
Collection Date:	11/9/2023	11/9/2023
VOC (ug/L)		
cis-1,2-Dichloroethene	500	560
Tetrachloroethene	19	1.7
Trichloroethene	16	0.98J
Vinyl chloride	2.3 J	2.6 J
Acetone	2.3 J	2.6 J

LEGEND:

- MW-1R (200') - SRIWP MONITORING WELL LOCATION (MARCH 2026)
- (200') - DEPTH OF WELL (FT. BGS)
- RI-MW1 - MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2022) (DECOMMISSIONED)
- MW-5 - MW-5 MONITORING WELL NUMBER & APPROX. LOCATION (MARCH 2023) (DECOMMISSIONED)
- MW-8D - MW-8D (28.5-30 ft bgs) MONITORING WELL NUMBER & APPROX. LOCATION (MARCH AND JULY 2023) (DECOMMISSIONED)
- MW-11DD - MW-1DD (55-59' bgs) MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2023) (DECOMMISSIONED)
- 5 - CONCENTRATION ISOPLETH 5 Ug/L
- 100 - CONCENTRATION ISOPLETH 100 Ug/L
- 1000 - CONCENTRATION ISOPLETH 1000 Ug/L
- 2000 - CONCENTRATION ISOPLETH 2000 Ug/L

SCALE: 1"=30'

0 30 60

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dwg by: EC
chk by: SL
scale: AS NOTED
date: 06/11/26

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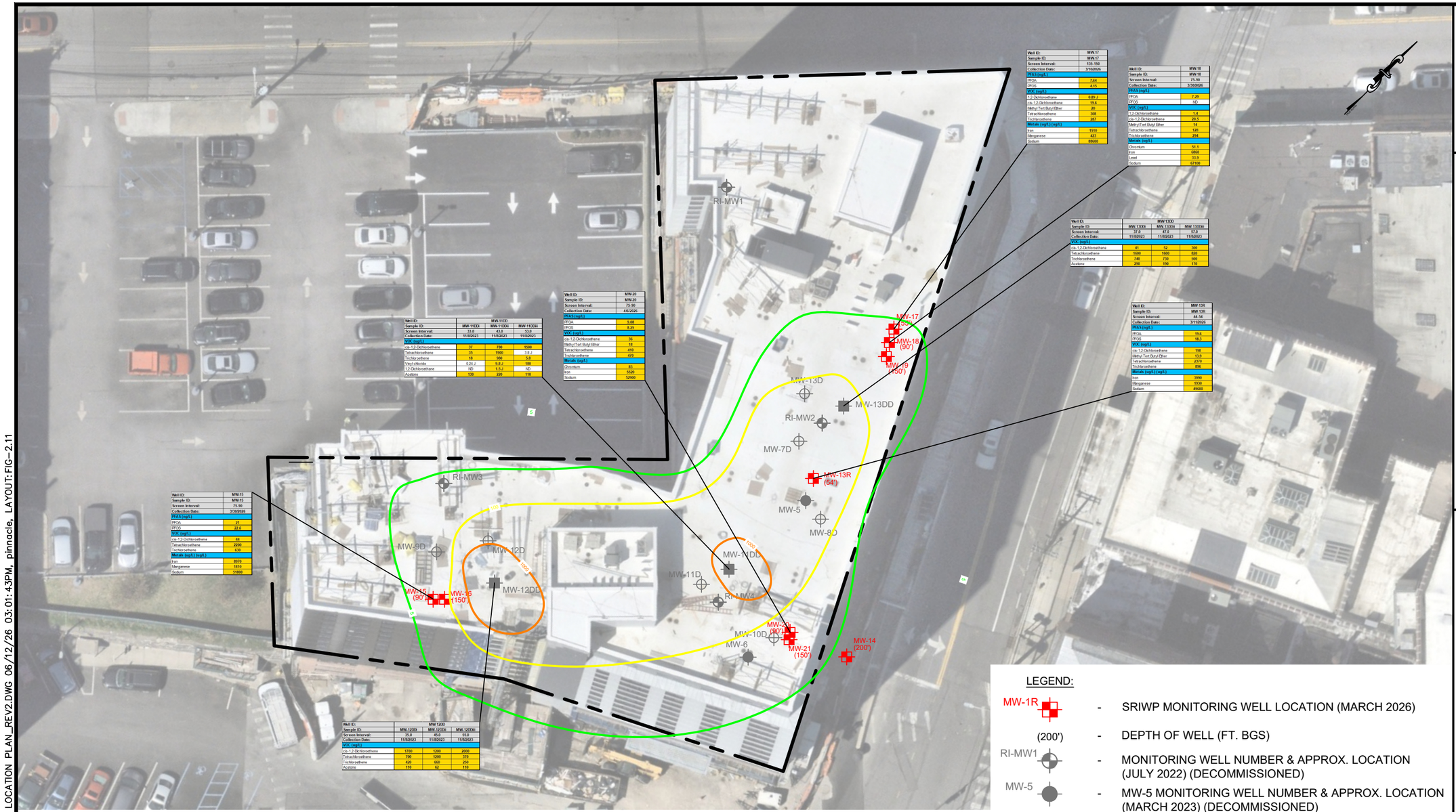
project: 146 WESTCHESTER AVENUE PORT CHESTER, NY

title: CIS-1,2-DICHLOROETHENE CONCENTRATION ISOPLETHS - SHALLOW (GROUND TO 0 ft EL)

job no: 11895
drawing no: FIG-2.10

1 of 1

N:\ACAD\11895\11895.DWG.INJ & MON WELL LOCATION PLAN_REV2.DWG 06/12/26 03:01:33PM, pinnacle, LAYOUT:FIG-2.10



Well ID:	MW-11D		
Sample ID:	MW-11D3	MW-11D6	MW-11D8
Screen Interval:	33.0	43.0	53.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	37	780	1500
Tetrachloroethene	35	1900	3.9 J
Trichloroethene	18	980	5.8
Vinyl chloride	0.24 J	9.8 J	180
1,2-Dichloroethane	ND	1.5 J	ND
Acetone	130	220	110

Well ID:	MW-20
Sample ID:	MW-20
Screen Interval:	75-90
Collection Date:	4/6/2026
PFAS (ng/L)	
PFOA	9.68
PFOS	8.25
VOC (ug/L)	
cis-1,2-Dichloroethene	36
Methyl Tert Butyl Ether	18
Tetrachloroethene	410
Trichloroethene	470
Metals (ug/L)	
Chromium	83
Iron	5520
Sodium	52900

Well ID:	MW-17
Sample ID:	MW-17
Screen Interval:	135-150
Collection Date:	3/10/2026
PFAS (ng/L)	
PFOA	7.64
PFOS	4.55
VOC (ug/L)	
1,2-Dichloroethane	0.89 J
cis-1,2-Dichloroethene	19.6
Methyl Tert Butyl Ether	20
Tetrachloroethene	388
Trichloroethene	287
Metals (ug/L) (ug/L)	
Iron	5150
Manganese	423
Sodium	89500

Well ID:	MW-18
Sample ID:	MW-18
Screen Interval:	75-90
Collection Date:	3/30/2026
PFAS (ng/L)	
PFOA	7.25
PFOS	ND
VOC (ug/L)	
1,2-Dichloroethane	1.4
cis-1,2-Dichloroethene	20.5
Methyl Tert Butyl Ether	14
Tetrachloroethene	128
Trichloroethene	254
Metals (ug/L)	
Chromium	51.1
Iron	6950
Lead	33.9
Sodium	67100

Well ID:	MW-13DD		
Sample ID:	MW-13DD	MW-13DD	MW-13DDd
Screen Interval:	37.0	47.0	57.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	41	52	200
Tetrachloroethene	1600	1600	820
Trichloroethene	740	730	500
Acetone	200	190	170

Well ID:	MW-13R
Sample ID:	MW-13R
Screen Interval:	44-54
Collection Date:	3/11/2026
PFAS (ng/L)	
PFOA	19.8
PFOS	18.3
VOC (ug/L)	
cis-1,2-Dichloroethene	198
Methyl Tert Butyl Ether	13.9
Tetrachloroethene	2370
Trichloroethene	896
Metals (ug/L) (ug/L)	
Iron	3090
Manganese	1930
Sodium	49000

Well ID:	MW-15
Sample ID:	MW-15
Screen Interval:	75-90
Collection Date:	3/30/2026
PFAS (ng/L)	
PFOA	31
PFOS	22.6
VOC (ug/L)	
cis-1,2-Dichloroethene	44
Tetrachloroethene	2200
Trichloroethene	530
Metals (ug/L) (ug/L)	
Iron	8920
Manganese	1810
Sodium	51800

Well ID:	MW-12(D)		
Sample ID:	MW-12(D)3	MW-12(D)6	MW-12(D)8
Screen Interval:	35.0	45.0	55.0
Collection Date:	11/9/2023	11/9/2023	11/9/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	1700	1200	2000
Tetrachloroethene	700	1200	370
Trichloroethene	420	660	250
Acetone	110	52	110

LEGEND:

- MW-1R — SRIWP MONITORING WELL LOCATION (MARCH 2026)
- (200') — DEPTH OF WELL (FT. BGS)
- RI-MW1 — MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2022) (DECOMMISSIONED)
- MW-5 — MW-5 MONITORING WELL NUMBER & APPROX. LOCATION (MARCH 2023) (DECOMMISSIONED)
- MW-8D — MW-8D (28.5-30 ft bgs) MONITORING WELL NUMBER & APPROX. LOCATION (MARCH AND JULY 2023) (DECOMMISSIONED)
- MW-11DD — MW-1DD (55-59' bgs) MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2023) (DECOMMISSIONED)
- 5 — CONCENTRATION ISOPLETH 5 Ug/L
- 100 — CONCENTRATION ISOPLETH 100 Ug/L
- 1000 — CONCENTRATION ISOPLETH 1000 Ug/L
- 2000 — CONCENTRATION ISOPLETH 2000 Ug/L

SCALE: 1"=30'

0 30 60

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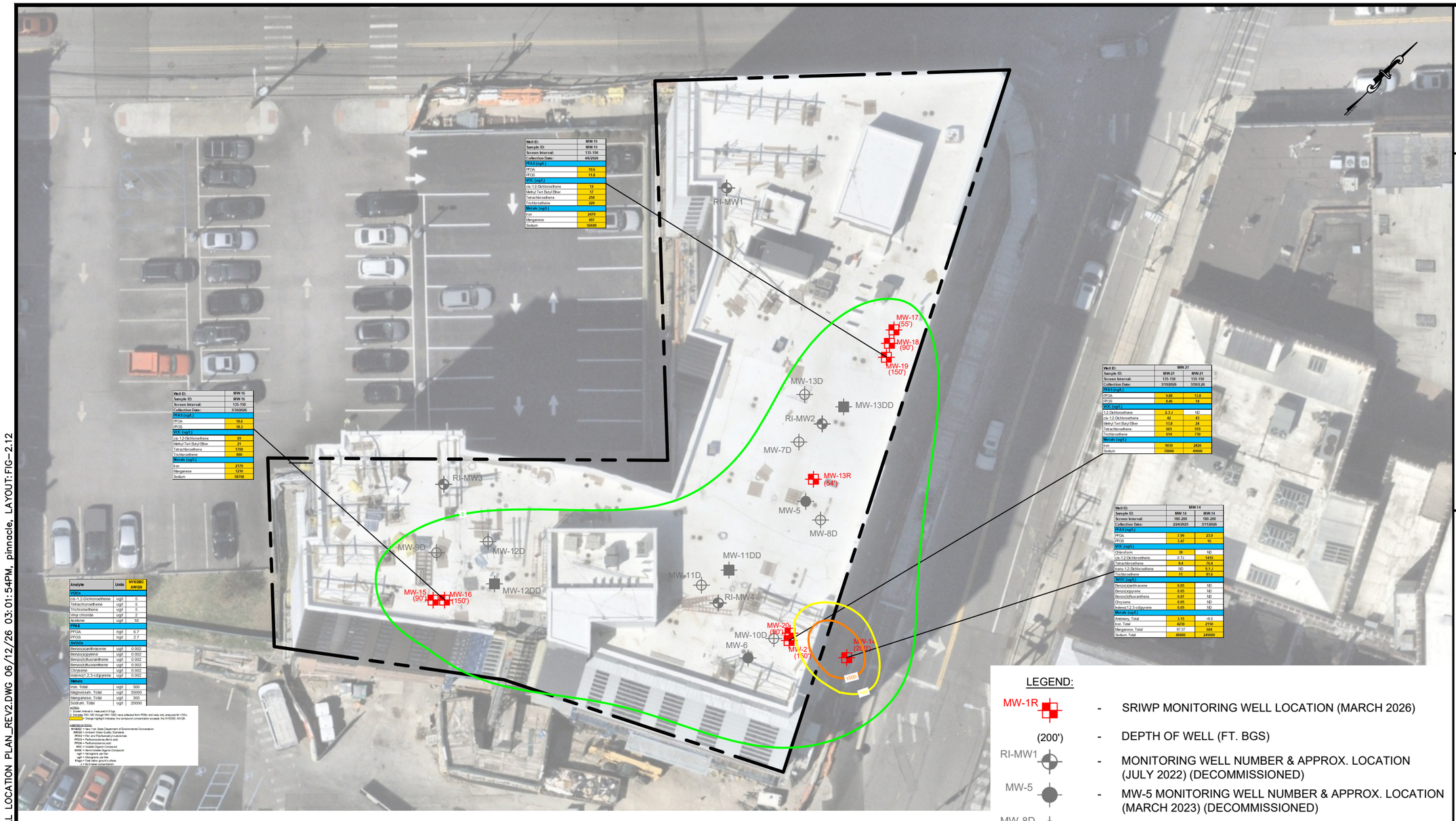
project: 146 WESTCHESTER AVENUE PORT CHESTER, NY

title: CIS-1,2-DICHLOROETHENE CONCENTRATION ISOPLETHS - INTERMEDIATE (0 ft EL TO -50 ft EL)

job no: 11895
drawing no: FIG-2.11

1 of 1

N:\ACAD\11895\11895.DWG\NJ & MON WELL LOCATION PLAN_REV2.DWG 06/12/26 03:01:43PM, pinnacle, LAYOUT:FIG-2.11



Well ID:	MW-19
Sample ID:	MW-19
Screen Interval:	135-150
Collection Date:	6/5/2026
PFAS (ng/L)	
PFOA	10.6
PFOS	11.0
VOC (ug/L)	
cis-1,2-Dichloroethene	12
Methyl Tert Butyl Ether	17
Tetrachloroethene	250
Trichloroethene	220
Metals (ug/L)	
Iron	2470
Manganese	457
Sodium	52000

Well ID:	MW-16
Sample ID:	MW-16
Screen Interval:	135-150
Collection Date:	3/10/2026
PFAS (ng/L)	
PFOA	18.6
PFOS	18.3
VOC (ug/L)	
cis-1,2-Dichloroethene	69
Methyl Tert Butyl Ether	21
Tetrachloroethene	1700
Trichloroethene	880
Metals (ug/L)	
Iron	2170
Manganese	1210
Sodium	58700

Well ID:	MW-21	MW-21
Sample ID	MW-21	MW-21
Screen Interval:	135-150	135-150
Collection Date:	3/10/2026	3/30/2026
PFAS (ng/L)		
PFOA	9.88	13.8
PFOS	8.46	14
VOC (ug/L)		
1,2-Dichloroethane	2.2 J	ND
cis-1,2-Dichloroethene	42	43
Methyl Tert Butyl Ether	13.8	24
Tetrachloroethene	665	970
Trichloroethene	614	730
Metals (ug/L)		
Iron	3630	2520
Sodium	70000	49000

Well ID:	MW-14	MW-14
Sample ID:	MW-14	MW-14
Screen Interval:	180-200	180-200
Collection Date:	2/24/2025	3/11/2026
PFAS (ng/L)		
PFOA	7.99	23.9
PFOS	3.47	16
VOC (ug/L)		
Chloroform	38	ND
cis-1,2-Dichloroethene	0.7 J	1410
Tetrachloroethene	8.4	75.4
trans-1,2-Dichloroethene	ND	9.1 J
Trichloroethene	11	81.6
SVOC (ug/L)		
Benzo(a)anthracene	0.05	ND
Benzo(a)pyrene	0.05	ND
Benzo(b)fluoranthene	0.07	ND
Chrysene	0.05	ND
Indeno(1,2,3-cd)pyrene	0.05	ND
Metals (ug/L)		
Antimony, Total	3.15	<6.0
Iron, Total	6230	2150
Manganese, Total	97.37	664
Sodium, Total	48400	249000

Analyte	Units	NYSDEC AWQS
VOCs		
cis-1,2-Dichloroethene	ug/l	5
Tetrachloroethene	ug/l	5
Trichloroethene	ug/l	5
Vinyl chloride	ug/l	2
Acetone	ug/l	50
PFAS		
PFOA	ng/l	6.7
PFOS	ng/l	2.7
SVOCs		
Benzo(a)anthracene	ug/l	0.002
Benzo(a)pyrene	ug/l	0.002
Benzo(b)fluoranthene	ug/l	0.002
Benzo(k)fluoranthene	ug/l	0.002
Chrysene	ug/l	0.002
Indeno(1,2,3-cd)pyrene	ug/l	0.002
Metals		
Iron, Total	ug/l	300
Magnesium, Total	ug/l	35000
Manganese, Total	ug/l	300
Sodium, Total	ug/l	20000

NOTES:
1. Screen interval is measured in ft bgs.
2. Samples MW-100 through MW-1DD were collected from PDBs and were only analyzed for VOCs.
3. Orange highlight indicates the compound concentration exceeds the NYSDEC AWQS.

ABBREVIATIONS:
NYSDEC = New York State Department of Environmental Conservation
AWQS = Ambient Water Quality Standards
PFAS = Per and Polyfluoroalkyl substances
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
VOC = Volatile Organic Compound
SVOC = Semi-Volatile Organic Compound
ng/l = Nanograms per liter
ug/l = Micrograms per liter
ft bgs = Feet below ground surface
ND = Not detected above reporting limits

LEGEND:

- MW-1R - SRIWP MONITORING WELL LOCATION (MARCH 2026)
- (200') - DEPTH OF WELL (FT. BGS)
- RI-MW1 - MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2022) (DECOMMISSIONED)
- MW-5 - MW-5 MONITORING WELL NUMBER & APPROX. LOCATION (MARCH 2023) (DECOMMISSIONED)
- MW-8D - MW-8D (28.5-30 ft bgs) MONITORING WELL NUMBER & APPROX. LOCATION (MARCH AND JULY 2023) (DECOMMISSIONED)
- MW-11DD - MW-1DD (55-59' bgs) MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2023) (DECOMMISSIONED)
- 5 - CONCENTRATION ISOPLETH 5 Ug/L
- 100 - CONCENTRATION ISOPLETH 100 Ug/L
- 1000 - CONCENTRATION ISOPLETH 1000 Ug/L
- 2000 - CONCENTRATION ISOPLETH 2000 Ug/L

SCALE: 1"=30'

0 30 60

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REFERENCE:
EXIST CONDITIONS & BOUNDARY ARE TAKEN FROM FOUNDATION PLAN PREPARED BY LESSARD DESIGN INC. P.C., DATED NOVEMBER 8, 2024.

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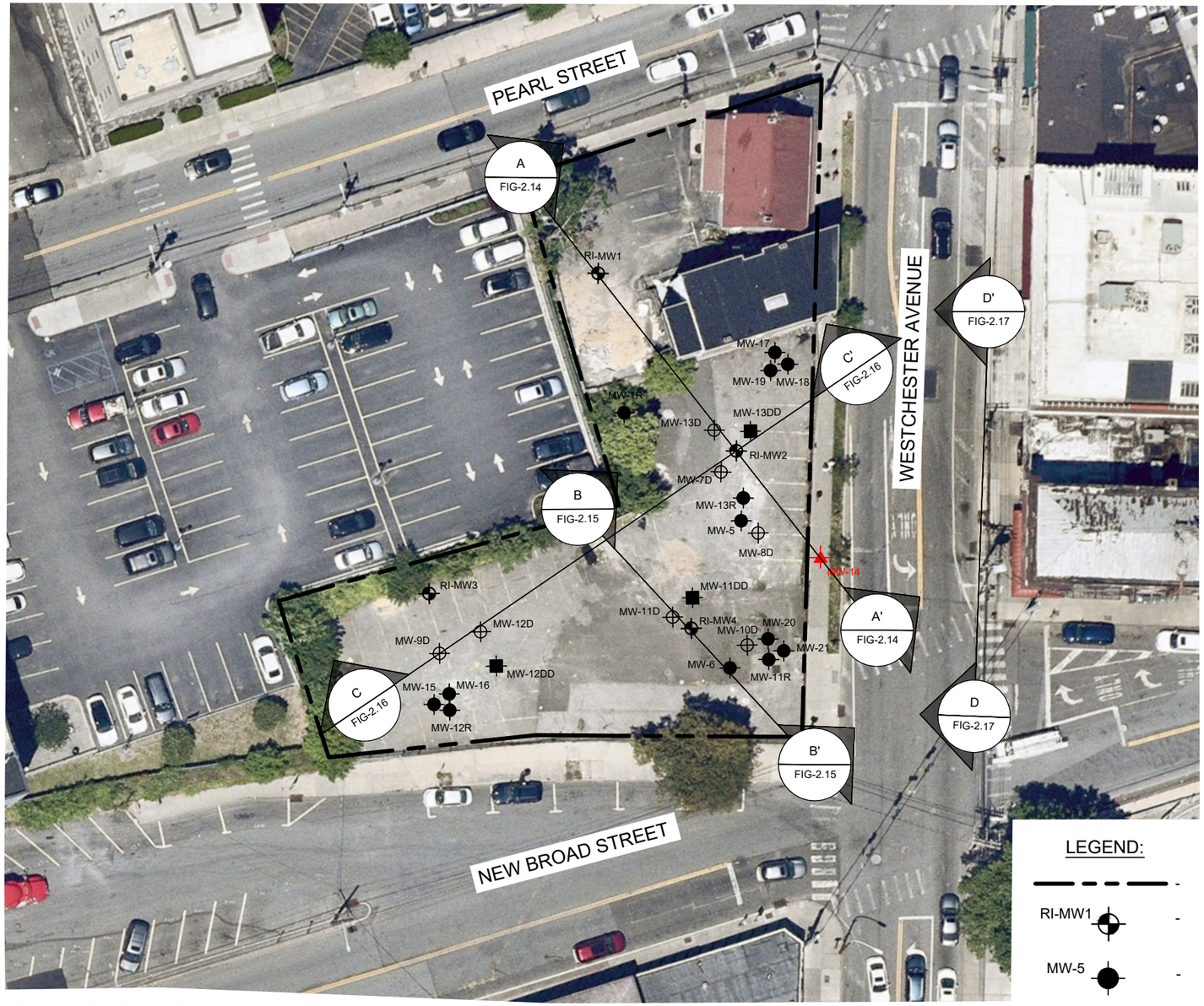
dwg by: EC
chk by: SL
scale: AS NOTED
date: 06/11/26

project: 146 WESTCHESTER AVENUE PORT CHESTER, NY

title: CIS-1,2-DICHLOROETHENE CONCENTRATION ISOPLETHS - DEEP (-50 ft EL TO -150 ft EL)

job no: 11895
drawing no: FIG-2.12

N:\ACAD\11895\11895.DWG.INJ & MON WELL LOCATION PLAN_REV2.DWG 06/12/26 03:01:54PM, pinnacle, LAYOUT:FIG-2.12



REFERENCE
SITE SURVEY PREPARED BY RICHARD J. DOMATO, DATED MARCH 5, 2021.

NOTE:
THIS PLAN IS FOR LOCATING SOIL BORINGS ONLY.
OTHER SITE WORK SHOWN HERE IS NOT INTENDED FOR CONSTRUCTION.

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LEGEND:

- PROPERTY/SITE BOUNDARY
- RI-MW1 - MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2022)
- MW-5 - MW-5 SHALLOW MONITORING WELL NUMBER & APPROX. LOCATION (MARCH 2023)
- MW-8D - MW-8D DEEP (28.5-30 ft bgs) MONITORING WELL NUMBER & APPROX. LOCATION (MARCH AND JULY 2023)
- MW-11DD - MW-1DD DEEP (55-59' bgs) MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2023)
- MW-14 - MW-14 DEEP (200' bgs) MONITORING WELL NUMBER & APPROX. LOCATION (FEBRUARY 2025)

Scale 1"=40'
0 40 80

dwg by: AW
chk by: SL
scale: AS NOTED
date: 03/31/2025

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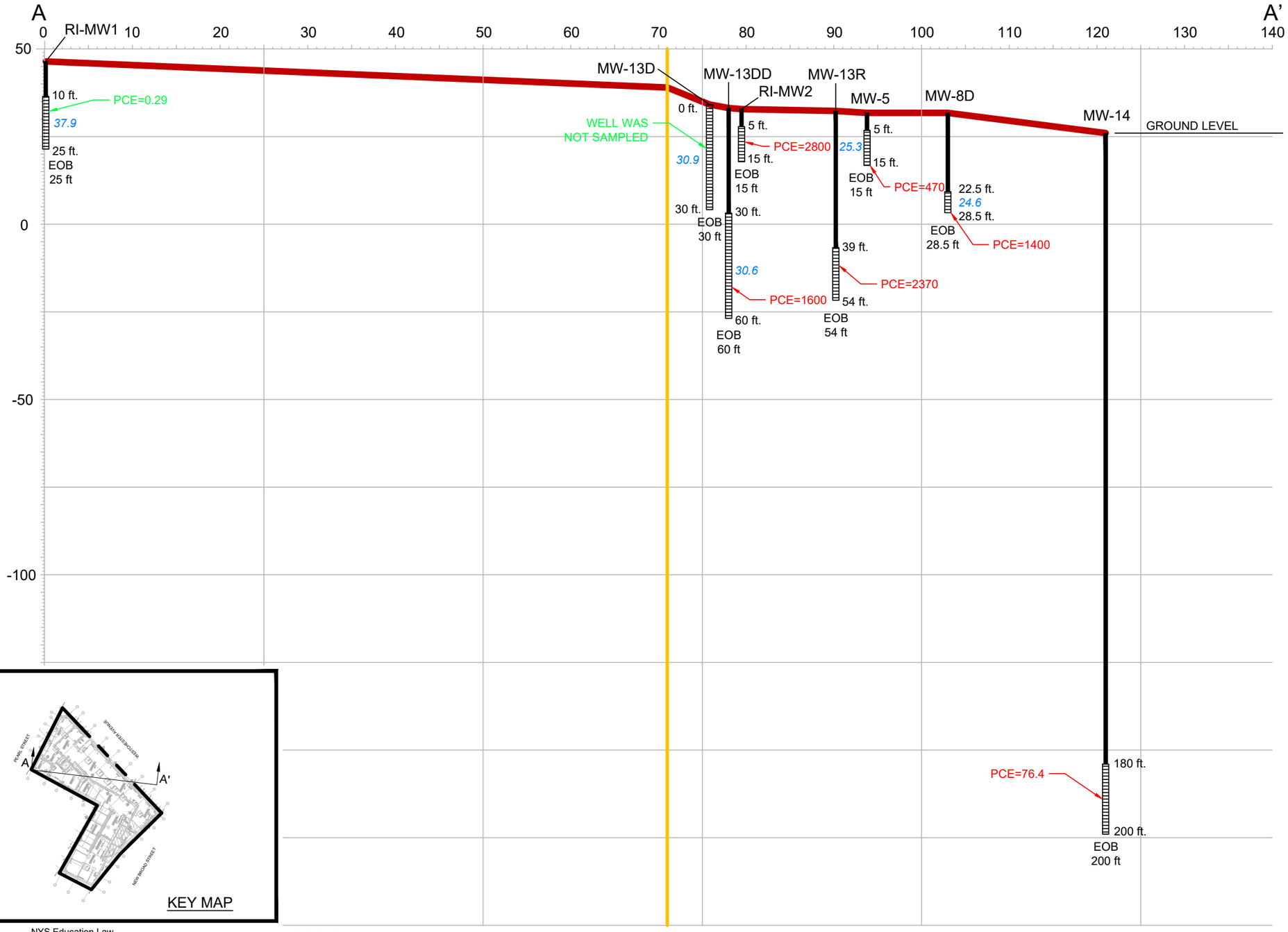
project: REMEDIAL INVESTIGATION REPORT
146 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title: SITE PLAN
WITH CROSS-SECTIONS

job no: 11895A
drawing no:

FIG-2.13

N:\ACAD\11895\RI\11895.DWG.PRO MON WELL LOCATION PLAN — NO DATA_INTERNAL.DWG 06/12/26 01:00:07PM, pinnacle, LAYOUT:FIG-1 PROMON WELL LOC PLAN



KEY MAP

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LEGEND:

- GROUND ELEVATION
- 30.6 - DTW ELEVATION
- GREEN - BELOW NYSDEC AWQS
- RED - ABOVE NYSDEC AWQS
- MONITORING WELL
- WELL SCREEN

SCALE: 1"=5' HORIZ., 1"=2' VERT.

0 2 4 8 ft.
0 5 10 20 ft.

dwg by: EC
chk by: SL
scale: N.T.S.
date: 03/31/2025

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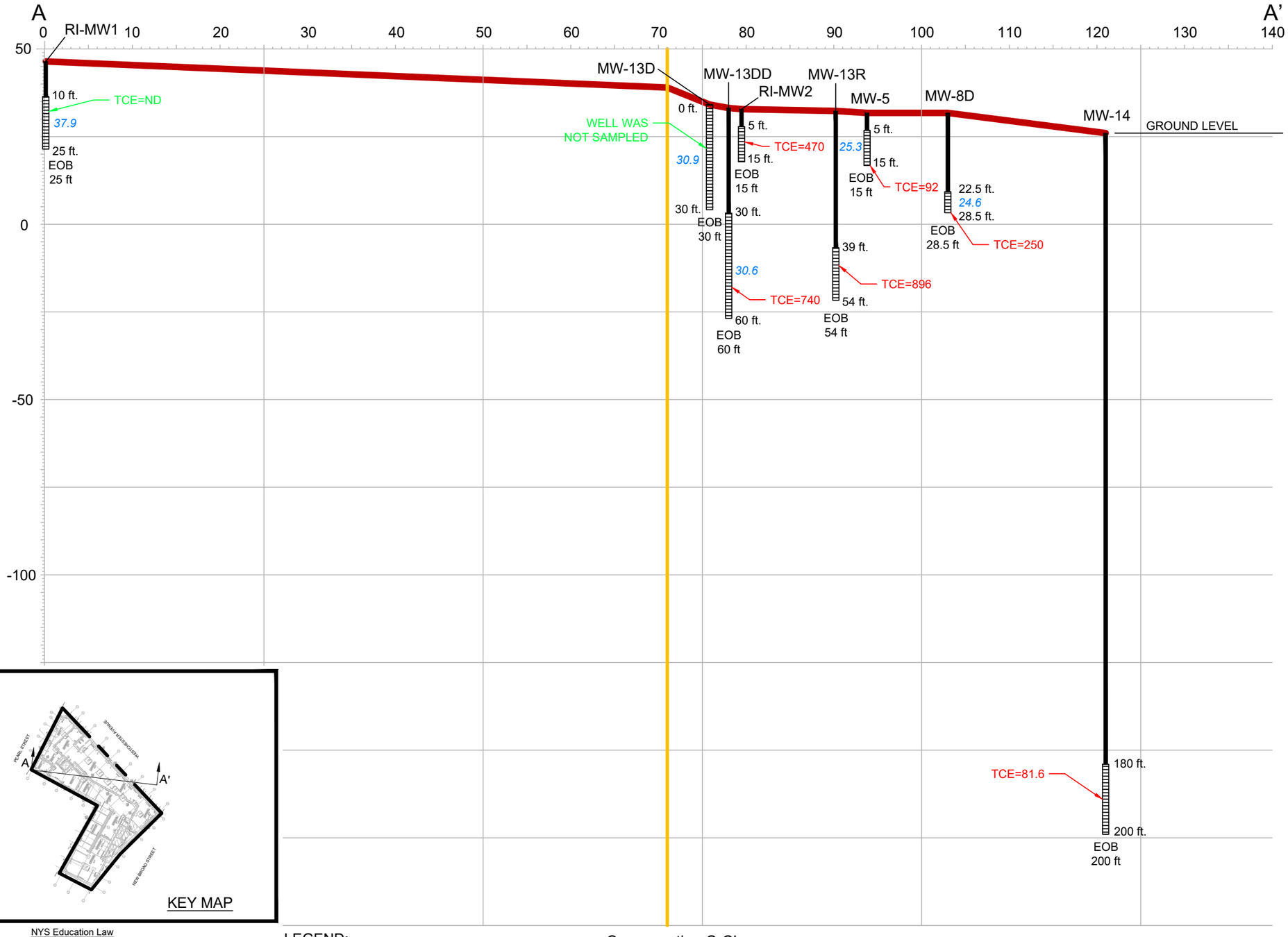
project: REMEDIAL INVESTIGATION REPORT
146 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title: CROSS SECTION A-A'
WITH PCE ISOCONTOURS

job no: 11895A
drawing no:

FIG-2.14A

N:\CAD\11895\RI\11895.DWG.PRO MON WELL LOCATION PLAN — NO DATA_INTERNAL.DWG 06/12/26 01:00:10PM, pinnacle, LAYOUT:CROSS SECTION A-A' (F-2.14A)



KEY MAP

Cross-section C-C'

LEGEND:

- GROUND ELEVATION
- 30.6 - DTW ELEVATION
- GREEN - BELOW NYSDEC AWQS
- RED - ABOVE NYSDEC AWQS
- MONITORING WELL
- WELL SCREEN

NOTE:
"TCE = 470" - TCE @ 470 MICROGRAMS PER LITER (ppb)

SCALE: 1"=5' HORIZ., 1"=2' VERT.

0 2 4 8 ft.
0 5 10 20 ft.

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dwg by: EC
chk by: SL
scale: N.T.S.
date: 03/31/2025

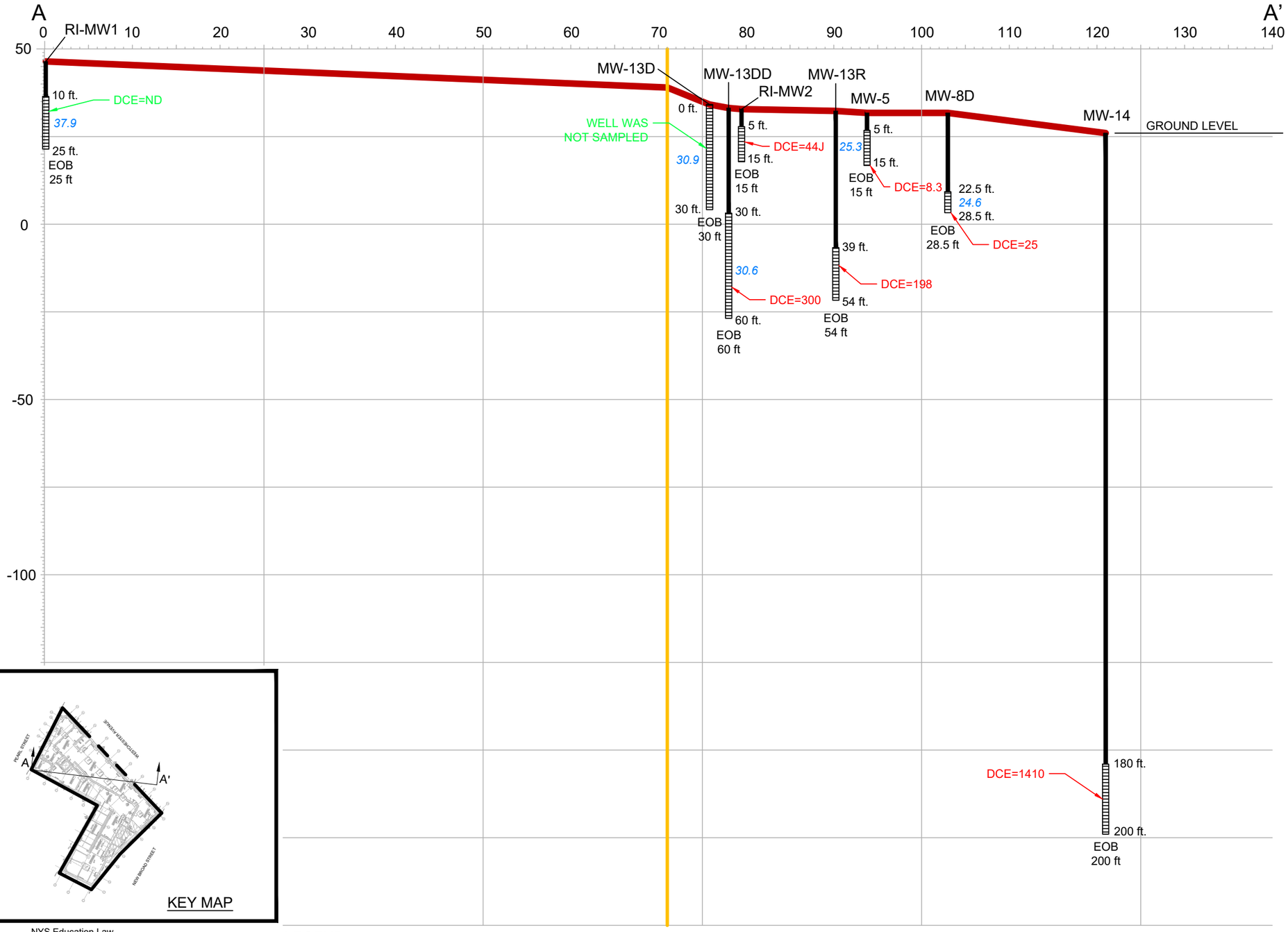
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PORT CHESTER, NEW YORK 10573

title:
CROSS SECTION A-A'
WITH TCE ISOCONTOURS

job no: 11895A
drawing no:

FIG-2.14B



KEY MAP

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LEGEND:

- GROUND ELEVATION
- 30.6 - DTW ELEVATION
- GREEN - BELOW NYSDEC AWQS
- RED - ABOVE NYSDEC AWQS
- MONITORING WELL
- WELL SCREEN

NOTE:
"DCE = 300" - DCE @ 300 MICROGRAMS PER LITER (ppb)

Cross-section C-C'

SCALE: 1"=5' HORIZ., 1"=2' VERT.

0 2 4 8 ft.
0 5 10 20 ft.

dwg by: EC
chk by: SL
scale: N.T.S.
date: 03/31/2025

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PORT CHESTER, NEW YORK 10573

title: CROSS SECTION A-A'
WITH DCE ISOCONTOURS

job no: 11895A
drawing no:

FIG-2.14C

N:\CAD\11895\RI\11895.DWG.PRO MON WELL LOCATION PLAN — NO DATA_INTERNAL.DWG 06/12/26 01:00:15PM, pinnacle, LAYOUT:CROSS SECTION A-A' (F-2.14C)

B

B'

0 10 20 30 40 50 60 70

50 0 -50 -100

MW-11DD MW-11D MW-11R MW-20 MW-21 RI-MW4 MW-10D MW-6

GROUND LEVEL

0 ft

PCE=150 23.8 30 ft. EOB 30 ft

PCE=1900 24.3 39 ft. 54 ft. EOB 54 ft

WELL WAS NOT SAMPLED

60 ft. EOB 60 ft

75 ft.

PCE=970 90 ft. EOB 90 ft

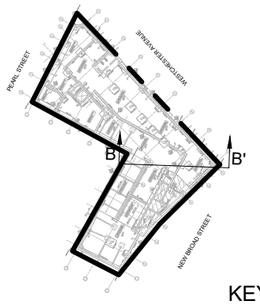
135 ft.

PCE=970 150 ft. EOB 150 ft

5 ft. 24.1 15 ft. EOB 15 ft PCE=110

0 ft. 23.9 30 ft. EOB 30 ft PCE=19

22.5 ft. 24.2 28.5 ft. EOB 28.5 ft PCE=1.9



KEY MAP

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LEGEND:

- GROUND ELEVATION
- 30.6 - DTW ELEVATION
- GREEN - BELOW NYSDEC AWQS
- RED - ABOVE NYSDEC AWQS
- MONITORING WELL
- WELL SCREEN

SCALE: 1"=10' HORIZ., 1"=2' VERT.

0 2 4 8 ft.

0 10 20 40 ft.

dwg by: AW
chk by: SL
scale: N.T.S.
date: 03/31/2025

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146 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title: CROSS SECTION B-B'
WITH PCE ISOCONTOURS

job no: 11895A
drawing no:

FIG-2.15A

N:\CAD\11895\RI\11895.DWG.PRO MON WELL LOCATION PLAN — NO DATA_INTERNAL.DWG 06/12/26 01:00:18PM, pinnacle, LAYOUT:CROSS SECTION B-B' (F-2.15A)

B

B'

0 10 20 30 40 50 60 70

50 0 -50 -100

MW-11DD MW-11D MW-11R MW-20 MW-21 RI-MW4 MW-10D MW-6

GROUND LEVEL

0 ft

TCE=81 23.8 30 ft. EOB 30 ft

TCE=980 24.3 39 ft. 54 ft. EOB 54 ft

WELL WAS NOT SAMPLED

60 ft. EOB 60 ft

75 ft.

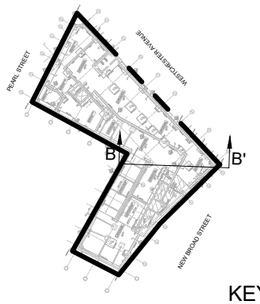
TCE=470 90 ft. EOB 90 ft

TCE=730 135 ft. 150 ft. EOB 150 ft

5 ft. 24.1 15 ft. EOB 15 ft TCE=24

0 ft. 23.9 30 ft. EOB 30 ft TCE=16

22.5 ft. 24.2 28.5 ft. EOB 28.5 ft TCE=1.6



KEY MAP

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LEGEND:

- GROUND ELEVATION
- 30.6 - DTW ELEVATION
- GREEN - BELOW NYSDEC AWQS
- RED - ABOVE NYSDEC AWQS
- MONITORING WELL
- WELL SCREEN

NOTE:
"TCE = 470" - TCE @ 470 MICROGRAMS PER LITER (ppb)

SCALE: 1"=10' HORIZ., 1"=2' VERT.

0 2 4 8 ft.
0 10 20 40 ft.

dwg by: AW
chk by: SL
scale: N.T.S.
date: 03/31/2025

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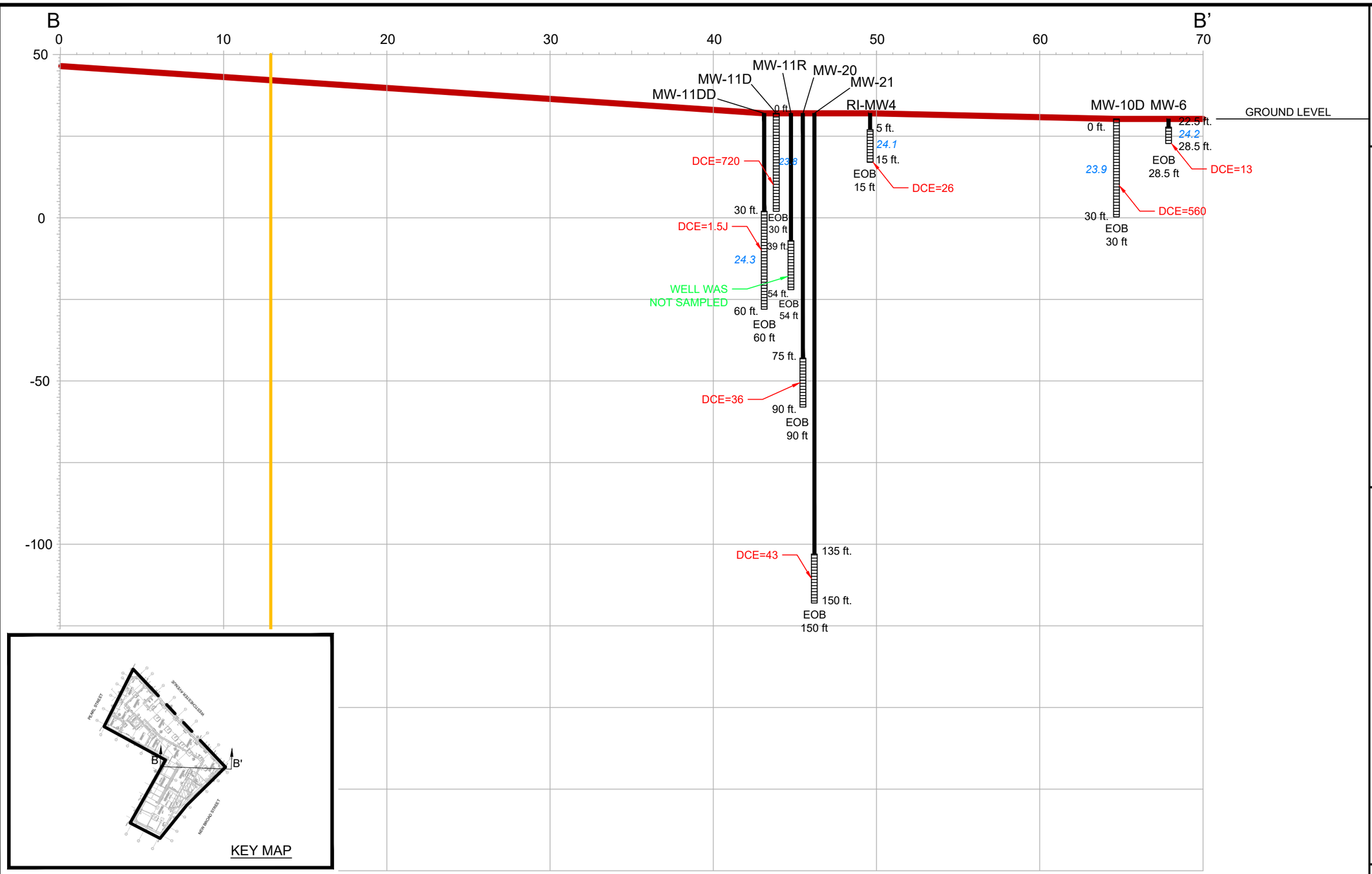
project: REMEDIAL INVESTIGATION REPORT
146 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title: CROSS SECTION B-B'
WITH TCE ISOCONTOURS

job no: 11895A
drawing no:

FIG-2.15B

N:\ACAD\11895\RI\11895.DWG.PRO MON WELL LOCATION PLAN – NO DATA_INTERNAL.DWG 06/12/26 01:00:20PM, pinnacle, LAYOUT:CROSS SECTION B–B' (F–2.15B)



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LEGEND:

- GROUND ELEVATION
- 30.6 - DTW ELEVATION
- GREEN - BELOW NYSDEC AWQS
- RED - ABOVE NYSDEC AWQS
- MONITORING WELL
- WELL SCREEN

NOTE:
"DCE = 300" - DCE @ 300 MICROGRAMS PER LITER (ppb)

SCALE: 1"=10' HORIZ., 1"=2' VERT.

0 2 4 8 ft.
0 10 20 40 ft.

dwg by: AW
chk by: SL
scale: N.T.S.
date: 03/31/2025

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PORT CHESTER, NEW YORK 10573

title: CROSS SECTION B-B'
WITH DCE ISOCONTOURS

job no: 11895A
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FIG-2.15C

N:\CAD\11895\RI\11895.DWG.PRO MON WELL LOCATION PLAN – NO DATA_INTERNAL.DWG 06/12/26 01:00:22PM, pinnacle, LAYOUT:CROSS SECTION B–B' (F–2.15C)

C

C'

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140

50 0 -50 -100

MW-16 MW-15 MW-12R MW-9D MW-12D MW-12DD MW-7D RI-MW2 MW-13DD MW-17 MW-18 MW-19

GROUND LEVEL

MW-16: 135 ft. EOB 150 ft; PCE=1700

MW-15: 75 ft. EOB 90 ft; PCE=2200

MW-12R: 43 ft. EOB 58 ft; WELL WAS NOT SAMPLED

MW-9D: 25 ft. 30.8 30 ft. EOB 30 ft; PCE=4000

MW-12D: 0 ft. 30 ft. EOB 30 ft; PCE=1300; 30.1

MW-12DD: 30 ft. 29.7 60 ft. EOB 60 ft; PCE=1200

MW-7D: 24 ft. 30.6 29 ft. EOB 29 ft; PCE=3800

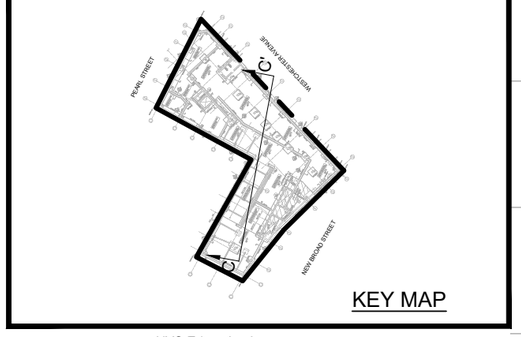
RI-MW2: 5 ft. 15 ft. EOB 15 ft; PCE=2800

MW-13DD: 30 ft. 60 ft. EOB 60 ft; PCE=1600

MW-17: 45 ft. 38.6 55 ft. EOB 55 ft; PCE=308

MW-18: 75 ft. 90 ft. EOB 90 ft; PCE=128

MW-19: 135 ft. 150 ft. EOB 150 ft; PCE=250



KEY MAP

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LEGEND:

- GROUND ELEVATION
- 30.6 - DTW ELEVATION
- GREEN - BELOW NYSDEC AWQS
- RED - ABOVE NYSDEC AWQS
- MONITORING WELL
- WELL SCREEN

Cross-section B-B'

Cross-section A-A'

SCALE: 1"=5' HORIZ., 1"=2' VERT.

0 2 4 8 ft.

0 5 10 20 ft.

dwg by: AW
chk by: SL
scale: N.T.S.
date: 03/31/2025

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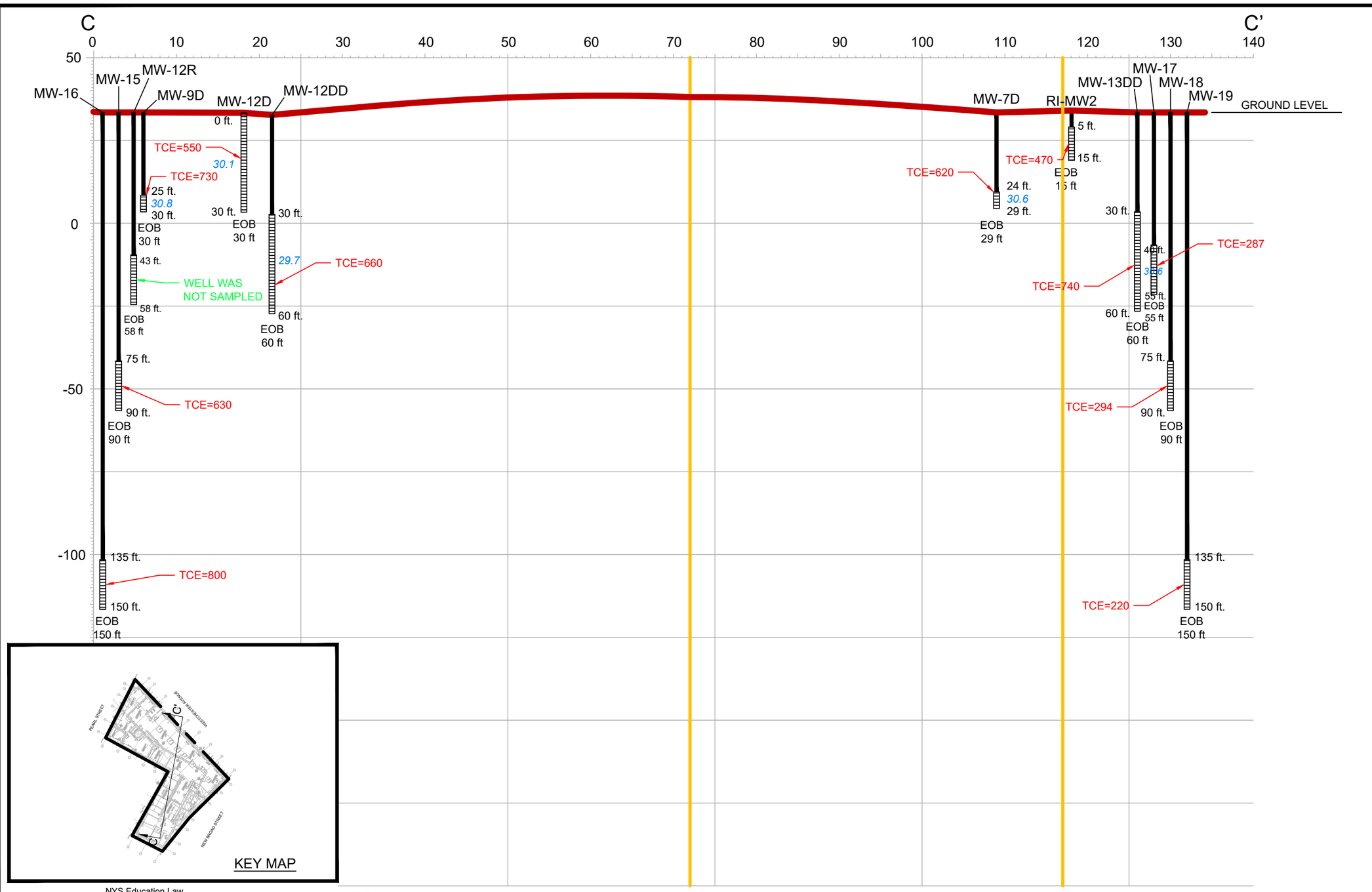
project: REMEDIAL INVESTIGATION REPORT
140, 148-150 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title: CROSS SECTION C-C'
WITH PCE ISOCONTOURS

job no: 11895A
drawing no:

FIG-2.16A

N:\ACAD\11895\RI\11895.DWG;PRO_MON WELL LOCATION PLAN – NO DATA_INTERNAL.DWG 06/12/26 01:00:25PM, pinnacle, LAYOUT:CROSS SECTION C–C' (F–2.16A)



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LEGEND:

- GROUND ELEVATION
- 30.6 - DTW ELEVATION
- GREEN - BELOW NYSDEC AWQS
- RED - ABOVE NYSDEC AWQS
- MONITORING WELL
- WELL SCREEN

NOTE:
"TCE = 470" - TCE @ 470 MICROGRAMS PER LITER (ppb)

Cross-section B-B'

Cross-section A-A'

SCALE: 1"=5' HORIZ., 1"=2' VERT.

0 2 4 8 ft.
0 5 10 20 ft.

dwg by: AW
chk by: SL
scale: N.T.S.
date: 03/31/2025

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project: REMEDIAL INVESTIGATION REPORT
140, 148-150 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title: CROSS SECTION C-C'
WITH TCE ISOCONTOURS

job no: 11895A
drawing no:

FIG-2.16B

N:\CAD\11895\RI\11895.DWG,PRO MON WELL LOCATION PLAN — NO DATA_INTERNAL.DWG 06/12/26 01:00:27PM, pinnacle, LAYOUT:CROSS SECTION C–C' (F–2.16B)

C

C'

0 10 20 30 40 50 60 70 80 90 100 110 120 130 140

50 0 -50 -100

MW-16 MW-15 MW-12R MW-9D MW-12D MW-12DD MW-7D RI-MW2 MW-13DD MW-17 MW-18 MW-19

GROUND LEVEL

MW-16: 135 ft. EOB 150 ft; DCE=69; 150 ft.

MW-15: 90 ft. EOB 90 ft; DCE=44; 75 ft.

MW-12R: 58 ft. EOB 58 ft; WELL WAS NOT SAMPLED; 43 ft.

MW-9D: DCE=53; 25 ft. 30.8 30 ft. EOB 30 ft

MW-12D: DCE=160; 30.1; 0 ft. 30 ft. EOB 30 ft

MW-12DD: 60 ft. EOB 60 ft; DCE=2000; 29.7; 30 ft.

MW-7D: DCE=55; 24 ft. 30.6 29 ft. EOB 29 ft

RI-MW2: DCE=44J; 5 ft. 15 ft. EOB 15 ft

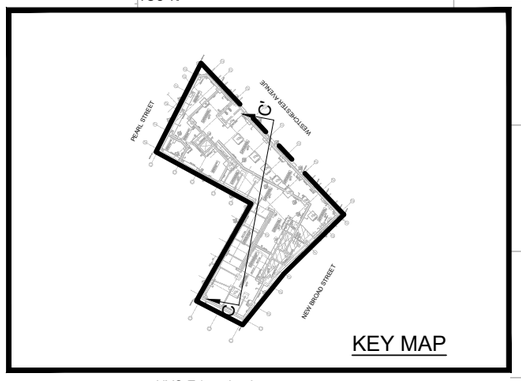
MW-13DD: DCE=300; 60 ft. EOB 60 ft; 30 ft.

MW-17: 55 ft. EOB 55 ft; 45 ft.

MW-18: DCE=19.6; 3.6.6

MW-19: DCE=20.5; 90 ft. EOB 90 ft; 75 ft.

MW-12R: DCE=12; 135 ft. 150 ft. EOB 150 ft



KEY MAP

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LEGEND:

- GROUND ELEVATION
- 30.6 - DTW ELEVATION
- GREEN - BELOW NYSDEC AWQS
- RED - ABOVE NYSDEC AWQS

MONITORING WELL
WELL SCREEN

NOTE:
"DCE = 300" - DCE @ 300 MICROGRAMS PER LITER (ppb)

Cross-section B-B'

Cross-section A-A'

SCALE: 1"=5' HORIZ., 1"=2' VERT.

0 2 4 8 ft.
0 5 10 20 ft.

dwg by: AW
chk by: SL
scale: N.T.S.
date: 03/31/2025

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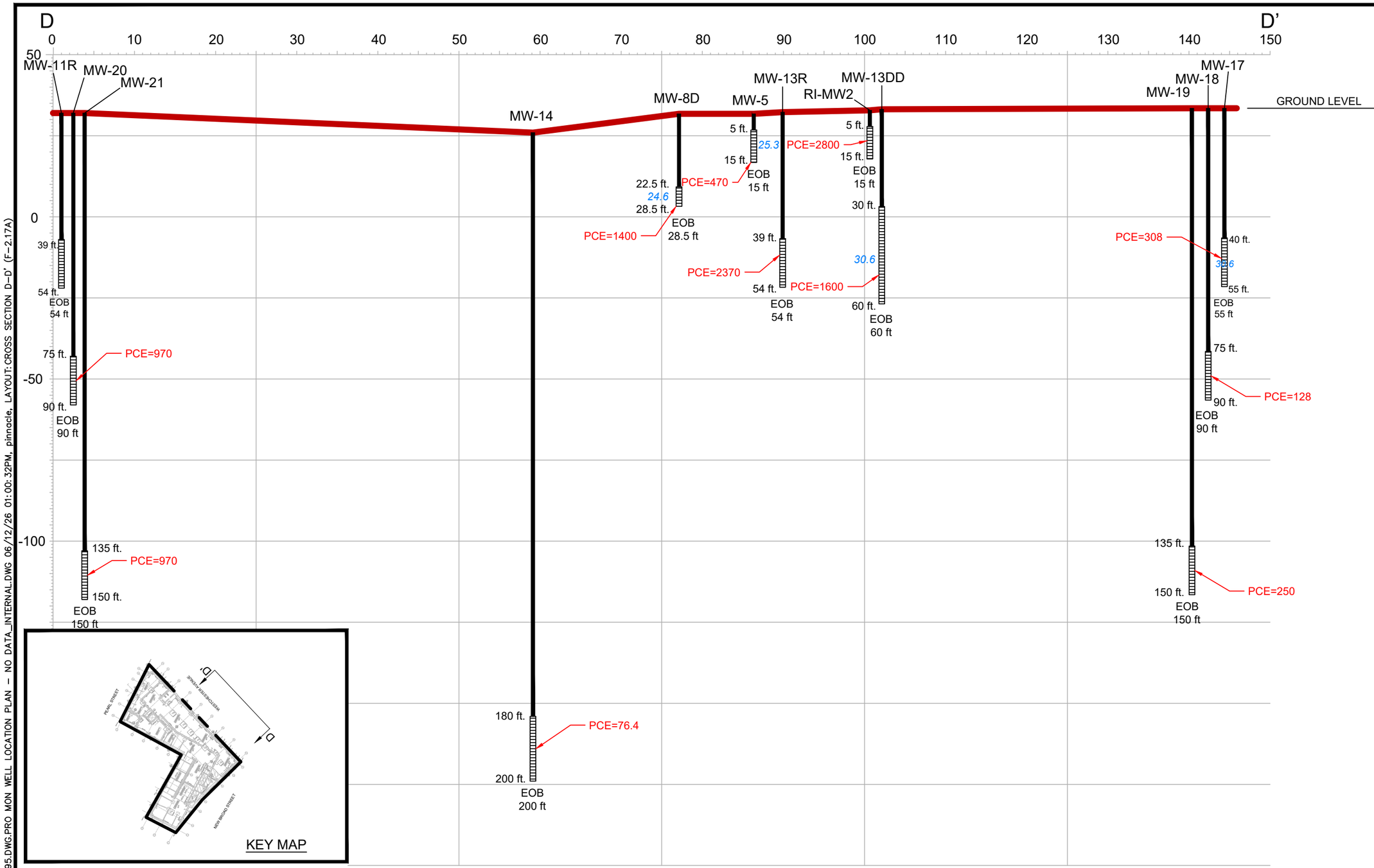
project: REMEDIAL INVESTIGATION REPORT
140, 148-150 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title: CROSS SECTION C-C'
WITH DCE ISOCONTOURS

job no: 11895A
drawing no:

FIG-2.16C

N:\CAD\11895\RI\11895.DWG.PRO_MON WELL LOCATION PLAN – NO DATA_INTERNAL.DWG 06/12/26 01:00:30PM, pinnacle, LAYOUT:CROSS SECTION C–C' (F–2.16C)



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LEGEND:

- GROUND ELEVATION
- 30.6 - DTW ELEVATION
- GREEN - BELOW NYSDEC AWQS
- RED - ABOVE NYSDEC AWQS
- MONITORING WELL
- WELL SCREEN

SCALE: 1"=5' HORIZ., 1"=2' VERT.

0 2 4 8 ft.

0 5 10 20 ft.

dwg by: AW
chk by: SL
scale: N.T.S.
date: 03/31/2025

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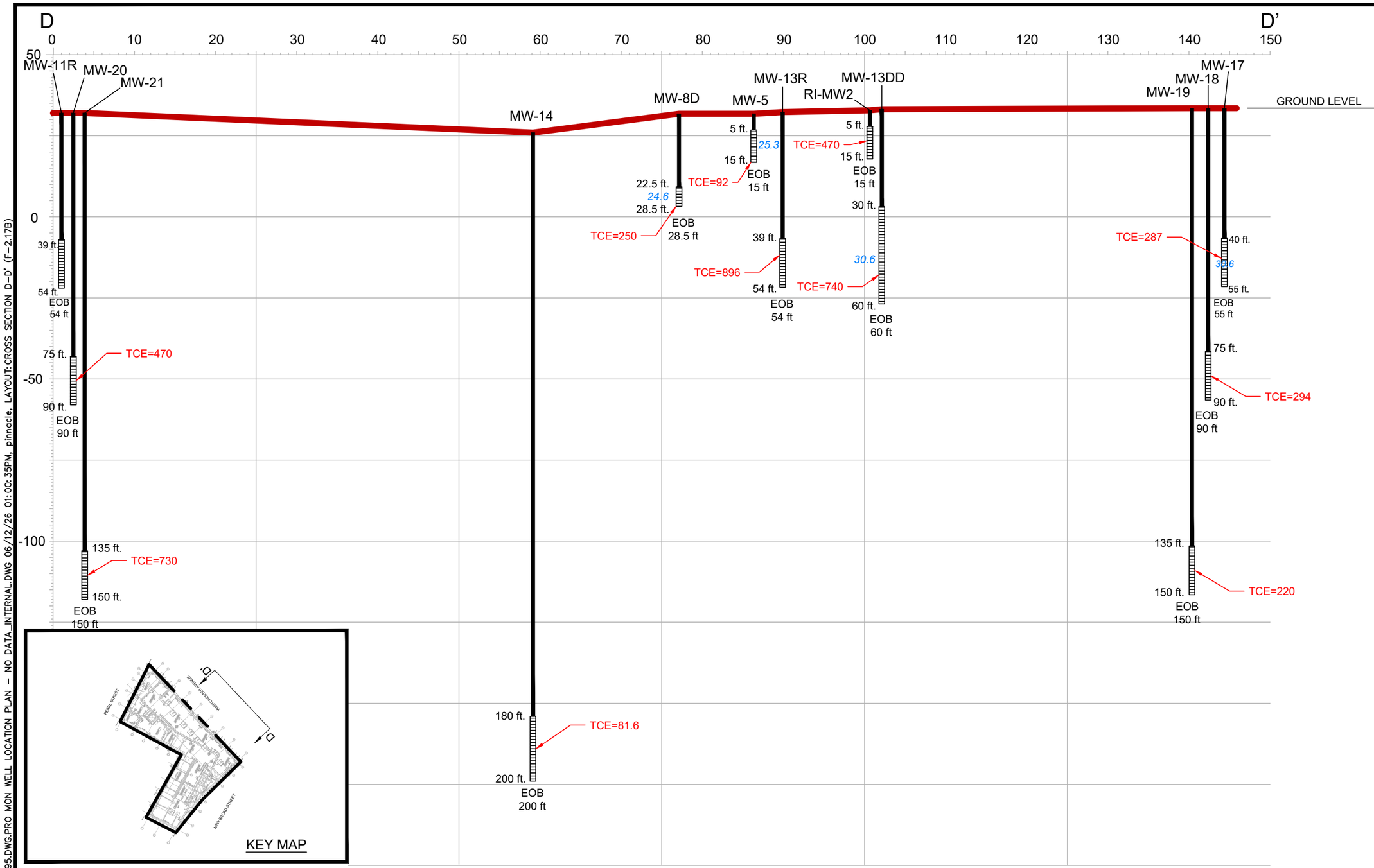
project: REMEDIAL INVESTIGATION REPORT
140, 148-150 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title: CROSS SECTION D-D'
WITH PCE ISOCONTOURS

job no: 11895A
drawing no:

FIG-2.17A

N:\ACAD\11895\RI\11895.DWG.PRO MON WELL LOCATION PLAN – NO DATA_INTERNAL.DWG 06/12/26 01:00:32PM, pinnacle, LAYOUT:CROSS SECTION D–D' (F–2.17A)



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LEGEND:

- GROUND ELEVATION
- 30.6 - DTW ELEVATION
- GREEN - BELOW NYSDEC AWQS
- RED - ABOVE NYSDEC AWQS
- MONITORING WELL
- WELL SCREEN

NOTE:
"TCE = 470" - TCE @ 470 MICROGRAMS PER LITER (ppb)

SCALE: 1"=5' HORIZ., 1"=2' VERT.

0 2 4 8 ft.
0 5 10 20 ft.

dwg by: AW
chk by: SL
scale: N.T.S.
date: 03/31/2025

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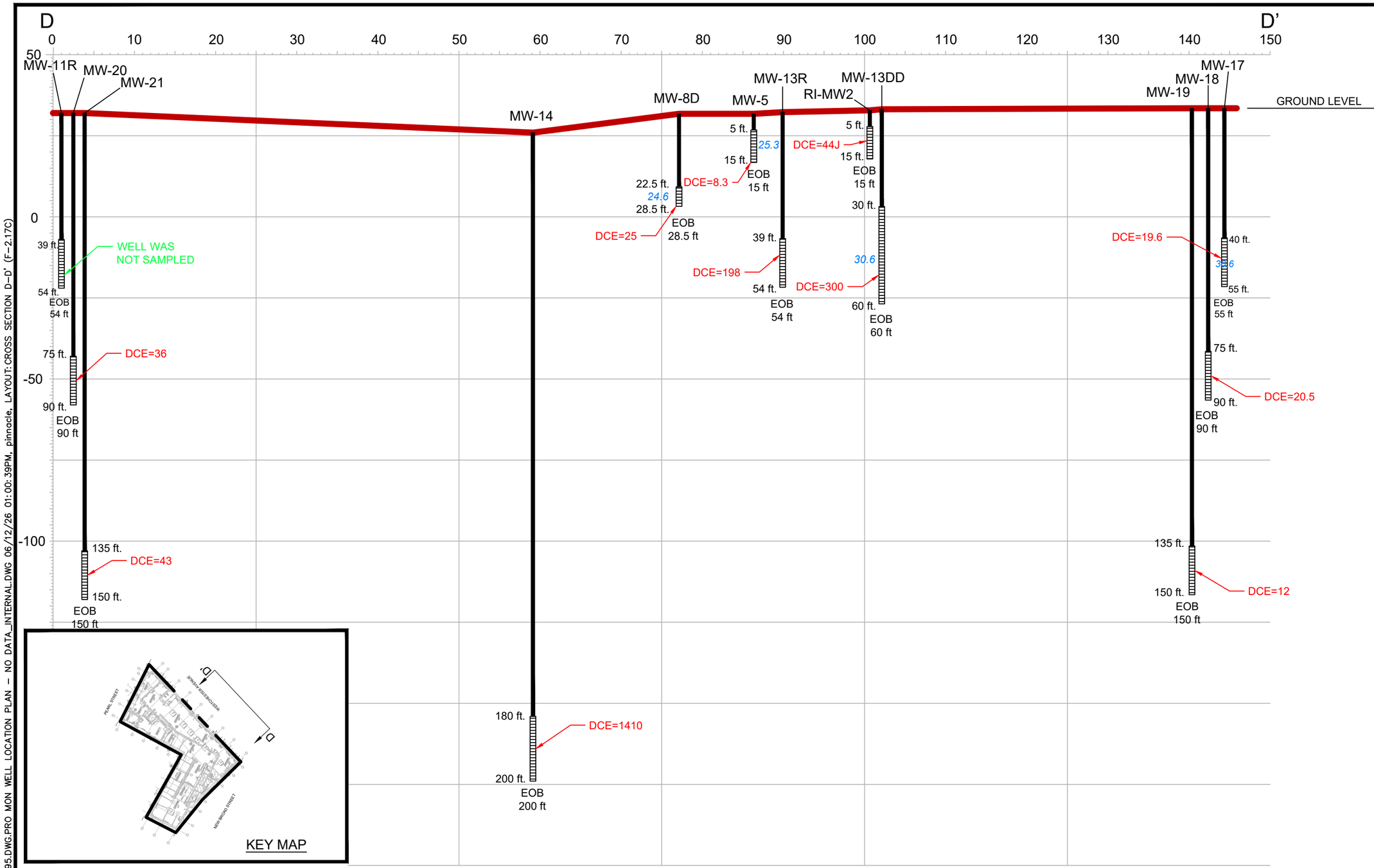
project: REMEDIAL INVESTIGATION REPORT
140, 148-150 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title: CROSS SECTION D-D'
WITH TCE ISOCONTOURS

job no: 11895A
drawing no:

FIG-2.17B

N:\ACAD\11895\R\11895.DWG.PRO MON WELL LOCATION PLAN – NO DATA_INTERNAL.DWG 06/12/26 01:00:35PM, pinnacle, LAYOUT:CROSS SECTION D–D' (F–2.17B)



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LEGEND:

- GROUND ELEVATION
- 30.6 - DTW ELEVATION
- GREEN - BELOW NYSDEC AWQS
- RED - ABOVE NYSDEC AWQS
- MONITORING WELL
- WELL SCREEN

NOTE:
"DCE = 300" - DCE @ 300 MICROGRAMS PER LITER (ppb)

SCALE: 1"=5' HORIZ., 1"=2' VERT.

0 2 4 8 ft.
0 5 10 20 ft.

dwg by: AW
chk by: SL
scale: N.T.S.
date: 03/31/2025

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project:
REMEDIAL INVESTIGATION REPORT
140, 148-150 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title:
CROSS SECTION D-D'
WITH DCE ISOCONTOURS

job no: 11895A
drawing no:

FIG-2.17C

N:\ACAD\11895\R\11895.DWG.PRO MON WELL LOCATION PLAN – NO DATA_INTERNAL.DWG 06/12/26 01:00:39PM, pinnacle, LAYOUT:CROSS SECTION D–D' (F–2.17C)



REFERENCE
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LEGEND:

- PROPERTY/SITE BOUNDARY
- RI-MW1 - MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2022)
- MW-5 - MW-5 MONITORING WELL NUMBER & APPROX. LOCATION (MARCH 2023)
- (24.2) - APPROX. GROUNDWATER ELEVATION (SEPT. 22, 2023)
- APPROX. GROUNDWATER FLOW DIRECTION

Scale 1"=40'
0 40 80

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dwg by: AW
chk by: SL
scale: AS NOTED
date: 09/16/2024

project:
146 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title:
GROUNDWATER ELEVATION CONTOURS
(APPROX. EL. 15' AND ABOVE)

job no: 11895A
drawing no:

FIG-2.18

N:\ACAD\11895A\CAD\SRI\11895A.DWG.GW DATA – 2.17, 2.18, 2.19.DWG 06/12/26 03:42:22PM, pinnacle, LAYOUT:3–SHALLOW SRI



REFERENCE
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LEGEND:

- PROPERTY/SITE BOUNDARY
- MW-8D (28.5-30 ft bgs) MONITORING WELL NUMBER & APPROX. LOCATION (MARCH AND JULY 2023)
- (24.6) - APPROX. GROUNDWATER ELEVATION (SEPT. 22, 2023)
- APPROX. GROUNDWATER FLOW DIRECTION

Scale 1"=40'
0 40 80

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dwg by: AW
chk by: SL
scale: AS NOTED
date: 09/16/2024

project: 146 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title: GROUNDWATER ELEVATION CONTOURS
(APPROX. EL. 0' TO 15')

job no: 11895A
drawing no:

FIG-2.19

N:\ACAD\11895A\CAD\SRI\11895A.DWG.GW DATA – 2.17, 2.18, 2.19.DWG 06/12/26 03:42:25PM, pinnacle, LAYOUT:4– INTER SRI



REFERENCE
SITE SURVEY PREPARED BY RICHARD J. DOMATO, DATED MARCH 5, 2021.

NOTE:
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LEGEND:

- PROPERTY/SITE BOUNDARY
- MW-11DD - MW-11DD (55-59' bgs) MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2023)
- (24.3) - APPROX. GROUNDWATER ELEVATION (SEPT. 22, 2023)
- APPROX. GROUNDWATER FLOW DIRECTION

Scale 1"=40'
0 40 80

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dwg by: AW
chk by: SL
scale: AS NOTED
date: 09/16/2024

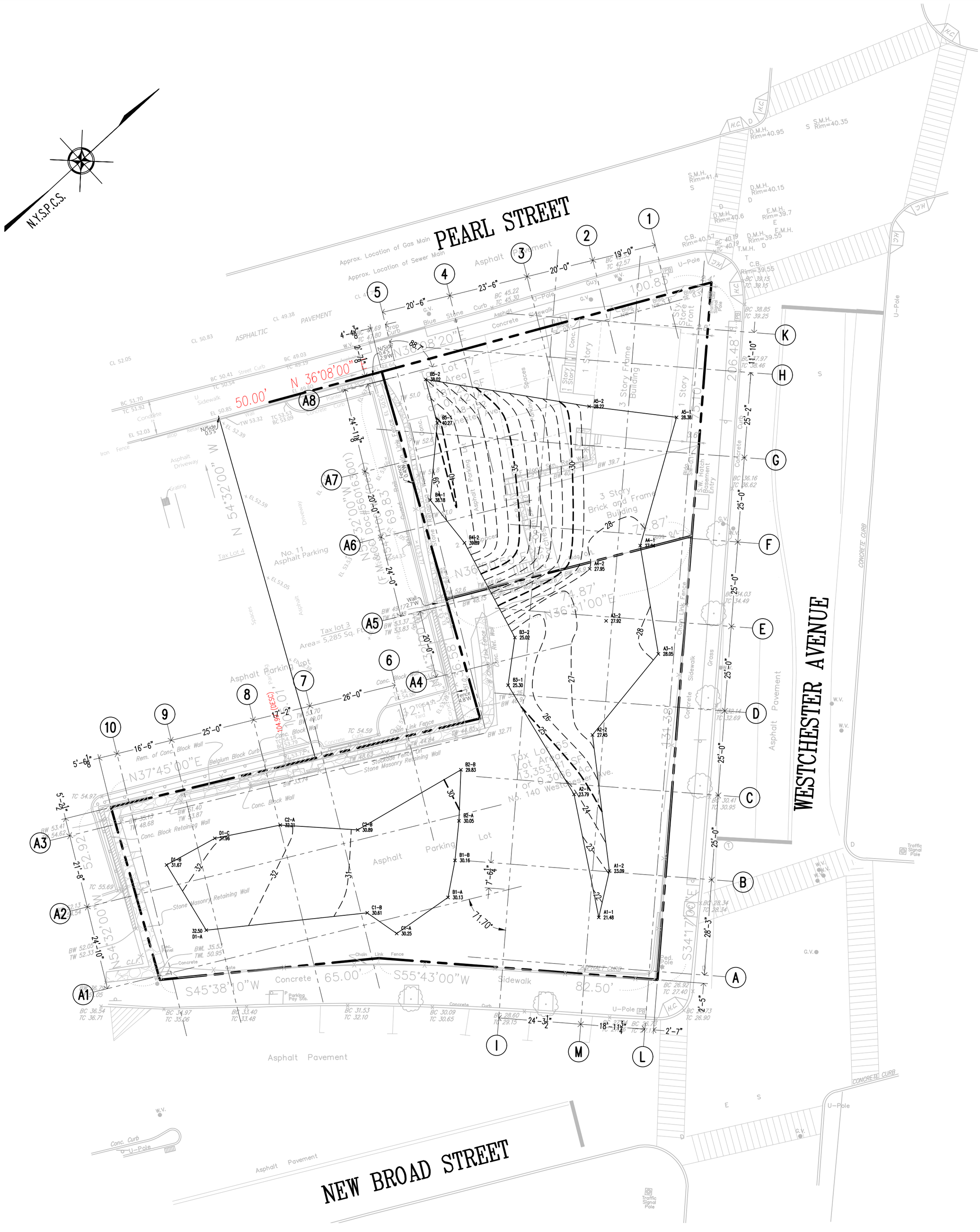
project: 146 WESTCHESTER AVENUE
PORT CHESTER, NEW YORK 10573

title: GROUNDWATER ELEVATION CONTOURS (APPROX. EL. 30' TO 0')

job no: 11895A
drawing no:

FIG-2.20

N:\ACAD\11895A\CAD\SRI\11895A.DWG,GW DATA – 2.17, 2.18, 2.19.DWG 06/12/26 03:42:30PM, pinnacle, LAYOUT:5–DEEP SRI



BACKGROUND SURVEY INFORMATION WAS PROVIDED BY HUDSON ENGINEERING & CONSULTING P.C.
ELEVATIONS ARE RELATIVE TO THE DATUM ESTABLISHED BY THE ABOVE SURVEY INFORMATION.
BUILDING GRID WAS TAKEN FROM PLANS PREPARED BY LESSARD DESIGN INC. P.C.

THE SURVEYOR'S SEAL, SIGNATURE AND ANY CERTIFICATION APPEARING HEREON SIGNIFY THAT, TO THE BEST OF HIS KNOWLEDGE AND BELIEF, THIS SURVEY WAS PREPARED IN ACCORDANCE WITH THE MINIMUM STANDARDS FOR LAND SURVEYS AS SET FORTH IN THE CODE OF PRACTICE ADOPTED BY THE NEW YORK STATE ASSOCIATION OF PROFESSIONAL LAND SURVEYORS, INC.

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.

LINE & GRADE SURVEYORS D.P.C.

23 Nepperhan Avenue
Elmsford, New York 10523
Phone: (914) 347-3141
email: office@lineandgrade.net

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STATE OF NEW YORK
STEVEN J. WILLARD
050054
LICENSED LAND SURVEYOR

NO.	DATE	DESCRIPTION	BY
1	01/23/25	ADDITIONAL SURVEY DATA	FM

TOPOGRAPHIC SURVEY
PREPARED FOR
140-150 WESTCHESTER AVE.
PROPERTY SITUATE AT
VILLAGE OF PORT CHESTER
COUNTY OF WESTCHESTER
STATE OF NEW YORK

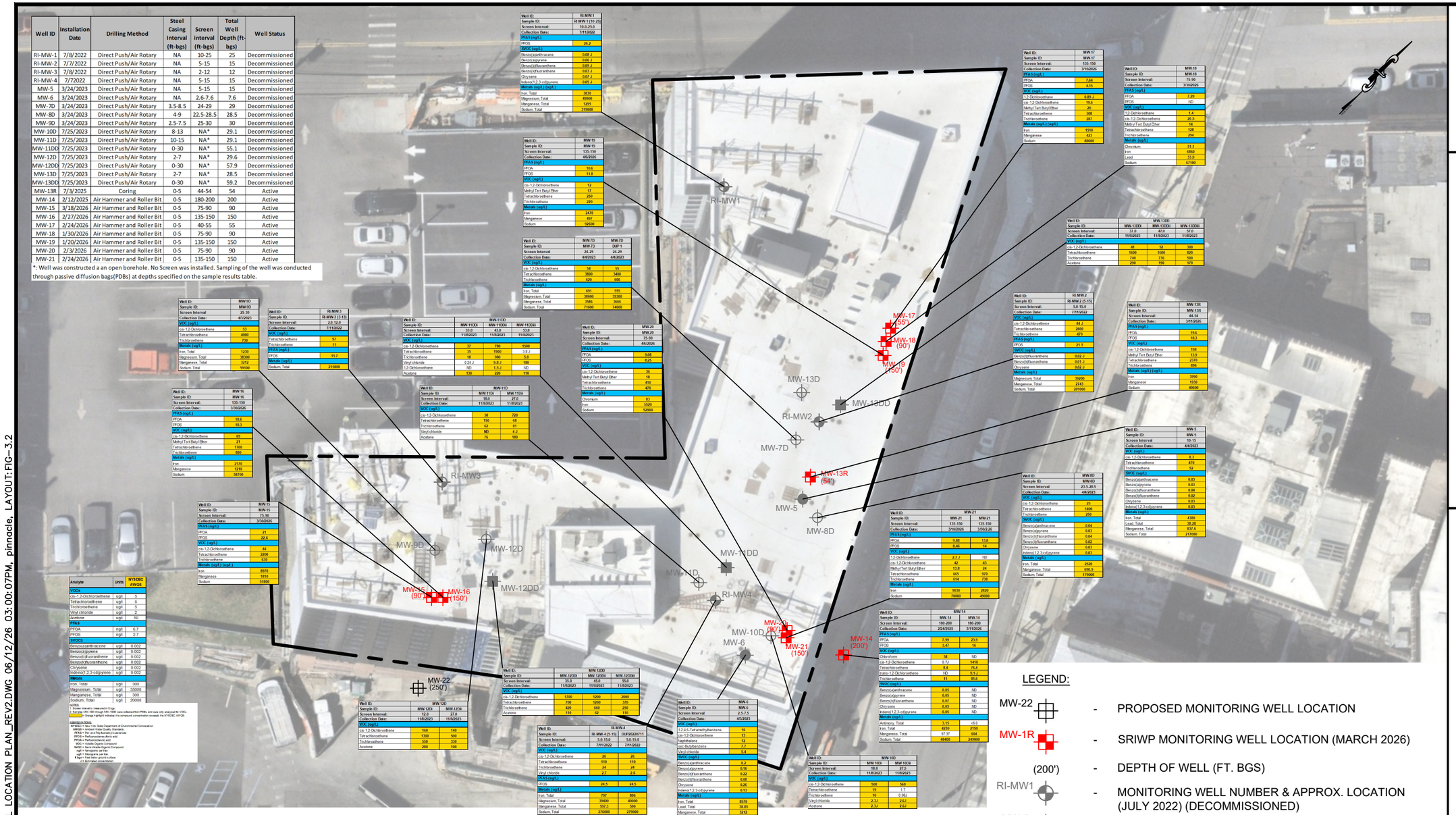
0 20 40 Feet

DATE: OCTOBER 24, 2024

N: /C3D/24-4196 KINGS CAPITAL_140 150 Westchester AVE/dwg/4196-146 WESTCHESTER AVE TOPO 10-10-24.dwg

Well ID	Installation Date	Drilling Method	Steel Casing Interval (ft-bgs)	Screen interval (ft-bgs)	Total Well Depth (ft-bgs)	Well Status
RI-MW-1	7/8/2022	Direct Push/Air Rotary	NA	10-25	25	Decommissioned
RI-MW-2	7/7/2022	Direct Push/Air Rotary	NA	5-15	15	Decommissioned
RI-MW-3	7/8/2022	Direct Push/Air Rotary	NA	2-12	12	Decommissioned
RI-MW-4	7/7202	Direct Push/Air Rotary	NA	5-15	15	Decommissioned
MW-5	3/24/2023	Direct Push/Air Rotary	NA	5-15	15	Decommissioned
MW-6	3/24/2023	Direct Push/Air Rotary	NA	2.6-7.6	7.6	Decommissioned
MW-7D	3/24/2023	Direct Push/Air Rotary	3.5-8.5	24-29	29	Decommissioned
MW-8D	3/24/2023	Direct Push/Air Rotary	4-9	22.5-28.5	28.5	Decommissioned
MW-9D	3/24/2023	Direct Push/Air Rotary	2.5-7.5	25-30	30	Decommissioned
MW-10D	7/25/2023	Direct Push/Air Rotary	8-13	NA*	29.1	Decommissioned
MW-11D	7/25/2023	Direct Push/Air Rotary	10-15	NA*	29.1	Decommissioned
MW-11DD	7/25/2023	Direct Push/Air Rotary	0-30	NA*	55.1	Decommissioned
MW-12D	7/25/2023	Direct Push/Air Rotary	2-7	NA*	29.6	Decommissioned
MW-12DD	7/25/2023	Direct Push/Air Rotary	0-30	NA*	57.9	Decommissioned
MW-13D	7/25/2023	Direct Push/Air Rotary	2-7	NA*	28.5	Decommissioned
MW-13DD	7/25/2023	Direct Push/Air Rotary	0-30	NA*	59.2	Decommissioned
MW-13R	7/3/2025	Coring	0-5	44-54	54	Active
MW-14	2/12/2025	Air Hammer and Roller Bit	0-5	180-200	200	Active
MW-15	3/18/2026	Air Hammer and Roller Bit	0-5	75-90	90	Active
MW-16	2/27/2026	Air Hammer and Roller Bit	0-5	135-150	150	Active
MW-17	2/24/2026	Air Hammer and Roller Bit	0-5	40-55	55	Active
MW-18	1/30/2026	Air Hammer and Roller Bit	0-5	75-90	90	Active
MW-19	1/20/2026	Air Hammer and Roller Bit	0-5	135-150	150	Active
MW-20	2/3/2026	Air Hammer and Roller Bit	0-5	75-90	90	Active
MW-21	2/24/2026	Air Hammer and Roller Bit	0-5	135-150	150	Active

*: Well was constructed a an open borehole. No Screen was installed. Sampling of the well was conducted through passive diffusion bags(PDBs) at depths specified on the sample results table.



Analyte	Units	NYSDEC AWQS
VOCs		
cis-1,2-Dichloroethene	ug/l	5
Tetrachloroethene	ug/l	5
Trichloroethene	ug/l	5
Vinyl chloride	ug/l	2
Acetone	ug/l	50
PFAS		
PFOA	ng/l	6.7
PFOS	ng/l	2.7
SVOCs		
Benzo(a)anthracene	ug/l	0.002
Benzo(a)pyrene	ug/l	0.002
Benzo(b)fluoranthene	ug/l	0.002
Benzo(k)fluoranthene	ug/l	0.002
Chrysene	ug/l	0.002
Indeno(1,2,3-cd)pyrene	ug/l	0.002
Metals		
Iron, Total	ug/l	300
Magnesium, Total	ug/l	35000
Manganese, Total	ug/l	300
Sodium, Total	ug/l	20000

NOTES:
1. Screen interval is measured in ft-bgs.
2. Samples MW-100 through MW-1DD were collected from PDBs and were only analyzed for VOCs.
3. Orange highlight indicates the compound concentration exceeds the NYSDEC AWQS.

ABBREVIATIONS:
NYSDEC = New York State Department of Environmental Conservation
PFAS = Per and Polyfluoroalkyl substances
PFAS = Per and Polyfluoroalkyl substances
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
VOC = Volatile Organic Compound
SVOC = Semi-Volatile Organic Compound
ng/l = Nanograms per liter
ug/l = Micrograms per liter
ft-bgs = Feet below ground surface
BTV = Background concentration

Well ID:	RI-MW-1
Sample ID:	RI MW 1 (10-25)
Screen Interval:	10.0-25.0
Collection Date:	7/11/2022
PFAS (ng/L)	
PFOS	25.2
SVOC (ug/L)	
Benzo(a)anthracene	0.08 J
Benzo(a)pyrene	0.06 J
Benzo(b)fluoranthene	0.09 J
Benzo(k)fluoranthene	0.03 J
Chrysene	0.07 J
Indeno(1,2,3-cd)pyrene	0.05 J
Metals (ug/L) (ug/L)	
Iron, Total	3830
Magnesium, Total	49900
Manganese, Total	5295
Sodium, Total	319000

Well ID:	MW-19
Sample ID:	MW-19
Screen Interval:	135-150
Collection Date:	4/6/2026
PFAS (ng/L)	
PFOA	10.6
PFOS	11.0
VOC (ug/L)	
cis-1,2-Dichloroethene	12
Methyl Tert Butyl Ether	17
Tetrachloroethene	250
Trichloroethene	220
Metals (ug/L)	
Iron	2470
Manganese	857
Sodium	52600

Well ID:	MW-17
Sample ID:	MW-17
Screen Interval:	135-150
Collection Date:	3/10/2026
PFAS (ng/L)	
PFOA	7.64
PFOS	4.55
VOC (ug/L)	
1,2-Dichloroethene	0.89 J
cis-1,2-Dichloroethene	19.6
Methyl Tert Butyl Ether	20
Tetrachloroethene	388
Trichloroethene	287
Metals (ug/L) (ug/L)	
Iron	5150
Manganese	623
Sodium	88600

Well ID:	MW-18
Sample ID:	MW-18
Screen Interval:	75-90
Collection Date:	3/30/2026
PFAS (ng/L)	
PFOA	7.25
PFOS	ND
VOC (ug/L)	
1,2-Dichloroethane	1.4
cis-1,2-Dichloroethene	20.5
Methyl Tert Butyl Ether	14
Tetrachloroethene	128
Trichloroethene	254
Metals (ug/L)	
Chromium	51.1
Iron	6850
Lead	33.9
Sodium	67100

Well ID:	MW-13DD	MW-13D	MW-13DDi
Sample ID:	MW-13DD	MW-13DI	MW-13DDi
Screen Interval:	57.0	47.0	37.0
Collection Date:	11/9/2023	11/9/2023	11/9/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	820	52	41
Tetrachloroethene	500	730	1600
Trichloroethene	170	150	740
Acetone	110	110	250

Well ID:	RI-MW-2
Sample ID:	RI-MW-2 (5-15)
Screen Interval:	5.0-15.0
Collection Date:	7/11/2022
VOC (ug/L)	
cis-1,2-Dichloroethene	48 J
Tetrachloroethene	2800
Trichloroethene	470
PFAS (ng/L)	
PFOS	21.5
SVOC (ug/L)	
Benzo(b)fluoranthene	0.02 J
Benzo(k)fluoranthene	0.01 J
Chrysene	0.02 J
Metals (ug/L)	
Magnesium, Total	15200
Manganese, Total	2743
Sodium, Total	2910000

Well ID:	MW-13R
Sample ID:	MW-13R
Screen Interval:	44-54
Collection Date:	3/11/2026
PFAS (ng/L)	
PFOA	19.3
PFOS	18.3
VOC (ug/L)	
cis-1,2-Dichloroethene	198
Methyl Tert Butyl Ether	13.5
Tetrachloroethene	2370
Trichloroethene	896
Metals (ug/L) (ug/L)	
Iron	3990
Manganese	1930
Sodium	490000

Well ID:	MW-5
Sample ID:	MW-5
Screen Interval	10-15
Collection Date:	4/4/2023
VOC (ug/L)	
cis-1,2-Dichloroethene	8.3
Tetrachloroethene	470
Trichloroethene	92
SVOC (ug/L)	
Benzo(a)anthracene	0.03
Benzo(a)pyrene	0.03
Benzo(b)fluoranthene	0.04
Benzo(k)fluoranthene	0.02
Chrysene	0.03
Indeno(1,2,3-cd)pyrene	0.03
Metals (ug/L)	
Iron, Total	4380
Lead, Total	38.28
Manganese, Total	837.6
Sodium, Total	217000

Well ID:	MW-8D
Sample ID:	MW-8D
Screen Interval	23.5-28.5
Collection Date:	4/4/2023
VOC (ug/L)	
cis-1,2-Dichloroethene	25
Tetrachloroethene	1450
Trichloroethene	250
SVOC (ug/L)	
Benzo(a)anthracene	0.04
Benzo(a)pyrene	0.03
Benzo(b)fluoranthene	0.04
Benzo(k)fluoranthene	0.02
Chrysene	0.03
Indeno(1,2,3-cd)pyrene	0.03
Metals (ug/L)	
Iron, Total	2520
Manganese, Total	696.5
Sodium, Total	179000

Well ID:	MW-21	MW-21
Sample ID:	MW-21	MW-21
Screen Interval:	135-150	135-150
Collection Date:	3/10/2026	3/30/2.26
PFAS (ng/L)		
PFOA	9.88	13.8
PFOS	5.45	14
VOC (ug/L)		
1,2-Dichloroethene	2.3 J	ND
cis-1,2-Dichloroethene	42	43
Methyl Tert Butyl Ether	13.8	24
Tetrachloroethene	665	970
Trichloroethene	614	730
Metals (ug/L)		
Iron	9030	2520
Sodium	70000	49000

Well ID:	MW-14	MW-14
Sample ID:	MW-14	MW-14
Screen Interval:	180-200	180-200
Collection Date:	2/24/2025	3/11/2026
PFAS (ng/L)		
PFOA	7.95	23.9
PFOS	3.47	16
VOC (ug/L)		
Chloroform	38	ND
cis-1,2-Dichloroethene	0.72	1410
Tetrachloroethene	8.4	76.4
trans-1,2-Dichloroethene	ND	9.1 J
Trichloroethene	11	91.6
SVOC (ug/L)		
Benzo(a)anthracene	0.05	ND
Benzo(a)pyrene	0.05	ND
Benzo(b)fluoranthene	0.07	ND
Chrysene	0.05	ND
Indeno(1,2,3-cd)pyrene	0.05	ND
Metals (ug/L)		
Antimony, Total	3.15	<6.0
Iron, Total	4230	2150
Manganese, Total	67.37	594
Sodium, Total	46400	249000

Well ID:	MW-20
Sample ID:	MW-20
Screen Interval:	75-90
Collection Date:	4/6/2026
PFAS (ng/L)	
PFOA	9.08
PFOS	8.25
VOC (ug/L)	
cis-1,2-Dichloroethene	36
Methyl Tert Butyl Ether	18
Tetrachloroethene	410
Trichloroethene	470
Metals (ug/L)	
Chromium	83
Iron	5520
Sodium	52900

Well ID:	MW-10D	MW-10DI	MW-10DDi
Sample ID:	MW-10D	MW-10DI	MW-10DDi
Screen Interval:	35.0	45.0	55.0
Collection Date:	11/9/2023	11/9/2023	11/9/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	1700	1200	2000
Tetrachloroethene	700	1200	370
Trichloroethene	420	660	250
Acetone	110	62	110

Well ID:	MW-11D	MW-11DI	MW-11DDi
Sample ID:	MW-11D	MW-11DI	MW-11DDi
Screen Interval:	12.0	27.0	
Collection Date:	11/8/2023	11/9/2023	
VOC (ug/L)			
Tetrachloroethene	160	140	
Trichloroethene	1300	500	
Trichloroethene	550	330	
Acetone	280	100	

Well ID:	MW-11D	MW-11DI	MW-11DDi
Sample ID:	MW-11D	MW-11DI	MW-11DDi
Screen Interval:	10.0	27.0	
Collection Date:	11/8/2023	11/9/2023	
VOC (ug/L)			
cis-1,2-Dichloroethene	38	720	
Tetrachloroethene	150	68	
Trichloroethene	62	81	
Vinyl chloride	ND	4.1	
Acetone	76	100	

Well ID:	MW-10D	MW-10DI	MW-10DDi
Sample ID:	MW-10D	MW-10DI	MW-10DDi
Screen Interval:	33.0	43.0	53.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
Tetrachloroethene	37	780	1500
Trichloroethene	35	1900	310
Trichloroethene	18	980	5.8
Vinyl chloride	0.24 J	9.8 J	180
1,2-Dichloroethane	ND	1.5 J	ND
Acetone	130	220	110

Well ID:	MW-6
Sample ID:	MW-6
Screen Interval	2.5-7.5
Collection Date:	4/5/2023
VOC (ug/L)	
1,2,4,5-Tetramethylbenzene	16
cis-1,2-Dichloroethene	13
Naphthalene	12
sec-Butylbenzene	7.7
Vinyl chloride	5.4
SVOC (ug/L)	
Benzo(a)anthracene	0.2
Benzo(a)pyrene	0.16
Benzo(b)fluoranthene	0.22
Benzo(k)fluoranthene	0.08
Chrysene	0.26
Indeno(1,2,3-cd)pyrene	0.13
Metals (ug/L)	
Iron, Total	8570
Lead, Total	38.85
Manganese, Total	3212
Sodium, Total	158000

Well ID:	MW-9D	MW-9DI	MW-9DDi
Sample ID:	MW-9D	MW-9DI	MW-9DDi
Screen Interval:	25.0	35.0	45.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
Tetrachloroethene	160	140	
Trichloroethene	1300	500	
Trichloroethene	550	330	
Acetone	280	100	

Well ID:	MW-15	MW-16
Sample ID:	MW-15	MW-16
Screen Interval:	75-90	
Collection Date:	3/30/2026	
PFAS (ng/l)		
PFOA	21	
PFOS	22.6	
VOC (ug/L)		
cis-1,2-Dichloroethene	44	
Tetrachloroethene	2200	
Trichloroethene	630	
Metals (ug/L) (ug/L)		
Iron	8970	
Manganese	1810	
Sodium	15000	

Well ID:	MW-16
Sample ID:	MW-16
Screen Interval:	135-150
Collection Date:	3/30/2026
PFAS (ng/L)	
PFOA	18.6
PFOS	18.3
VOC (ug/L)	
cis-1,2-Dichloroethene	69
Methyl Tert Butyl Ether	21
Tetrachloroethene	1700
Trichloroethene	880
Metals (ug/L)	
Iron	2170
Manganese	1210
Sodium	58700

Well ID:	RI-MW-3
Sample ID:	RI-MW-3 (3-13)
Screen Interval:	2.0-12.0
Collection Date:	7/11/2022
VOC (ug/L)	
Tetrachloroethene	37
Trichloroethene	11
PFAS (ng/L)	
PFOS	11.7
Metals (ug/L)	
Sodium, Total	211000

Well ID:	RI-MW-4	RI-MW-4
Sample ID:	RI-MW-4 (5-15)	DUP20220711
Screen Interval:	5.0-15.0	5.0-15.0
Collection Date:	7/11/2022	7/11/2022
VOC (ug/L)		
cis-1,2-Dichloroethene	25	25
Tetrachloroethene	110	110
Trichloroethene	24	24
Vinyl chloride	7.7	7.6
PFAS (ng/L)		
PFOS	24.5	24.5
Metals (ug/L)		
Iron, Total	797	806
Magnesium, Total	33400	40000
Manganese, Total	597.3	596
Sodium, Total	275000	277000

Well ID:	MW-12D	MW-12Di	MW-12Dd
Sample ID:	MW-12D	MW-12Di	MW-12Dd
Screen Interval:	12.0	27.0	
Collection Date:	11/8/2023	11/8/2023	
VOC (ug/L)			
Tetrachloroethene	160	140	
Trichloroethene	1300	500	
Trichloroethene	550	330	
Acetone	280	100	

Well ID:	MW-12D	MW-12Di	MW-12Dd
Sample ID:	MW-12D	MW-12Di	MW-12Dd
Screen Interval:	35.0	45.0	55.0
Collection Date:	11/9/2023	11/9/2023	11/9/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	1700	1200	2000
Tetrachloroethene	700	1200	370
Trichloroethene	420	660	250
Acetone	110	62	110

LEGEND:

MW-22	-	PROPOSED MONITORING WELL LOCATION
MW-1R	-	SRIWP MONITORING WELL LOCATION (MARCH 2026)
(200')	-	DEPTH OF WELL (FT. BGS)
RI-MW1	-	MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2022) (DECOMMISSIONED)
MW-5	-	MW-5 MONITORING WELL NUMBER & APPROX. LOCATION (MARCH 2023) (DECOMMISSIONED)
MW-8D	-	MW-8D (28.5-30 ft bgs) MONITORING WELL NUMBER & APPROX. LOCATION (MARCH AND JULY 2023) (DECOMMISSIONED)
MW-11DD	-	MW-1DD (55-59' bgs) MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2023) (DECOMMISSIONED)

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REFERENCE:

EXIST CONDITIONS & BOUNDARY ARE TAKEN FROM FOUNDATION PLAN PREPARED BY LESSARD DESIGN INC. P.C., DATED NOVEMBER 8, 2024.

SCALE: 1"=30'

0 30 60

N:\ACAD\11895\11895.DWG\INJ & MON WELL LOCATION PLAN_REV2.DWG 06/12/26 03:00:07PM, pinnacle, LAYOUT-FIG-3.2

dwg by: EC
chk by: SL
scale: AS NOTED
date: 06/11/26

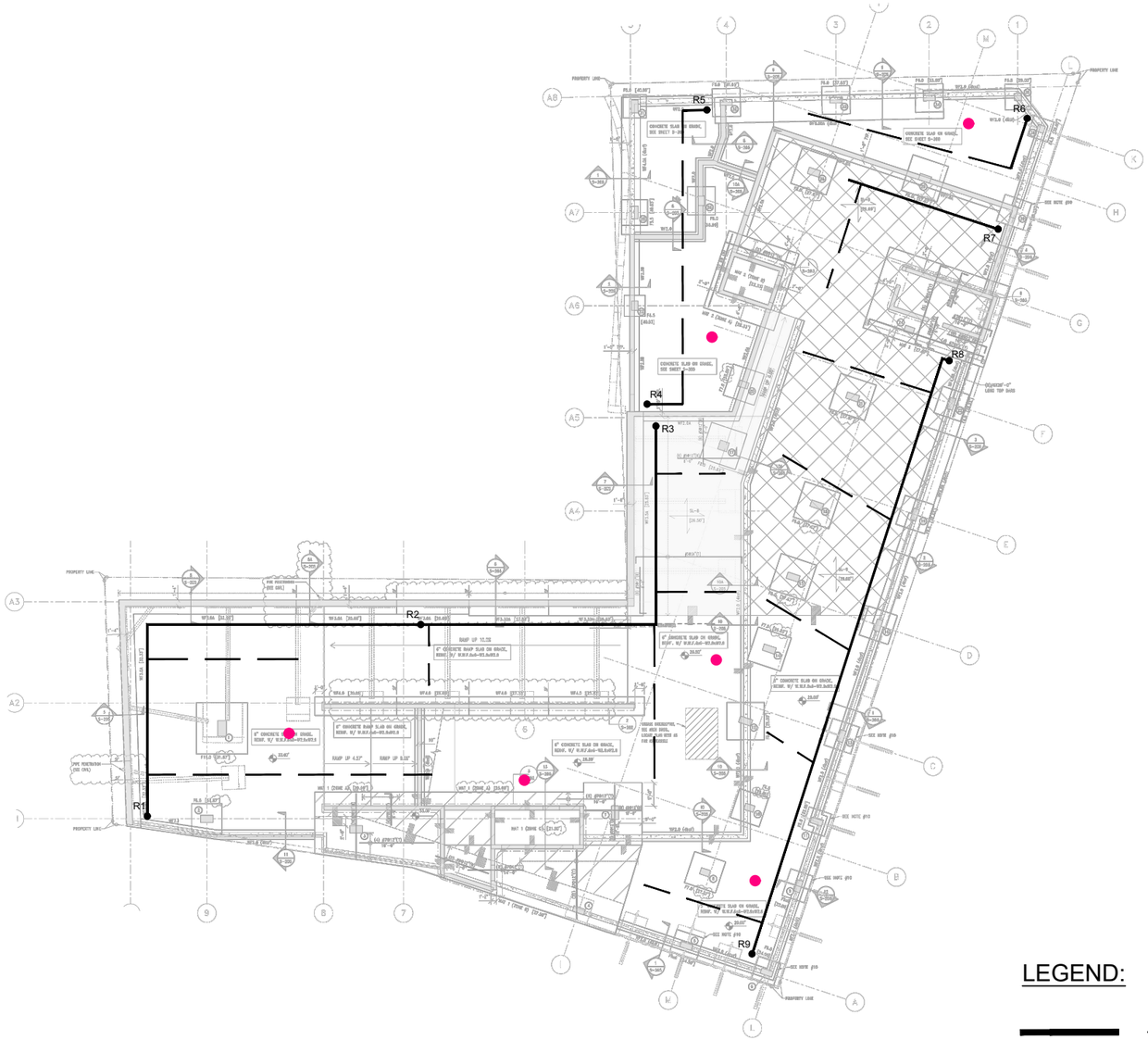
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959 ROUTE 46E, 3RD FLOOR, PARSIPPANY, NJ 07054 PH: 973.808.9050

project: 146 WESTCHESTER AVENUE PORT CHESTER, NY

title: MONITORING WELL NETWORK PLAN

job no: 11895
drawing no: FIG-3.2

1 of 1



LEGEND:

- 4" SOLID PVC
- 12" J-DRAIN OR APPROVED EQUAL
- RISER TO VENT TO ROOF/GARAGE
- APPROXIMATE LOCATION OF VAPOR PIN SAMPLING POINT

SCALE: 1"=30'

0 30 60

REFERENCE:

FOUNDATION PLAN IS TAKEN FROM "FOUNDATION PLAN" PREPARED FOR LESSARD DESIGN INC. P.C. PREPARED BY CHRISTIE ENGINEERING, P.C. CONSULTING ENGINEERS, DATED MAY 10, 2023, LAST REVISED MARCH 15, 2024.

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dwg by: EC
chk by: JV
scale: AS NOTED
date: 03/26/24

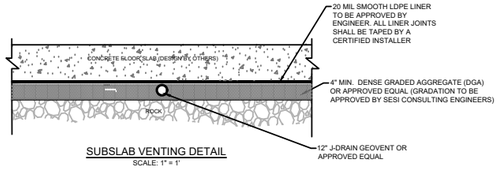
project: 146 WESTCHESTER AVENUE PORT CHESTER, NY

title: SUB SLAB DEPRESSURIZATION SYSTEM

job no: 11895A
drawing no:

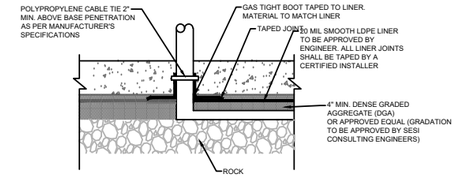
FIG 6.1A

N:\ACAD\11895A\CAD\ENVIRONMENTAL\VAPOR\11895A.DWG.SSDS PLAN-2.DWG 06/12/26 04:32:38PM, pinnacle, LAYOUT:FIG 6.1A

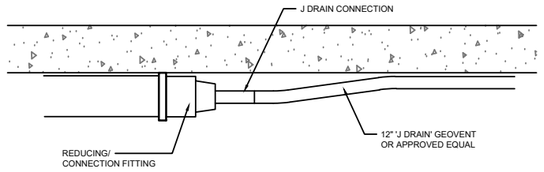


SUBSLAB VENTING DETAIL
SCALE: 1" = 1'

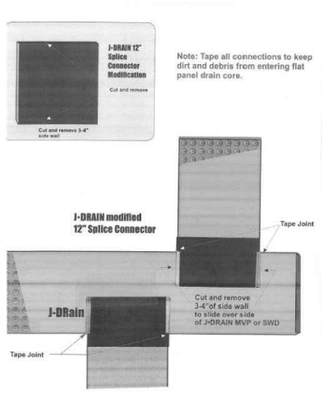
NOTES:
1. VENTING STONE SHALL MEET ASTM C33 AGGREGATE SIZE NO. 5, 56, 57, 6, OR ALTERNATE GRADATION APPROVED BY SESI CONSULTING ENGINEERS. MATERIAL SHOULD BE EVALUATED AND APPROVED BY SESI PRIOR TO INSTALLATION.
2. SESI SHALL INSPECT THE LINER PRIOR TO PLACEMENT OF CONCRETE. SMOKE TESTING SHALL BE PERFORMED ON A REGULAR BASIS DURING INSTALLATION. TRUCKS TRAFFIC OVER LINER SHALL BE KEPT TO A MINIMUM AND OR LINER SHALL BE INSTALLED IN SECTIONS TO MINIMIZE HEAVY TRAFFIC.
3. DGA SHALL CONTAIN LESS THAN 10% "FINES" (MATERIAL PASSING NO. 200 SEIVE).



TYPICAL LINER CONNECTION
@ PIPING PENETRATIONS DETAIL
SCALE: N.T.S.
NOTE: REFER TO MECHANICAL DRAWINGS FOR LOCATIONS OF PIPE PENETRATIONS



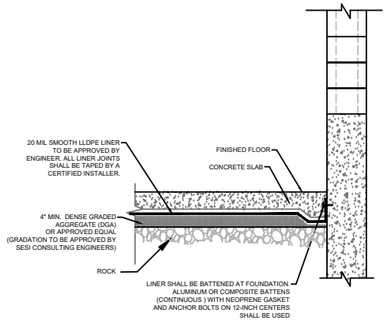
SOLID PIPE AND J DRAIN CONNECTION
SCALE: N.T.S.



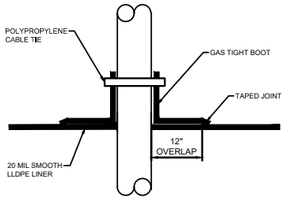
4 WAY J DRAIN CONNECTION
SCALE: N.T.S.

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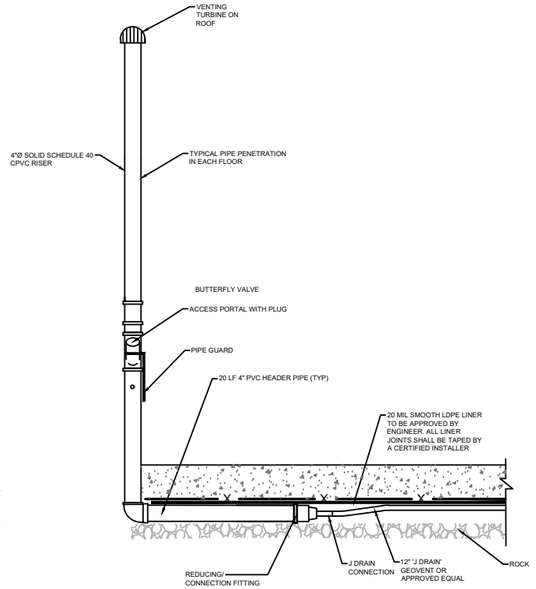
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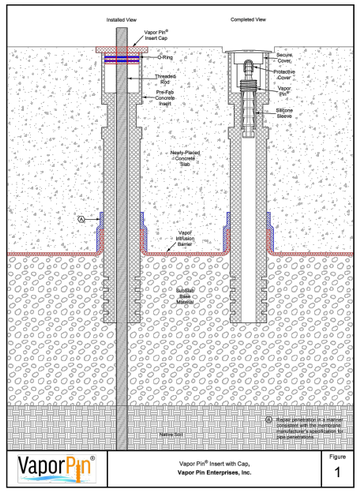
MEMBRANE TERMINATION AT
FOUNDATION WALL
NTS



TYPICAL GAS TIGHT BOOT
@ PIPING PENETRATIONS
SCALE: N.T.S.



TYPICAL SECTION RISERS
SCALE: N.T.S.



VAPOR PIN DETAIL
(TO BE LOCATED AND INSTALLED PENDING COMPLETION OF CONCRETE SLAB)

NOTES:
1. PINS TO BE DISTRIBUTED THROUGHOUT THE BUILDING AT A RATE OF APPROXIMATELY 1 PIN PER 3,000 SF.

GENERAL NOTES

1. THE PLANNED SUB-SLAB VAPOR INTRUSION (VI) MITIGATION SYSTEM WILL BE PLACED BENEATH THE CONCRETE SLAB IN THE ENCLOSED AREAS. THE VI MITIGATION SYSTEM INCLUDES THE FOLLOWING ELEMENTS:
   a) GRAVEL VENTING LAYER - A MINIMUM 4-INCH THICK OF CLEAN (LESS THAN 10% FINES ADEQUATE PERMEATION AND GRADATION TO BE APPROVED BY SESI PRIOR TO PLACEMENT) DGA OR GRAVEL LAYER SHALL BE PLACED BELOW THE CONCRETE SLAB.
   b) SUB-SLAB COLLECTION PIPING - A NETWORK OF VENTING PIPES (J-DRAIN OR HDPE PIPE) WILL BE PLACED WITHIN THE GRAVEL VENTING LAYER. THE VENTING PIPES WILL BE MANIFOLDED AS SHOWN IN THE DRAWING.
   c) RISERS - CONVEYANCE RISER PIPES WILL BE INSTALLED FROM THE SUB-SLAB HEADER PIPES TO BUILDING ROOF AS SHOWN IN THE DRAWING
   d) OPTIONAL BLOWER(S) - A BLOWER(S) CAN BE CONNECTED TO ANY OF THE RISERS IN THE FUTURE, IF NECESSARY, TO CONVERT THE PASSIVE-VENTED SYSTEM TO AN ACTIVE SYSTEM.
   e) ELECTRICAL CONDUITS - ELECTRICAL CONDUITS SHALL BE INSTALLED ADJACENT TO RISERS ON BUILDING ROOF TO FACILITATE PASSIVE-VENTED SYSTEM CONVERSION TO AN ACTIVE SYSTEM IF REQUIRED.
2. ALL CONDUITS AND/OR PIPE PENETRATIONS INTO THE SLAB SHOULD BE GAS TIGHT - REFER TO PIPE OR CONDUIT PENETRATION DETAIL ON THIS DRAWING PER WATERPROOFING DETAIL PROVIDED BY OTHERS.
3. OPERATION OF THE VI MITIGATION SYSTEM IS DESIGNED TO BE PASSIVE. THERE ARE NO MOVING OR MECHANICAL PARTS. ALL VENT RISERS SHALL BE FREE OF OBSTRUCTIONS AND VENT VALVES SHALL BE SET IN A FULLY OPEN POSITION. IF NECESSARY, ADJUSTMENT OF THE VENT VALVES SHALL BE PERFORMED BY A COMPETENT AND RESPONSIBLE AGENT TO ENSURE ADEQUATE VENTING OF THE SUB-SLAB SPACE.
4. ALL SUB-SLAB COLLECTION LATERALS AND VERTICAL VENT RISERS SHALL BE FREE OF OBSTRUCTIONS, NOT INUNDATED WITH WATER, AND ABLE TO VENT AIR FREELY FROM BELOW THE BUILDING SLAB TO THE ATMOSPHERE.
5. THE CONTRACTOR SHALL COORDINATE INSTALLATION OF VI MITIGATION SYSTEM WITH OTHER TRADES.
6. THESE PLANS AND DETAILS SHALL BE PROVIDED TO THE STRUCTURAL ENGINEER FOR REVIEW TO DETERMINE IF THE VAPOR MITIGATION SYSTEM WILL CONFLICT WITH THE INTEGRITY OF PROPOSED BUILDING SLAB AND/OR THE ACTIVATION OF ANY PROPOSED CONTROL JOINTS.

VENT RISER AIR TEST PROCEDURE NOTES

THE PURPOSE OF THE AIR TEST IS TO VERIFY THAT VENT RISERS ARE CLEAR OF OBSTRUCTIONS AND FREELY TRANSMIT AIR FROM THE SUB-SLAB GRAVEL VENTING LAYER TO EACH VENT'S TERMINATION ABOVE THE ROOF. IT IS RECOMMENDED THAT THE TEST BE PERFORMED PRIOR TO AND AFTER PLACEMENT OF THE CONCRETE FLOOR SLAB. FOR EACH VENTING SECTION

1. CLOSE GATE VALVES OF ALL VENTS.
2. BLOW AMBIENT AIR IN ONE VENT. IT IS THE CONTRACTOR'S RESPONSIBILITY TO PROVIDE AN ADEQUATELY SIZED BLOWER; PRELIMINARILY, A 200 - 400 CFM BLOWER IS RECOMMENDED.
3. WITH THE AIR SUPPLY DISCHARGING INTO THE VAPOR MITIGATION PIPING SYSTEM, OPEN FULLY EACH REMAINING VENT SEPARATELY, AND MEASURE AIR FLOW VELOCITY AND DIRECTION AT EACH VENT SAMPLE PORT. RECORD THE RESULTS AND CLOSE THE GATE VALVE.
4. REPEAT THIS PROCEDURE FOR ALL VENTS.
5. ALL AIR TESTING SHALL BE PERFORMED UNDER THE OBSERVATION OF SESI.

VAPOR BARRIER INSTALLATION SPECIFICATIONS

1. UNROLL VAPOR BARRIER WITH THE LONGEST DIMENSION PARALLEL WITH THE DIRECTION OF THE POUR. VISUALLY INSPECT THE MATERIAL DURING INSTALLATION FOR IMPERFECTIONS AND MARK FAULTY OR SUSPECT AREAS.
   a. UNROLL VAPOR BARRIER USING METHODS THAT WILL NOT DAMAGE MATERIAL AND WILL PROTECT UNDERLYING SURFACE FROM DAMAGE.
   b. PERSONNEL WALKING ON VAPOR BARRIER SHALL NOT ENGAGE IN ACTIVITIES OR WEAR SHOES THAT COULD DAMAGE IT. SMOKING SHALL NOT BE PERMITTED ON THE BARRIER.
   c. DO NOT ALLOW VEHICULAR TRAFFIC DIRECTLY ON THE VAPOR BARRIER.
2. OVERLAP JOINTS IN MATERIAL SHALL BE THE MINIMUM OVERLAP REQUIRED BY THE MANUFACTURER IN ORDER TO FUSION WELD THE MATERIALS. INSTALLATION AND FUSION WELDING OF THE LINER SHALL BE COMPLETED BY A CERTIFIED CONTRACTOR.
3. THE CONTRACTOR SHALL REPAIR DAMAGED AREAS BY CUTTING PATCHES OF VAPOR BARRIER, OVERLAPPING THEM ON THE DAMAGED AREA, AND FUSION WELDING THE PATCHES TO THE LINER.
4. SESI AND THE CONTRACTOR SHALL INSPECT ALL SEAMS, JOINTS, AND PENETRATIONS IN THE VAPOR BARRIER AND DOCUMENT INSPECTION REPORT. THE CONTRACTOR SHALL REPAIR OR REPLACE ALL DEFECTIVE SEAMS, JOINTS, AND PENETRATIONS PRIOR TO COVERING VAPOR BARRIER.
5. QA/QC TESTING SHALL BE COMPLETED DURING FUSION WELDING BY THE CERTIFIED CONTRACTOR TO DOCUMENT THAT ALL WELDS ARE BEING COMPLETED CORRECTLY. THE QA/QC PACKAGE SHALL BE PROVIDED TO SESI FOLLOWING COMPLETION OF THE SYSTEM.

TESTING AND INSPECTION

1. THE VAPOR BARRIER SHALL BE SMOKE TESTED FOR QUALITY ASSURANCE. SMOKE TESTING SHALL BE CONDUCTED BY SESI OR AN APPROVED VAPOR BARRIER APPLICATOR.
   a. THE VAPOR BARRIER SHALL BE VISUALLY INSPECTED. ANY APPARENT DEFICIENCIES AND/OR INSTALLATION PROBLEMS SHALL BE CORRECTED PRIOR TO SMOKE TESTING.
   b. THE DATE, TIME, TESTING REFERENCE AREA, TEMPERATURE, WIND SPEED/DIRECTION, AND CLOUD COVER SHALL BE RECORDED ON THE SMOKE TESTING RECORD. THE AMBIENT AIR TEMPERATURE AT THE TIME OF TESTING SHOULD BE IN EXCESS OF 45° F AND THE WIND SPEED AT GROUND LEVEL SHOULD BE 15 MPH OR LESS. (NOTE: VISUAL IDENTIFICATION OF LEAKS BECOMES MORE DIFFICULT WITH INCREASING WIND SPEED.)
   c. DELINEATE A SMOKE TESTING AREA. ASSEMBLE AND SITUATE SMOKE TESTING SYSTEM TO INJECT SMOKE BENEATH VAPOR BARRIER. ONLY INERT, NON-TOXIC SMOKE IS TO BE UTILIZED FOR VAPOR BARRIER SMOKE TEST.
   d. DESIGNATE TESTING CONTROL AREAS BY CUTTING OPENINGS IN AN "X" PATTERN (MINIMUM 4" X 4") IN THE VAPOR BARRIER AT SELECTED LOCATIONS. MARK TESTING CONTROL AREAS FOR IDENTIFICATION PRIOR TO CONDUCTING THE SMOKE TEST.
   e. ACTIVATE SMOKE GENERATOR/BLOWER SYSTEM (NOMINAL 150-950 CFM). APPLY SUFFICIENT PRESSURE AS TO ENSURE THAT SMOKE WILL PERMEATE THE DESIGNATED TESTING AREA. FOR VERIFICATION, ENSURE THAT SMOKE IS LEAKING THROUGH TESTING CONTROL AREAS.
   f. PUMP SMOKE BENEATH THE VAPOR BARRIER FOR A MINIMUM PERIOD OF 1-2 MINUTES. OBSERVE FOR LEAKS IN THE VAPOR BARRIER. REDUCE PRESSURE/FLOW RATE IF EXCESSIVE LIFTING OF THE VAPOR BARRIER OCCURS.
   g. THOROUGHLY INSPECT ENTIRE VAPOR BARRIER SURFACE WITHIN AREA DELINEATED FOR TESTING. USE MARKING DEVICE TO MARK/LABEL ANY LEAK LOCATIONS. MARK/LABEL LEAK LOCATIONS ON FLOOR PLAN AND CORRESPONDING TESTING REFERENCE AREA.
   h. REPAIR LEAK LOCATIONS MARKED IN STEP G BY CUTTING PATCHES OF VAPOR BARRIER, OVERLAPPING DAMAGED AREA BY 6 INCHES MINIMUM, AND TAPING ALL FOUR SIDES.

REPEAT STEPS F AND G, AS NECESSARY TO CONFIRM INTEGRITY OF THE VAPOR BARRIER. ONCE THE VAPOR BARRIER HAS PASSED THE SMOKE TEST INSPECTION, THE SUCCESSFUL COMPLETION

dwg by: EC
chk by: JV
scale: AS NOTED
date: 03/26/24

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project: 146 WESTCHESTER AVENUE PORT CHESTER, NY

title: SSDS DETAILS & NOTES

job no: 11895A
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FIG 6.1B

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Appendix A:

Groundwater Treatment Design

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Groundwater Remediation Design

For:

Grand Union Hotel Bowling Alley Site
146 Westchester Avenue
Port Chester, New York
BCP Site No. C360222

Prepared for:

Port Chester OZ Fund QOZB, LLC
June 2026

SESI Project No:
11895A

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LIST OF ACRONYMS

Acronym	Definition
AWQS	Ambient Water Quality Standards
CVOCs	Chlorinated Volatile Organic Compounds
ERD	Enhanced Reductive Dechlorination
ISCR	In-Situ Chemical Reduction
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PCE	Tetrachloroethene
SSDS	Sub-Slab Depressurization System
TCE	Trichloroethene
VC	Vinyl Chloride
VOC	Volatile Organic Compound
UUSCOs	Unrestricted Use Soil Cleanup Objectives

1.0 INTRODUCTION

Port Chester OZ Fund III QOZB, LLC entered into a Brownfield Cleanup Agreement (BCA) with NYSDEC on March 25, 2022 to investigate and remediate the Grand Union Hotel Bowling Alley Site, designated NYSDEC Brownfield Cleanup Program (BCP) Site No. C360222. Port Chester Oz Fund III PropCo, LLC, (PropCo) was added as a Volunteer on August 20, 2024. The BCP Site is located at 146 Westchester Avenue, Port Chester, New York (hereinafter referred to as the "Site"). and consists of one (1) parcel that encompasses approximately 0.4486 acres. The parcel is identified on local tax maps under Tax Map ID 143.30-2-70.

Historic operations at the Site have included tin smith, blacksmith, plumbing supply, carpet cleaning, lodging, bowling alley, and locksmith.

As noted above, a RAWP was submitted to NYSDEC in April 2025 and revised and resubmitted in June 2026. The RAWP describes the following remediation action (RA) activities:

- Remedial action (RA) activities for soil, which were conducted under the approved IRMWP. Soils were excavated to achieve the NYSDEC Unrestricted Use Soil Cleanup Objectives (UUSCOs).
- Planned RA activities for groundwater, which include targeted injection of ISCR/ERD amendments, including GEOFORM® and ZVI, designed to reduce groundwater contamination to levels below the Ambient Water Quality Standards (AWQS), followed by remedy verification.
- The installation of a vapor barrier and the components of a sub-slab depressurization system (SSDS) and the planned soil vapor evaluation.

This RAWP Appendix provides a detailed approach to remediate groundwater contamination at the site, which revises the initial proposal described in the April 2025 RAWP and revised approach described in the July 2025 RAWP Addendum.

2.0 SUMMARY OF GROUNDWATER FINDINGS AT THE SITE

The Site groundwater has been impacted with VOCs, SVOCs, metals, and PFAS compounds above NYSDEC TOGS AWQS or the PFAS Guidance Values, as follows.

- VOCs were detected above the AWQS in fourteen (14) monitoring wells/boreholes.
- PCE and TCE levels appear to decrease with depth, particularly in boreholes MW-10D, MW-11D, MW-11DD, MW-12D, MW-12DD, and MW-13DD that were profile sampled using the passive diffusion bags.
- cis-1,2-Dichloroethene concentrations generally increase with depth in the central and southern portions of the site, indicating more optimal reducing conditions and the degradation of PCE and related parent compounds to daughter products in the deeper groundwater zone.
- MW-14 was installed to 200 feet below ground surface (ft bgs) and was sampled for VOCs, SVOCs, metals and PFAS. Chlorinated solvents minimally exceed the AWQS

and vertical delineation is complete (although chlorinated solvents were identified in MW-14, it is expected that downward flow is minimal and the bulk of the contaminant mass is present at much shallower depths).
- PFOS, PFOA, and metals were detected above the guidance values and/or AWQS across the entire Site.
- SVOCs were detected above the AWQS in five (5) monitoring wells.

The primary contaminants of concern in groundwater are chlorinated volatile organic compounds (CVOCs), including tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2 -DCE) and vinyl chloride (VC).

Princeton Geophysics:

In addition to the implementation of the NYSDEC approved Remedial Investigation Workplan (RIWP), three supplemental RIWP (SRIWP) were approved to advance the investigation of the groundwater contamination in the bedrock aquifer. These supplemental workplans consisted primarily of additional wells to complete vertical delineation. Another critical component of one of these SRIWPs was the geophysical logging of seven (7) bedrock boreholes. The complete report is attached. The geophysical logging consisted of three-arm caliper with fluid resistivity and temperature; high-resolution optical televiewer; high-resolution acoustic televiewer; stacked natural gamma; single point resistance; spontaneous potential and normal resistivity; and heat-pulse flow meter (HPFM) during static and pumped conditions.

Primary findings of this activity include:

- Seven (7) bedrock boreholes were successfully logged using caliper, OTV/ATV, resistivity, gamma, and HPFM methods to evaluate fracture occurrence, orientation, transmissivity, and vertical flow conditions within the Site bedrock aquifer.
- Fractures were identified from gently dipping to sub-vertical, with the majority (59%) classified as moderately dipping (31–60 degrees). Across all boreholes, 34 foliation features were identified with an average orientation of approximately 101/58.5 (dip azimuth/dip magnitude), or about N11E, 59SE, indicating a consistent east/southeast-dipping structure that may provide preferential pathways for groundwater and contaminant migration.
- Ambient HPFM testing showed little to no measurable vertical flow in five (5) of the seven (7) boreholes (generally <0.03 gpm), indicating that vertical flow is limited overall and occurs only where discrete hydraulically connected fractures are present.
- Localized ambient cross-flow was identified in only two wells, confirming that bedrock hydraulic connectivity is present but highly discrete:
    - MW-12D exhibited approximately 0.045 gpm of downward flow between fractures at approximately 17.5 and 18.5 feet bgs; and
    - MW-13DD exhibited approximately 0.05 gpm of upward flow beginning at a fracture near 39 feet bgs and exiting near the bottom of casing.

- Pumped HPFM testing demonstrated variable but generally limited transmissivity across the Site. In MW-10D and MW-13D, pumped HPFM testing could not be completed due to very low formation yield (~0.1 gpm or less) and the proximity of the water level to the bottom of casing, which is itself an indication of low bedrock productivity.
- In the deeper wells MW-11DD, MW-12DD, and MW-13DD, calculated total formation yields were on the order of ~0.6 to 0.8 gpm; however, HPFM results showed that only ~0.15 gpm or less was attributable to small fractures within the open bedrock interval. Princeton concluded that much of the apparent yield in these wells likely originated near the bottom of casing / enlarged borehole transition, where the casing was not fully advanced and the HPFM diverter could not properly seal, limiting confidence in open-hole inflow estimates at those locations.
- MW-11D showed somewhat better open-hole response than several other wells, with approximately 0.2 gpm measured from several small transmissive fractures, although Princeton noted that some portion of the apparent yield may also have originated from the casing-bottom transition zone.
- The clearest productive shallow-bedrock fracture zone on site was identified in MW-12D between approximately 12 and 18 feet bgs, including a dominant transmissive fracture at approximately 17.5 feet bgs. Princeton estimated total formation yield from MW-12D at approximately 0.51 gpm, with roughly 0.3 gpm likely contributed by the fracture at 17.5 feet, making this the strongest documented bedrock inflow zone observed during the geophysical program.
- Several boreholes also contained intervals where fractures were sparse or absent, supporting the interpretation that groundwater movement is not distributed uniformly through the bedrock, but instead controlled by a limited number of conductive fractures and weathered intervals.

Overall, Princeton's logging indicates that the Site bedrock aquifer is fracture-controlled, laterally variable, and locally connected, with limited ambient vertical flow and generally low transmissivity under both static and pumped conditions. These findings support a conceptual model in which groundwater and contaminant migration occur through a small number of productive fracture zones, rather than through a laterally continuous and uniformly transmissive bedrock system.

Tetra Tech:

Given the complexity of the case, SESI also engaged a third party (Tetra Tech) to provide some input with regard to the evaluation of the data, creation of a conceptual site model and a path forward for an effective remedial strategy. Tetra Tech's draft report is attached.

Upon review of the available data, Tetra Tech made the following conclusions:

- The fracture trace analysis did not identify a significant lineament within the Site boundaries that would be expected to influence groundwater flow or remediation performance at the Site;

- Chlorinated VOCs appear to be the primary groundwater constituents of concern related to Site and/or possible off-site releases, as they exhibit the highest concentrations and are the only constituent group consistently identified at depth.
- The Site is underlain by fractured metamorphic bedrock with shallow bedrock and a shallow water table, and groundwater flow is interpreted to be primarily to the east/east-southeast under a relatively strong horizontal gradient (~0.13).
- The hydraulic vertical gradient is very low (~0.01) in the nested well pairs, indicating limited vertical driving force and suggesting that contaminant migration is controlled more by discrete fractures and weathered intervals than by broad vertical groundwater movement.
- The low groundwater discharge rates observed during HPFM testing under pumping conditions indicate that hydraulic conductivity of the fractured rock is generally low, even where fractures are present. Tetra Tech noted that extraction from fractured bedrock wells would likely be limited to approximately 0.5 gpm or less.
- Tetra Tech concluded that groundwater flow within the weathered bedrock, particularly near the weathered bedrock/bedrock interface, is likely greater than flow through the deeper fracture network, which supports the interpretation that the principal contaminant mass and transport zone is in the shallow bedrock / weathered bedrock interval.
- Analytical trends indicate that PCE and TCE are present in both shallow and deep wells, while daughter products generally become more prominent at depth in parts of the Site, consistent with ongoing reductive dechlorination under more reducing conditions.
- Tetra Tech observed that groundwater concentrations in the southern and central portion of the Site are sufficiently similar to suggest some degree of connectivity through the fractured/weathered bedrock system, although not as a uniformly connected bedrock plume.
- Tetra Tech also noted that some wells, including MW-11D, MW-12DD, and MW-10D, show significant biological degradation from PCE to daughter products, with evidence of stall at cis-1,2-DCE in some locations.
- Tetra Tech concluded that low-pressure amendment delivery and ERD-based treatment are preferred over more infrastructure-intensive extraction approaches, and that the Site conditions favor a remedy that can account for fracture-controlled amendment distribution and support longer-lasting treatment.

SESI CSM Refinement:

As part of the April 2026 Supplemental RIR, Tetra Tech's April 2024 Draft Hydrogeologic Technical Memo, general Site hydrogeologic conditions, and borehole geophysical logs were reviewed by a SESI hydrogeologist. Based on that review, SESI concludes that the Site is controlled by fractured bedrock, with groundwater flow and contaminant transport occurring through discrete, unevenly distributed transmissive fractures and weathered intervals rather than through a uniformly connected bedrock matrix. Tetra Tech concluded that groundwater flow is primarily to the east/east-southeast, that the horizontal hydraulic gradient is relatively steep, and that the vertical hydraulic gradient within nested well pairs is low (<0.01), indicating limited vertical driving force. Consistent with that interpretation, Princeton Geoscience's borehole logging and HPFM testing showed little to no measurable ambient vertical flow in most boreholes, with localized inflow and cross-flow identified only at discrete fracture intervals, including MW-12D and MW-13DD. Collectively, these data indicate that bedrock groundwater movement and

contaminant transport are controlled by a limited number of hydraulically conductive fractures and weathered intervals, resulting in a laterally variable and vertically stratified plume geometry.

The highest on-site PCE concentrations appear to be associated with the weathered and upper bedrock intervals, which represent the primary source area and lateral transport zone. This interpretation is consistent with Tetra Tech's conclusion that groundwater flow within the weathered bedrock, particularly near the weathered bedrock/competent bedrock interface, is likely greater than flow through the deeper fracture network. In the southern and central portions of the Site, concentration patterns in nested well pairs, including MW-12D/MW-12DD and MW-13D/MW-13DD, indicate a transition from higher parent-compound concentrations in shallower intervals to greater daughter-product expression at depth. This distribution is consistent with reductive dechlorination under more reducing conditions in deeper groundwater and suggests at least partial hydraulic connectivity through discrete transmissive fractures and weathered intervals in the southern/central portion of the plume. In contrast, the northern portion of the Site exhibits a different pattern, with elevated PCE and TCE persisting in the MW-11 well pair and less pronounced daughter-product development at depth, suggesting that the northern and southern/central portions of the Site may function as hydraulically distinct fracture-controlled zones rather than as a single laterally uniform bedrock plume. Remedial investigation findings are detailed in the April 2026 Remedial Investigation Report (RIR).

Based on the updated groundwater data in the southern portion of the Site (Treatment Area C), SESI further interprets that MW-15 (90') and MW-16 (150') are likely being influenced by a significant transmissive fracture or fracture zone in the upper bedrock, rather than being solely representative of true deeper bedrock conditions. This interpretation is supported by borehole geophysics, which identified the clearest productive shallow-bedrock fracture zone on site in MW-12D between approximately 12 and 18 feet bgs, including a dominant transmissive fracture at approximately 17.5 feet bgs that produced the strongest measured bedrock inflow during heat-pulse flow meter testing. Both MW-15 and MW-16 show highly elevated parent compound concentrations and exhibited relatively strong purging and sampling yields compared to the generally low-yield conditions observed elsewhere in the site well network. Considered together, these data support SESI's interpretation that a productive shallow-to-intermediate fracture zone in the upper bedrock is preferentially transmitting contaminants downward from the shallow source area into MW-15 and MW-16. This same fracture-controlled transport mechanism also provides a reasonable explanation for downgradient impacts observed in Treatment Area B. Under the current CSM, the elevated parent-compound concentrations observed in Area C may be migrating downgradient through productive fractures into deeper intervals in Area B, including MW-21 and MW-14. SESI has also observed chlorinated VOC impacts in both the southern and central portions of the Site, including at depth, which supports at least partial hydraulic connectivity through discrete fractures and weathered intervals.

This refined CSM has direct implications for remedial design. Specifically, it indicates that elevated concentrations observed at depth in portions of the Site may, in some cases, reflect shallow fracture influence within productive upper-bedrock pathways rather than uniformly persistent impacts throughout the deeper bedrock system. Accordingly, future injections may need to be focused within isolated depth intervals using packers, rather than across broader open intervals, in order to effectively target transmissive zones and avoid poorly distributed amendment

delivery. This interpretation also supports the need for deeper, isolated monitoring in key locations to distinguish shallow fracture influence from true deeper bedrock impacts as part of final remedy development.

SESI engaged three in-situ groundwater remediation firms to provide conceptual remediation plans. SESI evaluated these approaches and settled on the remedy described in the following sections.

3.0 REMEDIAL APPROACH

SESI considered Pump and Treat; Groundwater Recirculation and Treatment; and In-situ Treatment. Based on the evaluation of the available remedial methods, in-situ treatment using GEOFORM® by Evonik has been selected for this Site. This approach integrates In-Situ Chemical Reduction (ISCR) with Enhanced Reductive Dechlorination (ERD) to address the identified contaminants within the Site's fracture-controlled bedrock formation.

3.1 RATIONALE

The primary factors that were considered to make the decision regarding the groundwater treatment technology include:

1. The potential for an onsite source has been removed with the completion of the Interim Remedial Measures that resulted in the removal of all soil from the Site.
2. Given the fact that there are potentially offsite sources to the groundwater contamination, the remedy was selected to have an immediate impact on the concentrations and long-lasting impacts.
3. Chemical injections (in situ chemical oxidation [ISCO]) and/or ISCR are expected to have an immediate impact, and GEOFORM® by Evonik (an ISCR/ERD amendment) is expected to have longer lasting effects to address impacted groundwater that may continue to migrate on the Site.
4. The bulk of the contaminant mass on Site is expected to be associated with the weathered and upper bedrock intervals, although deeper impacts are present in discrete bedrock wells and appear to be controlled by productive fracture pathways.
5. Based on the refined CSM, amendment placement should focus on hydraulically relevant transmissive fractures and weathered intervals rather than assuming uniform distribution across broad open borehole intervals.
6. Slug testing and short-duration pumping/interference testing will be conducted using on-site wells to further refine targeted treatment intervals and evaluate local hydraulic connectivity between injection and monitoring wells.
7. Where appropriate, packers will be used during injection to isolate and treat discrete depth intervals in order to improve amendment placement within productive fracture zones and reduce losses to less transmissive portions of the borehole.

3.2 TREATMENT METHOD SELECTION

SESI has conducted a review of remedial actions for the site CVOC source zone contamination. Based on our understanding of site hydrogeology, CVOC distribution, and treatment goals, three remedial actions were considered: (1) Pump and Treat; (2) Groundwater Recirculation and Treatment; and (3) In-situ Treatment. Based on the evaluation of the available remedial methods, in-situ treatment using GEOFORM® by Evonik has been selected for this Site. This approach integrates In-Situ Chemical Reduction (ISCR) with Enhanced Reductive Dechlorination (ERD) to address the identified contaminants.

1) Pump and Treat

This remedial action includes the extraction of groundwater from multiple on-site wells and treatment of the groundwater for discharge to the sanitary sewer or storm sewer via permit. Due to the site hydrogeology, limited extraction volumes are expected, and the treatment may not affect all impacted fractures, thereby limiting the long-term effectiveness of the treatment. Pilot testing would be required to determine extraction rates and number/location of wells required for this remedy. The lengthy cleanup time required, permitting requirements and time to obtain permits, and the required infrastructure above and below ground, make this remedy less desirable.

2) Groundwater Recirculation and Treatment

In this alternative, groundwater would be extracted from one set of wells, treated via activated carbon for removal of CVOCs and potentially PFAS, amended for either In-Situ Chemical Oxidation (ISCO) or Enhanced Reductive Dechlorination (ERD), and reinjected into another set of wells. As a result, the amendments would be distributed in a zone between the injection and extraction wells. Due to the Site hydrogeology, limited extraction volumes are expected, and pilot testing would be required to determine extraction rates and number/location of wells required for this remedy. The capacity of the wells to accept flow would be the limiting factor for the groundwater extraction rate and additional injection wells may be required based on the pilot testing. This remedy would require aboveground infrastructure to treat, amend and reinject the extracted groundwater, which would disrupt site operation. The recirculation can be conducted at discrete times (not continuous) to limit the effect on the site operation, but this would make the treatment less effective. This remedial action is less desirable.

3) In-situ Treatment

This remedial action would include injection of amendments to the subsurface to either destroy (in situ chemical oxidation [ISCO] or In-Situ-Chemical Reduction, ISCR) and/or stimulate the biological breakdown (ERD) of the contaminants in the subsurface. For ISCO, catalyzed sodium persulfate and sodium permanganate were considered for ISCO, and GEOFORM® from Evonik for ISCR/ERD.

In this alternative, amendments would be gravity-fed or injected into the subsurface at low pressure. The injection pressure would be kept as low as possible to limit the potential of daylighting of material in nearby utilities or at the ground surface. Field hydraulic testing, including slug testing and short-duration pumping/interference testing, will be conducted during remedial design to refine the intervals most likely to accept and transmit amendment effectively. Based on

those results, injection may be performed within isolated intervals using packers, where appropriate, rather than relying solely on broad open-borehole amendment placement.

ISCO and ISCR are aggressive, faster-acting remedial methods compared to ERD. There are safety concerns with ISCO due to the location of the site in an urban setting with significant utilities and uncertain below-grade injection flow paths. Therefore, ISCO is not recommended. ISCR does not present significant safety concerns and can be used at this site. ERD takes longer to provide reductions in contaminant concentrations, but it is generally longer lasting in the environment and is safer to implement. An advantage for ERD in this case is that there is evidence of reductive dechlorination occurring naturally at this site. This is generally indicative of a site where ERD can be successful. One additional advantage of this alternative is that considering the expected low pore volume in this subsurface environment, lower injection volumes will likely be required to reach target subsurface concentrations compared to sites with contamination in overburden formations. Therefore, SESI has concluded that an ISCR/ERD combined treatment would be the most effective remedial option for this site. As currently proposed, this treatment approach also incorporates zero valent iron (ZVI) as part of the ISCR component to enhance abiotic reductive treatment of CVOCs within targeted transmissive intervals.

A technology that combines ISCR and ERD is GEOFORM® from Evonik. GEOFORM® reagents are engineered to promote in-situ biogeochemical reactions. GEOFORM® provides a source of sulfate, ferrous iron, electron donors, pH buffer, and nutrients to promote mechanisms for dehalogenation via enhanced anaerobic bioremediation, abiotic degradation, and the formation of reactive minerals. The component ratios have been optimized to maximize the formation of reactive iron sulfide minerals that provide an expanded surface area for abiotic degradation pathways of CVOCs. In particular, GEOFORM® SOLUBLE is formulated to be delivered as a fully soluble dry powder in two parts: GEOFORM® Soluble Mix, a proprietary blend of sulfate and ferrous iron, and Emulsified Lecithin Substrate ELS® Microemulsion or ELS® Concentrate, a 25% or concentrated organic carbon substrate. A Dehalococcoides sp (Dhc) inoculant would be added to the Soluble Mix to enhance reductive dechlorination of the CVOCs. The Dhc inoculate contains at least $1X10^{11}$ cells per liter of Dhc. The recommended target concentration of Dhc in the treatment areas is $1x10^{7}$ cells per liter. The final mix (GEOFORM® Soluble Mix and Dhc inoculant) would remain fully in solution during mixing and injection and may last as long as 2 to 3 years in-situ. The Soluble Mix/Dhc injection would be advantageous in this case due to the challenging injection conditions in fractured and weathered bedrock and the uncertainty in hydraulic communication within the impacted formation. SESI believes that treatment of the groundwater using GEOFORM® Soluble Mix with a Dhc inoculant would offer long-lasting treatment of the CVOCs and ease of placement of the amendments in the treatment areas. These advantages are expected to be further improved by focusing amendment placement within the discrete transmissive intervals identified during remedial design. Where included in the final design, ZVI would serve as a reductive amendment within the overall ISCR/ERD treatment approach and would not alter SESI's conclusion that ISCO is not appropriate for this Site.

3.3 TARGET ZONES AND DESIGN PARAMETERS

Four treatment zones have been established to target the hotspots identified during the Remedial Investigation (RI) at MW-11, MW-12, MW-13, and MW-18 well clusters. These zones are illustrated in **Figure A-1**. The proposed treatment column extends vertically from 25 feet above

mean sea level (amsl) to -50 feet amsl, which represents the overall treatment column used for preliminary amendment demand calculations. For reference, the bottom elevations of the 'DD' wells installed during the RI ranged from approximately -25 to -30 feet amsl. As a conservative measure, the treatment column extends below those intervals to account for deeper impacts observed in discrete bedrock wells and the potential for contaminant transport through productive fracture pathways. However, based on the refined CSM, amendment delivery is not expected to occur uniformly across this entire interval. Rather, final injection depths will be refined during remedial design based on analytical data, geophysical data, and field hydraulic testing, and amendments will be placed within targeted transmissive intervals using packers where appropriate. The highest CVOCs detected during the RI within each zone were used in the design to represent contaminant levels across the entire treatment interval.

Target zones information and design parameters are summarized in **Table 1-3** below.

Table 1: Treatment Area A (MW-13 Area)

Treatment Area Dimensions:	**Value**	**Unit**	
Width of targeted zone	45	ft	
Length of targeted zone	30	ft	
Depth to top of treatment zone	8	ft bgs	
Treatment zone thickness	75	ft	
Treatment volume	101,250	ft^3	
Total Porosity	5	%	
Groundwater volume	5,063	ft^3	
Soil bulk density	100	lbs/ft^3	
Soil mass	5,063	ton	
Transport characteristics:			
Treatment time / design life for one application	3	years	
Linear groundwater flow velocity	95	ft/year	
Effective porosity for groundwater flow	5	%	
Soil type	low permeability		
Fraction organic carbon in soil, foc	0.010		
	GW	**Soil***	**Total COC**
Contaminant	**(mg/L)**	**(mg/kg)**	**Mass** (lb)**
PCE	3.8	9.994	110.0
	GW	**Soil***	**Total COC**
Contaminant	**(mg/L)**	**(mg/kg)**	**Mass** (lb)**

TCE	0.74	0.7918	9.7
DCE	0.3	0.18	2.5

*Sorbed concentrations were roughly estimated based on expected groundwater concentrations, foc and Koc values.
**The total COC mass was estimated based on concentrations in soil and groundwater within the targeted area plus expected contributions from inflowing groundwater over the projected design life.

GEOFORM® demand calculations conducted by Evonik (attached) yielded the following recommendations:

- Four (4) injection wells (IW-A1 through IW-A4)
- Injection volume/well: 1,966 gallons (1,880 gallons of water mixed with: 375 lbs of GeoForm Soluble Mix; 345 lbs of ELS Microemulsion; 4.5 L of DHC Inoculum; and 125 lbs 5-micron ZVI)
- Total water needed for the MW-13 injection area: 7,520 gal
- Total mass of Geoform Mix: 1,500 lbs
- Total mass of ELS microemulsion: 1,380 lbs
- Total mass of 5-micron ZVI: 500 lbs
- Total volume of DHC Inoculum: 18 Liters
- Total volume injected in area MW-13: 7,865 gal

Table 2: Treatment Area B (MW-11 Area)

Treatment Area Dimensions:	**Value**	**Unit**	
Width of targeted zone (perpendicular to gw flow)	40	ft	
Length of targeted zone (parallel to gw flow)	35	ft	
Depth to top of treatment zone	2	ft bgs	
Treatment zone thickness	75	ft	
Treatment volume	105,000	ft^3	
Total Porosity	5	%	
Groundwater volume	5,250	ft^3	
Soil bulk density	100	lbs/ft^3	
Soil mass	5,250	ton	
Transport characteristics:			
Treatment time / design life for one application	3	years	
Transport characteristics:			
Linear groundwater flow velocity	95	ft/year	

Effective porosity for groundwater flow	5	%	
Soil type	low permeability		
Fraction organic carbon in soil, foc	0.010		
	GW	**Soil***	**Total COC**
Contaminant	**(mg/L)**	**(mg/kg)**	**Mass** (lb)**
PCE	1.9	4.997	56.5
TCE	0.98	1.0486	13.1
DCE	0.72	0.432	6.1
VC	0.18	0.0045	0.4

*Sorbed concentrations were roughly estimated based on expected groundwater concentrations, foc and Koc values.
**The total COC mass was estimated based on concentrations in soil and groundwater within the targeted area plus expected contributions from inflowing groundwater over the projected design life.

GEOFORM® demand calculations conducted by Evonik (attached) yielded the following recommendations:

- Four (4) injection wells (IW-2, IW-B1, IW-B2, and IW-B3)
- Injection volume/well: 1,966 gallons (1,880 gallons of water mixed with: 375 lbs of GeoForm Soluble Mix; 345 lbs of ELS Microemulsion; 4.5 L of DHC Inoculum; and 125 lbs 5-micron ZVI)
- Total water needed for the MW-11 injection area: 7,520 gal
- Total mass of Geoform Mix: 1,500 lbs
- Total mass of ELS microemulsion: 1,380 lbs
- Total mass of 5-micron ZVI: 500 lbs
- Total volume of DHC Inoculum: 18 Liters
- Total volume injected in area MW-11: 7,866 gal

Table 3: Treatment Area C (MW-12 Area)

Treatment Area Dimensions:	**Value**	**Unit**	
Width of targeted zone	55	ft	
Length of targeted zone	30	ft	
Depth to top of treatment zone	8	ft bgs	
Treatment zone thickness	75	ft	
Treatment volume	123,750	ft^3	
Total Porosity	5	%	
Groundwater volume	6,188	ft^3	
Soil bulk density	100	lbs/ft^3	
Soil mass	6,188	ton	
Transport characteristics:			
Treatment time / design life for one application	3	years	
Linear groundwater flow velocity	95	ft/year	
Effective porosity for groundwater flow	5	%	
Soil type	low permeability		
Fraction organic carbon in soil, foc	0.010		
	GW	**Soil***	**Total COC**
Contaminant	**(mg/L)**	**(mg/kg)**	**Mass** (lb)**
PCE	4	10.52	141.5
TCE	0.73	0.7811	11.7
DCE	2	1.2	20.5

*Sorbed concentrations were roughly estimated based on expected groundwater concentrations, foc and Koc values.
**The total COC mass was estimated based on concentrations in soil and groundwater within the targeted area plus expected contributions from inflowing groundwater over the projected design life.

GEOFORM® demand calculations conducted by Evonik (attached) yielded the following recommendations:

- Four (4) injection wells (IW-3, and IW-C1 through IW-C3)
- Injection volume/well: 1,966 gallons (1,880 gallons of water mixed with: 375 lbs of GeoForm Soluble Mix; 345 lbs of ELS Microemulsion; 4.5 L of DHC Inoculum; and 125 lbs 5-micron ZVI)
- Total water needed for the MW-12 injection area: 7,520 gal
- Total mass of Geoform Mix: 1,500 lbs

- Total mass of ELS microemulsion: 1,380 lbs
- Total volume of DHC Inoculum: 18 Liters
- Total volume injected in area MW-12: 7,866 gal

Table 4: Treatment Area D (MW-18 Area)

Treatment Area Dimensions:	**Value**	**Unit**	
Width of targeted zone	20	ft	
Length of targeted zone	15	ft	
Depth to top of treatment zone	5	ft bgs	
Treatment zone thickness	74	ft	
Treatment volume	22,200	ft^3	
Total Porosity	5	%	
Groundwater volume	1,110	ft^3	
Soil bulk density	100	lbs/ft^3	
Soil mass	1,100	ton	
Transport characteristics:			
Treatment time / design life for one application	3	years	
Linear groundwater flow velocity	95	ft/year	
Effective porosity for groundwater flow	5	%	
Soil type	low permeability		
Fraction organic carbon in soil, foc	0.010		
	GW	**Soil***	**Total COC**
Contaminant	**(mg/L)**	**(mg/kg)**	**Mass** (lb)**
PCE	0.3	0.789	2.0
TCE	0.3	0.321	1.0
DCE	0.02	0.012	0

*Sorbed concentrations were roughly estimated based on expected groundwater concentrations, foc and Koc values.
**The total COC mass was estimated based on concentrations in soil and groundwater within the targeted area plus expected contributions from inflowing groundwater over the projected design life.

GEOFORM® demand calculations conducted by Evonik (attached) yielded the following recommendations:

- Two (2) injection wells (IW-1 and IW-4)

- Injection volume/well: 849 gallons (800 gallons of water mixed with: 175 lbs of GeoForm Soluble Mix; 230 lbs of ELS Microemulsion; and 250 lbs 5-micron ZVI)
- Total water needed for the MW-18 injection area: 1,600 gal
- Total mass of Geoform Mix: 350 lbs
- Total mass of ELS microemulsion: 460 lbs
- Total mass of 5-micron ZVI: 500 lbs
- Total volume of DHC Inoculum: 0 Liters
- Total volume injected in area MW-18: 800 gal

3.4 MONITORING WELL AND INJECTION WELL INSTALLATIONS

Based on the design and considering site constraints—including subsurface utilities, footings, mat slabs, underground storage tanks (USTs), access limitations, and height clearance restrictions—the proposed locations of the injection and monitoring wells are shown in **Figure A-1**. A total of 14 injection wells and 13 monitoring wells are planned for installation. Treatment Areas A through D are intended to address the principal groundwater impact areas identified through the RI and refined CSM.

Injection wells will be constructed as 4-inch open bedrock boreholes extending to a depth of -50 feet amsl. The open borehole construction is being retained intentionally to allow flexibility during remedial implementation, including the use of packers to isolate and inject into discrete transmissive intervals identified during remedial design testing. Monitoring wells will be installed within each treatment area at the previously identified hotspots from the RI to assess remedial effectiveness. An upgradient monitoring well, designated MW-1R, will be installed to monitor background contaminant levels. A vertical delineation well, designated MW-22, will be installed to 250 ft bgs. to monitor vertical extent of the plume. All monitoring wells will be installed per specifications in **Table 5.** Groundwater monitoring activities are described in the subsequent sections.

A ground-penetrating radar (GPR) survey will be conducted prior to drilling activities. At each location, the first several feet below the concrete surface will be hand-dug or air-knifed following concrete cutting to safely clear any subsurface obstructions. Steel casing will be advanced through overburden and at least 5 feet into competent bedrock, as appropriate. Following installation, wells will be developed by pumping until the water runs clear. Well installation will follow the same methodology detailed in the approved December 2025 SRIWP. All investigation-derived waste, including development and purge water and drill cuttings, will be managed in accordance with the April 2026 Revised RAWP.

Monitoring well and injection well specifications are detailed in **Table 5** below:

Table 5: Monitoring Well and Injection Well Specifications

Category	Name	Well Dia (in)	Borehole Dia (in)	Slab EL. (ft)	Bottom EL. (ft)	Total Depth (ft. bgs)	Screen length (ft)
Monitoring	MW-1R	2	4	26.5	-25	51.5	10
Monitoring	MW-11R	2	4	29	-25	54	10
Monitoring	MW-12R	2	4	33	-25	58	10
Monitoring	MW-13R	2	3.75	29	-25	54	10
Monitoring	MW-14	2	4	28	-172	200	20
Monitoring	MW-15	2	4	33	-57	90	15
Monitoring	MW-16	2	4	33	-117	150	15
Monitoring	MW-17	2	4	29	-26	55	15
Monitoring	MW-18	2	4	29	-61	90	15
Monitoring	MW-19	2	4	29	-121	150	15
Monitoring	MW-20	2	4	29	-61	90	15
Monitoring	MW-21	2	4	29	-121	150	15
Monitoring	MW-22	2	4	33	-217	250	15
Injection	IW-1	NA*	4	29	-50	79	NA*
Injection	IW-2	NA*	4	27	-50	77	NA*
Injection	IW-3	NA*	4	32	-50	82	NA*
Injection	IW-4	NA*	4	29	-50	79	NA*
Injection	IW-A1	NA*	4	29	-50	79	NA*
Injection	IW-A2	NA*	4	29	-50	79	NA*
Injection	IW-A3	NA*	4	29	-50	79	NA*
Injection	IW-A4	NA*	4	29	-50	79	NA*
Injection	IW-B1	NA*	4	29	-50	79	NA*
Injection	IW-B2	NA*	2	29	-50	79	NA*
Injection	IW-B3	NA*	4	26.5	-50	76.5	NA*
Injection	IW-C1	NA*	4	33	-50	83	NA*
Injection	IW-C2	NA*	4	33	-50	83	NA*
Injection	IW-C3	NA*	4	33	-50	83	NA*

*: Well installed as an open bore hole

Drilling at this location was terminated prior to the original design depth due to the presence of heavily fractured bedrock intervals that resulted in borehole instability/collapse during advancement. Notwithstanding the reduced final depth, the well exhibited strong water production and acceptance during drilling and development, indicating interception of a highly transmissive fracture zone.

3.5 PUMP TEST AND SLUG TEST

In order to assess local hydraulic response and further refine targeted injection intervals, prior to injection events, slug testing will be conducted at selected injection wells and monitoring wells. For each well, a slug test will be performed by installing a pressure transducer to record water level changes. A slug will be rapidly added to or removed from the well, creating a sudden change in water level. The transducer will continuously measure the water level as it returns to equilibrium. The recorded data will then be analyzed using appropriate analytical methods (e.g., Bouwer-Rice or Hvorslev) to estimate the hydraulic conductivity of the surrounding aquifer and to help identify intervals with the greatest potential to accept amendment during injection. At selected locations, packer-isolated slug or pulse testing may also be performed to evaluate the hydraulic response

of specific bedrock intervals and further refine the depth zones most appropriate for amendment placement.

In order to assess the hydraulic connectivity between the wells, a pump test will be conducted at selected injection wells. Water will be pumped from one well at a controlled rate while pressure transducers are installed in the associated observation wells to continuously record water level changes. The response in each observation well will be evaluated based on the degree and timing of drawdown and recovery to assess hydraulic connectivity between the wells. A strong and timely response indicates good hydraulic connection within the aquifer system, and vice versa. These tests are intended to further refine the remedial design by identifying the intervals most likely to accept and transmit amendment effectively.

Pumped water will be managed in accordance with the June 2026 Revised RAWP.

A modification of the proposed injection plan, including targeted injection intervals, may be required based on the aquifer testing results.

3.6 INJECTION

The proposed injection plan is summarized in **Table 6** below. Amendments will be injected into the subsurface at low pressure. The injection pressure will be kept as low as possible to limit the potential of daylighting of material in nearby utilities or at the ground surface. This injection plan may be adjusted based on the aquifer testing results.

Table 6: Injection Plan Summary

Treatment Area	Injection Wells	GeoForm® Mix (lbs)	ELS® Microemulsion (lbs)	5-Micron ZVI (lbs)	Water Required (gal)	Volume of Solution to inject	GeoForm® Mix Concentration	ELS® Concentration
A	IW-A1, IW-A2, IW-A3, IW-A4	1,500	1,380	500	7,520	7,865	2.30%	2.10%
B	IW-2, IW-B1, IW-B2, IW-B3	1,500	1,380	500	7,520	7866	2.30%	2.10%
C	IW-3, IW-C1, IW-C2, IW-C3	1,500	1,380	500	7,520	7,866	2.30%	2.10%
D	IW-1 IW-4	350	460	500	1,600	1,697	2.50%	3.30%

3.7 GROUNDWATER MONITORING

Post-treatment groundwater monitoring will be conducted at all above-mentioned wells eight (8) weeks after injection, followed by quarterly monitoring for up to two years or until groundwater concentrations meet AWQS.

During each sampling event, monitoring wells will be sampled via low-flow purge and sampling method (LFPS).

Samples will be analyzed for volatile organic compounds (VOCs) and biogeochemical parameters including pH, oxidation-reduction potential (ORP), dissolved oxygen (DO), nitrate, sulfate, and total manganese and iron. These parameters will be used to evaluate contaminant reduction and subsurface geochemical conditions. Groundwater monitoring details are summarized in Table 7 below:

Table 7: Groundwater Monitoring Summary

Well ID	Sampling Depths (amsl)	Sampling Method	Parameters	Sampling Schedule
MW-11R MW-12R MW-13R MW-1R MW-14 MW-15 MW-16 MW-17 MW-18 MW-19 MW-20 MW-21 MW-22	Middle of Screen	LFPS	VOCs, pH, ORP, DO, Nitrate, Sulfate, Total Mn, Total Fe	Baseline, 8 weeks post-injection, then quarterly for up to 2 years or until AWQS achieved

Groundwater monitoring results will be evaluated using a multiple lines of evidence approach to assess treatment effectiveness. The data will inform the determination of eligibility for a Certificate of Completion (COC). If the treatment is found to be effective but AWQS are not fully achieved, a Track 2 COC will be pursued.

Ongoing groundwater monitoring, and if necessary, supplemental treatment will be conducted under a Site Management Plan (SMP). If AWQS are met within a five-year period, the Track 2 remedy will be converted to a Track 1 remedy.

4.0 GOVERNING DOCUMENTS AND OTHER CONSIDERATIONS

The monitoring well installation and injections activities are intrusive. The governing documents included with the June 2026 RAWP will be used during these activities. In particular, the

Community Air Monitoring Plan (CAMP) and Health and Safety Plan (HASP) will be adhered to during the well installations and groundwater injections. CAMP monitoring will be implemented using an upwind and downwind volatile organic compound and dust meter.

Materials used for injection will be stored in accordance with the manufacturer's recommendations (i.e., on pallets, in secure totes, etc.) and a material safety data sheet will be provided from the manufacturer prior to initiating work.

If there are any significant changes to the injection plan as result of the aquifer tests, the NYSDEC will be notified. Acknowledgement of these changes will be communicated prior to the initiation of the injection program.

Finally, the NYSDEC Project Manager will be notified at least one week prior to the implementation of the injection program

Figures

Category	Name	Well Dia (in)	Borehole Dia (in)	Slab EL. (ft)	Bottom EL. (ft)	Total Depth (ft. bgs)	Screen length (ft)
Monitoring	MW-1R	2	4	26.5	-25	51.5	10
Monitoring	MW-11R	2	4	29	-25	54	10
Monitoring	MW-12R	2	4	33	-25	58	10
Monitoring	MW-13R	2	3.75	29	-25	54	10
Monitoring	MW-14	2	4	28	-172	200	20
Monitoring	MW-15	2	4	33	-57	90	15
Monitoring	MW-16	2	4	33	-117	150	15
Monitoring	MW-17	2	4	29	-26	55	15
Monitoring	MW-18	2	4	29	-61	90	15
Monitoring	MW-19	2	4	29	-121	150	15
Monitoring	MW-20	2	4	29	-61	90	15
Monitoring	MW-21	2	4	29	-121	150	15
Monitoring	MW-22	2	4	33	-217	250	15
Injection	IW-1	NA*	4	29	-50	79	NA*
Injection	IW-2	NA*	4	27	-50	77	NA*
Injection	IW-3	NA*	4	32	-50	82	NA*
Injection	IW-4	NA*	4	29	-50	79	NA*
Injection	IW-A1	NA*	4	29	-50	79	NA*
Injection	IW-A2	NA*	4	29	-50	79	NA*
Injection	IW-A3	NA*	4	29	-50	79	NA*
Injection	IW-A4	NA*	4	29	-50	79	NA*
Injection	IW-B1	NA*	4	29	-50	79	NA*
Injection	IW-B2	NA*	2	29	-50	79	NA*
Injection	IW-B3	NA*	4	26.5	-50	76.5	NA*
Injection	IW-C1	NA*	4	33	-50	83	NA*
Injection	IW-C2	NA*	4	33	-50	83	NA*
Injection	IW-C3	NA*	4	33	-50	83	NA*

*: Well installed as an open bore hole

Well ID:	RI-MW1
Sample ID:	RI MW 1 (10-25)
Screen Interval:	10.0-25.0
Collection Date:	7/11/2022
PFAS (ng/L)	
PFOS	25.2
SVOC (ug/L)	
Benzo(a)anthracene	0.88 J
Benzo(a)pyrene	0.86 J
Benzo(b)fluoranthene	0.89 J
Benzo(k)fluoranthene	0.83 J
Chrysene	0.87 J
Indeno(1,2,3-cd)pyrene	0.85 J
Metals (ug/L) (ug/L)	
Iron, Total	3830
Magnesium, Total	49900
Manganese, Total	5295
Sodium, Total	319000

Well ID:	MW-19
Sample ID:	MW-19
Screen Interval:	135-150
Collection Date:	4/6/2026
PFAS (ng/L)	
PFOA	10.6
PFOS	11.0
VOC (ug/L)	
cis-1,2-Dichloroethene	12
Methyl Tert Butyl Ether	17
Tetrachloroethene	250
Trichloroethene	220
Metals (ug/L)	
Iron	2470
Manganese	857
Sodium	52600

Well ID:	MW-7D	MW-7D
Sample ID:	MW-7D	DUP 1
Screen Interval:	24-25	24-25
Collection Date:	4/4/2023	4/4/2023
VOC (ug/L)		
cis-1,2-Dichloroethene	54	55
Tetrachloroethene	3800	3400
Trichloroethene	520	500
Metals (ug/L)		
Iron, Total	691	555
Magnesium, Total	38500	35300
Manganese, Total	3586	3666
Sodium, Total	71600	74600

Well ID:	MW-17
Sample ID:	MW-17
Screen Interval:	135-150
Collection Date:	3/10/2026
PFAS (ng/L)	
PFOA	7.64
PFOS	4.55
VOC (ug/L)	
1,2-Dichloroethane	0.89 J
cis-1,2-Dichloroethene	19.6
Methyl Tert Butyl Ether	20
Tetrachloroethene	388
Trichloroethene	287
Metals (ug/L) (ug/L)	
Iron	5150
Manganese	623
Sodium	88500

Well ID:	MW-18
Sample ID:	MW-18
Screen Interval:	75-90
Collection Date:	3/30/2026
PFAS (ng/L)	
PFOA	7.25
PFOS	ND
VOC (ug/L)	
1,2-Dichloroethane	1.4
cis-1,2-Dichloroethene	20.5
Methyl Tert Butyl Ether	14
Tetrachloroethene	128
Trichloroethene	254
Metals (ug/L)	
Chromium	51.1
Iron	6950
Lead	33.9
Sodium	67100

Well ID:	MW-13DD	MW-13DD	MW-13DDR
Sample ID:	MW-13DD	MW-13DDI	MW-13DDRI
Screen Interval:	37.0	47.0	57.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	41	52	200
Tetrachloroethene	1600	1600	820
Trichloroethene	140	130	500
Acetone	200	190	170

Well ID:	MW-13D	MW-13DD	MW-13DDI
Sample ID:	MW-13DD	MW-13DDI	MW-13DDR
Screen Interval:	33.0	43.0	53.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
1,2-Dichloroethane	37	780	1500
Tetrachloroethene	35	1900	3.9 J
Trichloroethene	18	980	5.4
Vinyl chloride	0.24 J	9.8 J	180
1,2-Dichloroethene	ND	1.5 J	ND
Acetone	130	220	110

Well ID:	MW-20
Sample ID:	MW-20
Screen Interval:	75-90
Collection Date:	4/6/2026
PFAS (ng/L)	
PFOA	9.08
PFOS	8.25
VOC (ug/L)	
cis-1,2-Dichloroethene	36
Methyl Tert Butyl Ether	18
Tetrachloroethene	410
Trichloroethene	470
Metals (ug/L)	
Chromium	83
Iron	5520
Sodium	52900

Well ID:	RI-MW2
Sample ID:	RI-MW2 (5-15)
Screen Interval:	5.0-15.0
Collection Date:	7/11/2022
VOC (ug/L)	
cis-1,2-Dichloroethene	48 J
Tetrachloroethene	2800
Trichloroethene	470
PFAS (ng/L)	
PFOS	21.5
SVOC (ug/L)	
Benzo(b)fluoranthene	0.02 J
Benzo(k)fluoranthene	0.01 J
Chrysene	0.02 J
Metals (ug/L)	
Magnesium, Total	15200
Manganese, Total	2743
Sodium, Total	2910000

Well ID:	MW-13R
Sample ID:	MW-13R
Screen Interval:	44-54
Collection Date:	3/11/2026
PFAS (ng/L)	
PFOA	19.3
PFOS	18.3
VOC (ug/L)	
cis-1,2-Dichloroethene	198
Methyl Tert Butyl Ether	13.9
Tetrachloroethene	2370
Trichloroethene	896
Metals (ug/L) (ug/L)	
Iron	3990
Manganese	1930
Sodium	496000

Well ID:	MW-5
Sample ID:	MW-5
Screen Interval	10-15
Collection Date:	4/4/2023
VOC (ug/L)	
cis-1,2-Dichloroethene	8.3
Tetrachloroethene	470
Trichloroethene	92
SVOC (ug/L)	
Benzo(a)anthracene	0.83
Benzo(a)pyrene	0.83
Benzo(b)fluoranthene	0.84
Benzo(k)fluoranthene	0.82
Chrysene	0.83
Indeno(1,2,3-cd)pyrene	0.83
Metals (ug/L)	
Iron, Total	4380
Lead, Total	38.28
Manganese, Total	837.4
Sodium, Total	217000

Well ID:	MW-8D
Sample ID:	MW-8D
Screen Interval	23.5-28.5
Collection Date:	4/4/2023
VOC (ug/L)	
cis-1,2-Dichloroethene	25
Tetrachloroethene	1400
Trichloroethene	250
SVOC (ug/L)	
Benzo(a)anthracene	0.84
Benzo(a)pyrene	0.83
Benzo(b)fluoranthene	0.84
Benzo(k)fluoranthene	0.82
Chrysene	0.83
Indeno(1,2,3-cd)pyrene	0.83
Metals (ug/L)	
Iron, Total	2520
Manganese, Total	690.9
Sodium, Total	179000

Well ID:	MW-21	MW-21	MW-21
Sample ID:	MW-21	MW-21	MW-21
Screen Interval:	135-150	135-150	
Collection Date:	3/10/2026	3/30/2026	
PFAS (ng/L)			
PFOA	9.80	13.0	
PFOS	6.46	14	
VOC (ug/L)			
1,2-Dichloroethane	2.3 J	ND	
cis-1,2-Dichloroethene	42	43	
Methyl Tert Butyl Ether	13.8	24	
Tetrachloroethene	665	970	
Trichloroethene	614	730	
Metals (ug/L)			
Iron	9030	2520	
Sodium	79000	45000	

Well ID:	MW-14	MW-14
Sample ID:	MW-14	MW-14
Screen Interval:	185-200	185-200
Collection Date:	2/24/2025	3/11/2026
PFAS (ng/L)		
PFOA	7.99	23.9
PFOS	3.47	16
VOC (ug/L)		
Chloroform	38	ND
cis-1,2-Dichloroethene	0.72	1410
Tetrachloroethene	8.4	116
trans-1,2-Dichloroethene	ND	9.1 J
Trichloroethene	11	81.6
SVOC (ug/L)		
Benzo(a)anthracene	0.85	ND
Benzo(a)pyrene	0.85	ND
Benzo(b)fluoranthene	0.87	ND
Chrysene	0.85	ND
Indeno(1,2,3-cd)pyrene	0.85	ND
Metals (ug/L)		
Antimony, Total	3.15	<6.0
Iron, Total	4230	2150
Manganese, Total	97.37	594
Sodium, Total	48400	249000

Well ID:	MW-16
Sample ID:	MW-16
Screen Interval:	135-150
Collection Date:	3/30/2026
PFAS (ng/L)	
PFOA	18.6
PFOS	18.3
VOC (ug/L)	
cis-1,2-Dichloroethene	69
Methyl Tert Butyl Ether	21
Tetrachloroethene	1700
Trichloroethene	860
Metals (ug/L)	
Iron	2170
Manganese	1210
Sodium	58700

Well ID:	MW-15
Sample ID:	MW-15
Screen Interval:	75-90
Collection Date:	3/30/2026
PFAS (ng/L)	
PFOA	21
PFOS	22.6
VOC (ug/L)	
cis-1,2-Dichloroethene	44
Tetrachloroethene	2200
Trichloroethene	430
Metals (ug/L) (ug/L)	
Iron	8920
Manganese	1650
Sodium	55800

Well ID:	RI-MW3
Sample ID:	RI-MW3 (3-13)
Screen Interval:	3.0-12.0
Collection Date:	7/11/2022
VOC (ug/L)	
Tetrachloroethene	37
Trichloroethene	11
PFAS (ng/L)	
PFOS	11.7
Metals (ug/L)	
Sodium, Total	251000

Well ID:	MW-11D	MW-11D
Sample ID:	MW-11DI	MW-11DR
Screen Interval:	18.0	27.0
Collection Date:	11/8/2023	11/8/2023
VOC (ug/L)		
cis-1,2-Dichloroethene	38	720
Tetrachloroethene	150	68
Trichloroethene	62	81
Vinyl chloride	ND	4.2
Acetone	76	100

Well ID:	MW-12D	MW-12DI	MW-12DR
Sample ID:	MW-12DI	MW-12DII	MW-12DIII
Screen Interval:	33.0	43.0	53.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
cis-1,2-Dichloroethene	1700	1200	2000
Tetrachloroethene	700	1200	370
Trichloroethene	620	960	250
Acetone	110	62	110

Well ID:	MW-10D	MW-10DI	MW-10DR
Sample ID:	MW-10DI	MW-10DII	MW-10DIII
Screen Interval:	33.0	43.0	53.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
1,2,4,5-Tetramethylbenzene	16		
cis-1,2-Dichloroethene	13		
Naphthalene	12		
sec-Butylbenzene	7.7		
Vinyl chloride	5.4		
SVOC (ug/L)			
Benzo(a)anthracene	0.2		
Benzo(a)pyrene	0.16		
Benzo(b)fluoranthene	0.22		
Benzo(k)fluoranthene	0.08		
Chrysene	0.25		
Indeno(1,2,3-cd)pyrene	0.13		
Metals (ug/L)			
Iron, Total	8570		
Lead, Total	38.85		
Manganese, Total	3212		
Sodium, Total	158000		

Well ID:	MW-9D	MW-9DI	MW-9DR
Sample ID:	MW-9DI	MW-9DII	MW-9DIII
Screen Interval:	33.0	43.0	53.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
1,2-Dichloroethane	37	780	1500
Tetrachloroethene	35	1900	3.9 J
Trichloroethene	18	980	5.4
Vinyl chloride	0.24 J	9.8 J	180
1,2-Dichloroethene	ND	1.5 J	ND
Acetone	130	220	110

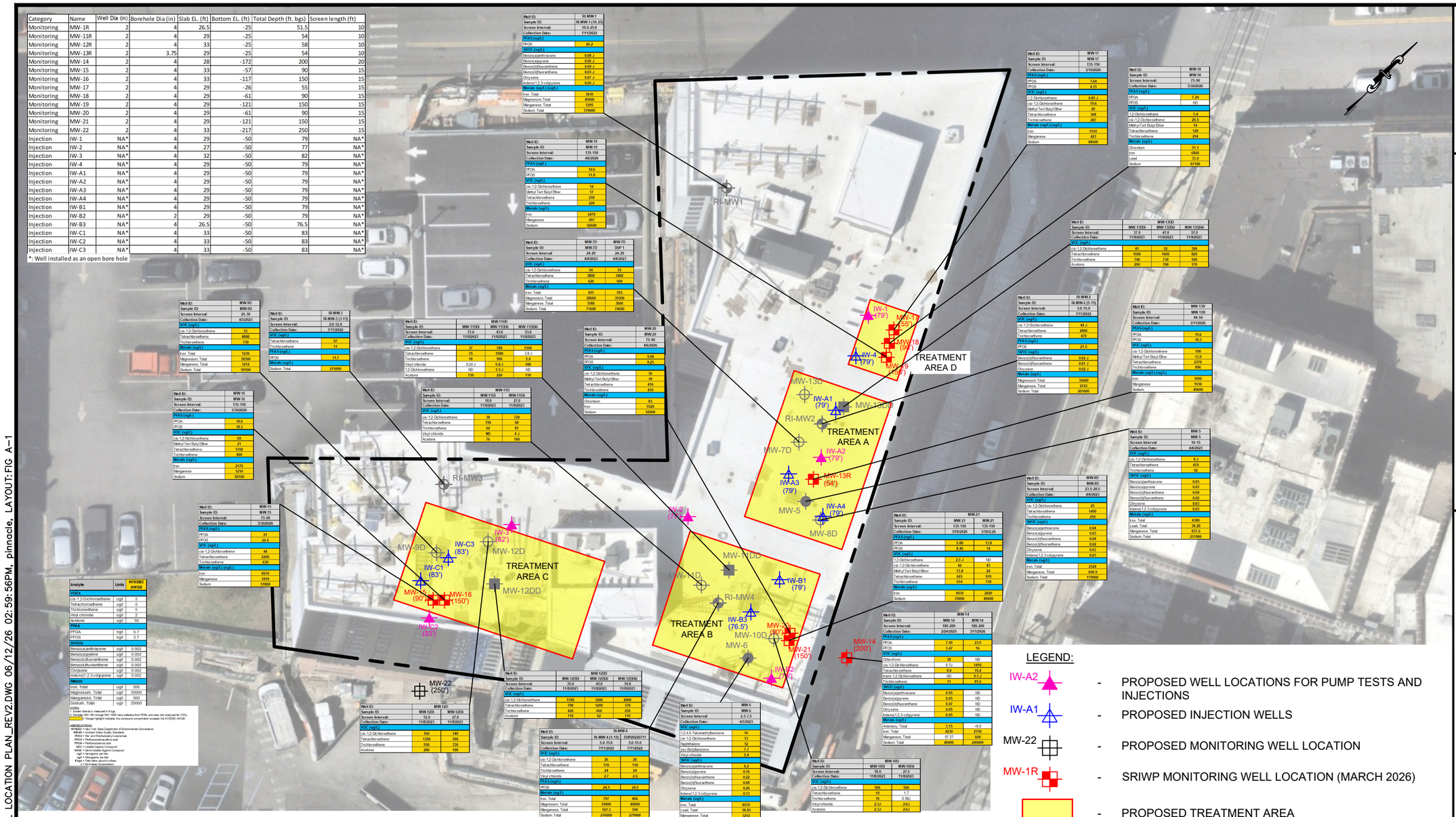
Well ID:	MW-10D	MW-10DI	MW-10DR
Sample ID:	MW-10DI	MW-10DII	MW-10DIII
Screen Interval:	33.0	43.0	53.0
Collection Date:	11/8/2023	11/8/2023	11/8/2023
VOC (ug/L)			
1,2,4,5-Tetramethylbenzene	16		
cis-1,2-Dichloroethene	13		
Naphthalene	12		
sec-Butylbenzene	7.7		
Vinyl chloride	5.4		
SVOC (ug/L)			
Benzo(a)anthracene	0.2		
Benzo(a)pyrene	0.16		
Benzo(b)fluoranthene	0.22		
Benzo(k)fluoranthene	0.08		
Chrysene	0.25		
Indeno(1,2,3-cd)pyrene	0.13		
Metals (ug/L)			
Iron, Total	8570		
Lead, Total	38.85		
Manganese, Total	3212		
Sodium, Total	158000		

Well ID:	MW-6
Sample ID:	MW-6
Screen Interval	2.5-7.5
Collection Date:	4/7/2023
VOC (ug/L)	
1,2,4,5-Tetramethylbenzene	16
cis-1,2-Dichloroethene	13
Naphthalene	12
sec-Butylbenzene	7.7
Vinyl chloride	5.4
SVOC (ug/L)	
Benzo(a)anthracene	0.2
Benzo(a)pyrene	0.16
Benzo(b)fluoranthene	0.22
Benzo(k)fluoranthene	0.08
Chrysene	0.25
Indeno(1,2,3-cd)pyrene	0.13
Metals (ug/L)	
Iron, Total	8570
Lead, Total	38.85
Manganese, Total	3212
Sodium, Total	158000

Well ID:	MW-22	MW-22
Sample ID:	MW-22	MW-22DI
Screen Interval:	12.0	27.0
Collection Date:	11/8/2023	11/8/2023
VOC (ug/L)		
cis-1,2-Dichloroethene	160	140
Tetrachloroethene	1300	500
Trichloroethene	550	330
Acetone	280	160

Well ID:	RI-MW4	
Sample ID:	RI-MW-4 (5-15)	DUP20220711
Screen Interval:	5.0-15.0	5.0-15.0
Collection Date:	7/11/2022	7/11/2022
VOC (ug/L)		
cis-1,2-Dichloroethene	26	26
Tetrachloroethene	110	110
Trichloroethene	24	24
Vinyl chloride	2.7	2.6
PFAS (ng/L)		
PFOS	24.5	24.5
Metals (ug/L)		
Iron, Total	797	806
Magnesium, Total	39400	40000
Manganese, Total	557.3	590
Sodium, Total	276000	279000

Well ID:	MW-10D	MW-10DI
Sample ID:	MW-10D	MW-10DI
Screen Interval:	135-150	135-150
Collection Date:	3/10/2026	3/10/2026
VOC (ug/L)		
cis-1,2-Dichloroethene	500	560
Tetrachloroethene	93	1.7
Trichloroethene	16	0.96 J
Vinyl chloride	2.3 J	2.6 J
Acetone	2.3 J	2.6 J



Analyte	Units	NYSDEC AWQS
VOCs		
cis-1,2-Dichloroethene	ug/l	5
Tetrachloroethene	ug/l	5
Trichloroethene	ug/l	5
Vinyl chloride	ug/l	2
Acetone	ug/l	50
PFAS		
PFOA	ng/l	6.7
PFOS	ng/l	2.7
SVOCs		
Benzo(a)anthracene	ug/l	0.002
Benzo(a)pyrene	ug/l	0.002
Benzo(b)fluoranthene	ug/l	0.002
Benzo(k)fluoranthene	ug/l	0.002
Chrysene	ug/l	0.002
Indeno(1,2,3-cd)pyrene	ug/l	0.002
Metals		
Iron, Total	ug/l	300
Magnesium, Total	ug/l	35000
Manganese, Total	ug/l	300
Sodium, Total	ug/l	20000

1. Screen interval is measured in ft bgs.
2. Samples MW-16D through MW-10DD were collected from PDBs and were only analyzed for VOCs.
Orange highlight indicates the compound concentration exceeds the NYSDEC AWQS.

ABBREVIATIONS:
NYSDEC = New York State Department of Environmental Conservation
AWQS = Ambient Water Quality Standards
PFAS = Per- and Polyfluoroalkyl Substances
PFOS = Perfluorooctanesulfonic acid
PFOA = Perfluorooctanoic acid
SVOC = Semi-Volatile Organic Compound
VOC = Semi-Volatile Organic Compound
ng/l = Nanograms per liter
ug/l = Micrograms per liter
ft bgs = Feet below ground surface
J = Estimated concentration

LEGEND:

- IW-A2 - PROPOSED WELL LOCATIONS FOR PUMP TESTS AND INJECTIONS
- IW-A1 - PROPOSED INJECTION WELLS
- MW-22 - PROPOSED MONITORING WELL LOCATION
- MW-1R - SRIWP MONITORING WELL LOCATION (MARCH 2026)
- PROPOSED TREATMENT AREA
- (200') - DEPTH OF WELL (FT. BGS)
- RI-MW1 - MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2022) (DECOMMISSIONED)
- MW-5 - MW-5 MONITORING WELL NUMBER & APPROX. LOCATION (MARCH 2023) (DECOMMISSIONED)
- MW-8D - MW-8D (28.5-30 ft bgs) MONITORING WELL NUMBER & APPROX. LOCATION (MARCH AND JULY 2023) (DECOMMISSIONED)
- MW-11DD - MW-1DD (55-59' bgs) MONITORING WELL NUMBER & APPROX. LOCATION (JULY 2023) (DECOMMISSIONED)

SCALE: 1"=30'

0 30 60

NYS Education Law

Unauthorized alterations or additions to this plan are a violation of section 7209 (2) of the New York State Education Law. Copies of this map not having the seal of the engineer shall not be valid.

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REFERENCE:

EXIST CONDITIONS & BOUNDARY ARE TAKEN FROM FOUNDATION PLAN PREPARED BY LESSARD DESIGN INC. P.C., DATED NOVEMBER 8, 2024.

dwg by: EC
chk by: SL
scale: AS NOTED
date: 06/11/26

SESI CONSULTING ENGINEERS
GEOTECHNICAL | ENVIRONMENTAL | SITE CIVIL
959 ROUTE 46E, 3RD FLOOR, PARSIPPANY, NJ 07054 PH: 973.808.9050

project: 146 WESTCHESTER AVENUE PORT CHESTER, NY

title: MONITORING WELL AND INJECTION WELL NETWORK PLAN

job no: 11895
drawing no: FIG A-1

1 of 1

N:\ACAD\11895\11895.DWG,INJ & MON WELL LOCATION PLAN_REV2.DWG 06/12/26 02:59:56PM, pinnacle, LAYOUT:FIG A–1

Attachment A:

Evonik Documents

GeoForm® Biogeochemical

EVONIK Leading Beyond Chemistry

Customer:	**SESI**		8-Apr-2026
Contact:	**Sheng Long**	**Prepared by:**	
Site Location:	**Port Chester, NY - MW-11 Area B**	**Fayaz Lakhwala PhD**	
Proposal Number:	**OPP26750**	**1-908-613-2443**	
Application Type:	**Source Zone Treatment**	**Fayaz.Lakhwala@evonik.com**	

GeoForm® Soluble Demand Calculations and Cost Estimate

Please find a reagent cost quotation below for the site and application referenced above. A product description, design assumptions, demand calculations and application guidelines are included as an appendix to this cost proposal.

Item	Quantity	Unit	Unit Price ($USD)	Cost in $USD (FOB Origin)
GeoForm® Soluble Mix	1,500	lbs	$5.50	$8,250
ELS® Liquid Concentrate	1,380	lbs	$3.10	$4,278
Evonik 5 micron ZVI (40% suspension)	500	lbs	$12.00	$6,000
Optional items:				
DHC Inoculum (incl. minimum)	18	L	$120	$2,160
Estimated Shipping[3]		per delivery		Not included
Estimated Taxes[2]				Not included
Estimated Total				**$20,688**

1) Price valid for 30 days from date at top of document. Terms: net 30 days. Prices are FOB Origin.

2) Please provide a copy of your tax exempt certificate or resale tax number when placing your order. In accordance with the law, applicable state and local taxes will be applied at the time of invoicing if Evonik has not been presented with your fully executed tax exemption documentation.

3) Price excludes shipping. Freight estimates available upon request. Volumes were rounded up based on container size.

4) Return Policy: Within 60 days of sale and following written approval by Evonik, products in their unopened containers, which by analysis meet the original specifications and are in the same condition as they were shipped, will be accepted for return at invoiced price, less a 25% handling charge and return freight paid by buyer. Products that are made to order or custom blended are non-returnable. Returned products that are not received back by Evonik in the same condition as they were shipped or that have been stored outside, may be subject to a higher restocking fees or no refund at all.

5) All sales are per Evonik's Terms and Conditions.

Disclaimer:

The estimated dosage and recommended application methodology described in this document are based on the site information provided to us, but are not meant to constitute a guaranty of performance or a predictor of the speed at which a given site is remediated. The calculations in the Cost Estimate regarding the amount of product to be used in your project are based on stoichiometry or default minimum guideline values, and do not take into account the kinetics, or speed of the reaction. Note that the Stoichiometric mass represents the minimum anticipated amount needed to address the contaminants of concern (COCs). As a result, these calculations should be used as a general approximation for purposes of an initial economic assessment. Evonik recommends that you or your consultants complete a comprehensive remedial design that takes into consideration the precise nature of the COC impact and actual site conditions.

PROPOSAL ATTACHMENTS

GEOFORM® SOLUBLE PRODUCT OVERVIEW

GeoForm® Biogeochemical Reagents are specifically designed to generate reactive iron sulfide minerals *in situ*. GeoForm® includes the key building blocks needed, including a source of sulfate, a source of ferrous iron and electron donor to establish sulfate reducing conditions. GeoForm® Soluble is fully soluble in water and is going to inject and distribute as a liquid, forming long lasting reactive solid minerals upon injection.



GeoForm® Soluble Mix

Packaging:

GeoForm® Soluble is delivered in 2 parts and mixed together with water in the field:

Part 1: GeoForm® Soluble Mix, a water soluble proprietary blend of ferrous iron, sulfate, pH buffer and other additives delivered in 50-lb/22-kg bags.

Part 2: Emulsified Lecithin Substrate, ELS®, available as either a Liquid Concentrate or 25% Liquid Microemulsion.



ELS® Liquid Concentrate and Microemulsion

SITE INFORMATION / DESIGN ASSUMPTIONS

Application type: Source Zone Treatment

Treatment Area Dimensions:	**Value**	**Unit**	**Comment**
Width of targeted zone (perpendicular to gw flow)	40	ft	customer supplied
Length of targeted zone (parallel to gw flow)	35	ft	customer supplied
Depth to top of treatment zone	2	ft bgs	customer supplied
Treatment zone thickness	75	ft	customer supplied
Treatment volume	105,000	ft3	calculated value
Total Porosity	5	%	default value
Groundwater volume	5,250	ft3	calculated value
Soil bulk density	100	lbs/ft3	default value
Soil mass	5,250	ton	calculated value
Transport characteristics:			
Treatment time / design life for one application	3	years	default value
Linear groundwater flow velocity	95	ft/year	calculated value
Effective porosity for groundwater flow	5	%	default value
Soil type	low permeability		customer supplied
Fraction organic carbon in soil, foc	0.010		estimated value

CONTAMINANTS OF CONCERN (COCs)

Contaminant	GW (mg/L)	Soil* (mg/kg)	Total COC Mass** (lb)
PCE	1.9	4.997	56.5
TCE	0.98	1.0486	13.1
DCE	0.72	0.432	6.1
VC	0.18	0.0045	0.4

*Unless provided, sorbed concentrations were roughly estimated based on expected groundwater concentrations, foc and Koc values. For a more refined estimate, it is recommended that actual values be verified via direct sampling of the targeted treatment interval.

**The total COC mass was estimated based on concentrations in soil and groundwater within the targeted area plus expected contributions from inflowing groundwater over the projected design life.

GEOCHEMICAL DATA

Competing Electron Acceptors	GW (mg/L)	
Dissolved oxygen	0	customer provided
Nitrate (as N)	0	customer provided
Anticipated bioavailable Mn(IV)*	3	default value
Anticipated bioavailable Fe(III)*	10	default value
Sulfate	0	customer provided

*An estimated projection of dissolved concentrations of Mn and Fe following ERD/ISCR were used to estimate H demand from the reduction of oxidized Fe and Mn minerals (typically only a portion of actual soil concentrations will be reduced).

ORP (mV)	NA
pH	NA

GEOFORM® DEMAND CALCULATIONS

GeoForm® Soluble Mix Dosing Calculation:

Target Concentration Sulfate in Groundwater*	1,000	mg/L
Background sulfate in Groundwater	0	mg/L
Target Sulfate Addition from GeoForm®	1,000	mg/L
Sulfate content in GeoForm® Soluble Mix	22.2	percent
Target Concentration GeoForm Soluble Mix in Groundwater	4,505	mg/L
Mass GeoForm® Soluble Mix Required	1,477	lbs

ELS® Concentrate Dosing Calculation:

H2 demand from COCs and non-target demand	4.6	lbs
H2 demand to reduce sulfate from GeoForm® addition	28	lbs
Total hydrogen demand	32	lbs
Specific H2 capacity of ELS® Concentrate	349	g H2/Kg
Minimum mass ELS® concentrate needed to meet H2 demand	92	lbs
Safety factor**	11	
Mass ELS® Concentrate (100% conc.)	983	lbs
Mass ELS® Microemulsion (25% conc.)	3,934	lbs

Volume GeoForm® Reagent & ELS® to Deliver Rounded Based on Selected Packaging Size & Concentration:

	Packaging	Mass per container (lbs)	Number of containers	Rounded volume (lbs)
GeoForm® Soluble Mix	Bags	50	30	1,500
ELS® Liquid Concentrate	50-gallon drum	460	3	1,380
Evonik 5 micron ZVI (40% suspension)	drum	1	500	500

*The target concentration sulfate to add to groundwater could be varied depending on baseline sulfate concentrations, the application type and the degree of geochemical vs. biological reaction desired.

**A safety factor is added to the volume hydrogen donor to account for inherent inefficiencies and to allow for continued rejuventaion of the the reduced mineral zone.

OPTIONAL DHC INOCULANT

Dehalococcoides sp (Dhc) are the only microorganisms demonstrated to completely degrade chlorinated ethenes to non-toxic end products (ethene). Dhc are also capable of degrading other chlorinated organics such as chlorinated ethanes. Bioaugmentation with a Dhc containing consortium is conducted during the substrate injection process, either as a discrete slug of the culture in anaerobic water or distributed through the entire injection solution immediately prior to injection. Dissolved oxygen and chlorine should be removed from the injection solution prior to adding the bioaugmentation culture. The Dhc inoculate will contain at least 1X10^11 cells per liter of Dhc. The recommended target concentration of Dhc in the treatment area is 1x10^7 cells per liter, however the application concentration can be modified based on site conditions (e.g., an existing Dhc population is present).

	Value	Unit
Dechlorinating consortium concentration in inoculant	1.00E+11	DHC/L
Design final concentration after dilution in aquifer	1.20E+07	DHC/L
Volume of Inoculant Required	18	L

ADDITIONAL pH BUFFER

GeoForm® Soluble Reagents includes pH buffers to help maintain the pH during tretament. However, if the groundwater pH is acidic at the baseline, additional pH buffers may be recommended to raise the pH to 7 in order to establish optimal conditions for biogeochemical treatment. The amount of buffer required to raise the pH of the groundwater to 7 will depend on the site-specific buffering capacity of the soil and will have to be determined by conducting a pH titration test.

	Value	Unit	
Baseline pH	NA	SI unit	
Type of pH buffer recommended	Not applicable		
Soil titration amount (if baseline pH needs adjustment only)	0.00	% by soil mass	estimated value
Estimated mass pH buffer to raise pH to 7	0	lbs	calculated value

INSTALLATION

To prepare the injection solution the GeoForm® Soluble Mix will be mixed with ELS® and water in the field. The GeoForm® Soluble Mix is delivered as a dry powder in 50-lb (22-kg) bags. ELS® is available either as a Liquid Microemulsion (25%) or Liquid concentrate (100%) in drums or totes, or as a Dry Concentrate in 44.1-lb (20-kg) boxes.

The GeoForm® solution could be injected via fixed wells or using direct push technology (DPT). The injection concentration / volume of water used to prepare the injection solution may be varied depending on the target injection volume / percent of the effective pore volume targeted for injection. Depending on the application method, between 10% and 100% of the effective porosity is typically targeted during liquid substrate injection, with a higher percent pore fill typically targeted during low-flow injections into wells and injection networks. This is in contrast to applications via DPT where typically around 10 to 25% of the effective pore volume is targeted. To facilitate the desired injection volume, the GeoForm® Soluble Reagents will be diluted with water in the field.

The injection spacing would be determined based on the radius of influence achieved for the specific implementation method and lithology.

Example Injection Design (can be altered):

Below is an example injection outline based on the site information provided. Note that the construction estimates presented below can be readily modified in the field or per recommendations from the injection contractor as required (for example, the concentration of the GeoForm solution could be changed to modify the total injection volume or the injections spacing could be altered based on installation technology and actual radius of influence).

	Value	Unit	Comment
Total mass GeoForm® Mix	1,500	lbs	calculated value
Total mass ELS® concentrate	1,380	lbs	calculated value
Evonik 5 micron ZVI (40% suspension)	500	lbs	calculated value
Percent of effective pore volume targeted for injection	20	%	can be altered
Total volume of water required	7,520	U.S. gallons	calculated value
Approximate volume of solution to inject	7,866	U.S. gallons	calculated value
Resulting GeoForm® Mix concentration in injection solution	2.3%		calculated value
Resulting ELS® concentration in injection solution	2.1%		calculated value
Injection spacing (grid)	20	ft	can be altered
Number of injection points required	4	locations	calculated value
Injection volume per point	1966	U.S. gallons	calculated value
Volume water per point	1880	U.S. gallons	calculated value
Mass GeoForm® Soluble Mix per point	375.0	lbs	calculated value
Mass ELS® concentrate per point	345.0	lbs	calculated value
Injection volume per vertical foot	26	U.S. gallons	calculated value

Review and follow guidance in the appropriate Safety Data Sheet (SDS) with all workers prior to use.

GeoForm® Biogeochemical

EVONIK Leading Beyond Chemistry

Customer:	**SESI**		8-Apr-2026
Contact:	**Sheng Long**	**Prepared by:**	
Site Location:	**Port Chester, NY - MW-12 Area C**	**Fayaz Lakhwala PhD**	
Proposal Number:	**OPP26750**	**1-908-613-2443**	
Application Type:	**Source Zone Treatment**	**Fayaz.Lakhwala@evonik.com**	

GeoForm® Soluble Demand Calculations and Cost Estimate

Please find a reagent cost quotation below for the site and application referenced above. A product description, design assumptions, demand calculations and application guidelines are included as an appendix to this cost proposal.

Item	Quantity	Unit	Unit Price ($USD)	Cost in $USD (FOB Origin)
GeoForm® Soluble Mix	1,500	lbs	$5.50	$8,250
ELS® Liquid Concentrate	1,380	lbs	$3.10	$4,278
Evonik 5 micron ZVI (40% suspension)	500	lbs	$12.00	$6,000
Optional items:				
DHC Inoculum (incl. minimum)	18	L	$120	$2,160
Estimated Shipping[3]		per delivery		Not included
Estimated Taxes[2]				Not included
Estimated Total				**$20,688**

1) Price valid for 30 days from date at top of document. Terms: net 30 days. Prices are FOB Origin.

2) Please provide a copy of your tax exempt certificate or resale tax number when placing your order. In accordance with the law, applicable state and local taxes will be applied at the time of invoicing if Evonik has not been presented with your fully executed tax exemption documentation.

3) Price excludes shipping. Freight estimates available upon request. Volumes were rounded up based on container size.

4) Return Policy: Within 60 days of sale and following written approval by Evonik, products in their unopened containers, which by analysis meet the original specifications and are in the same condition as they were shipped, will be accepted for return at invoiced price, less a 25% handling charge and return freight paid by buyer. Products that are made to order or custom blended are non-returnable. Returned products that are not received back by Evonik in the same condition as they were shipped or that have been stored outside, may be subject to a higher restocking fees or no refund at all.

5) All sales are per Evonik's Terms and Conditions.

Disclaimer:

The estimated dosage and recommended application methodology described in this document are based on the site information provided to us, but are not meant to constitute a guaranty of performance or a predictor of the speed at which a given site is remediated. The calculations in the Cost Estimate regarding the amount of product to be used in your project are based on stoichiometry or default minimum guideline values, and do not take into account the kinetics, or speed of the reaction. Note that the Stoichiometric mass represents the minimum anticipated amount needed to address the contaminants of concern (COCs). As a result, these calculations should be used as a general approximation for purposes of an initial economic assessment. Evonik recommends that you or your consultants complete a comprehensive remedial design that takes into consideration the precise nature of the COC impact and actual site conditions.

PROPOSAL ATTACHMENTS

GEOFORM® SOLUBLE PRODUCT OVERVIEW

GeoForm® Biogeochemical Reagents are specifically designed to generate reactive iron sulfide minerals *in situ* . GeoForm® includes the key building blocks needed, including a source of sulfate, a source of ferrous iron and electron donor to establish sulfate reducing conditions. GeoForm® Soluble is fully soluble in water and is going to inject and distribute as a liquid, forming long lasting reactive solid minerals upon injection.



GeoForm® Soluble Mix

Packaging:

GeoForm® Soluble is delivered in 2 parts and mixed together with water in the field:

Part 1: GeoForm® Soluble Mix, a water soluble proprietary blend of ferrous iron, sulfate, pH buffer and other additives delivered in 50-lb/22-kg bags.

Part 2: Emulsified Lecithin Substrate, ELS®, available as either a Liquid Concentrate or 25% Liquid Microemulsion.



ELS® Liquid Concentrate and Microemulsion

SITE INFORMATION / DESIGN ASSUMPTIONS

Application type: Source Zone Treatment

Treatment Area Dimensions:	**Value**	**Unit**	**Comment**
Width of targeted zone (perpendicular to gw flow)	55	ft	customer supplied
Length of targeted zone (parallel to gw flow)	30	ft	customer supplied
Depth to top of treatment zone	8	ft bgs	customer supplied
Treatment zone thickness	75	ft	customer supplied
Treatment volume	123,750	ft3	calculated value
Total Porosity	5	%	default value
Groundwater volume	6,188	ft3	calculated value
Soil bulk density	100	lbs/ft3	default value
Soil mass	6,188	ton	calculated value
Transport characteristics:			
Treatment time / design life for one application	3	years	default value
Linear groundwater flow velocity	95	ft/year	calculated value
Effective porosity for groundwater flow	5	%	default value
Soil type	low permeability		customer supplied
Fraction organic carbon in soil, foc	0.010		estimated value

CONTAMINANTS OF CONCERN (COCs)

Contaminant	GW (mg/L)	Soil* (mg/kg)	Total COC Mass** (lb)
PCE	4	10.52	141.5
TCE	0.73	0.7811	11.7
DCE	2	1.2	20.5

*Unless provided, sorbed concentrations were roughly estimated based on expected groundwater concentrations, foc and Koc values. For a more refined estimate, it is recommended that actual values be verified via direct sampling of the targeted treatment interval.

**The total COC mass was estimated based on concentrations in soil and groundwater within the targeted area plus expected contributions from inflowing groundwater over the projected design life.

GEOCHEMICAL DATA

Competing Electron Acceptors	GW (mg/L)	
Dissolved oxygen	0	customer provided
Nitrate (as N)	0	customer provided
Anticipated bioavailable Mn(IV)*	3	default value
Anticipated bioavailable Fe(III)*	10	default value
Sulfate	0	customer provided

*An estimated projection of dissolved concentrations of Mn and Fe following ERD/ISCR were used to estimate H demand from the reduction of oxidized Fe and Mn minerals (typically only a portion of actual soil concentrations will be reduced).

ORP (mV)	NA
pH	NA

GEOFORM® DEMAND CALCULATIONS

GeoForm® Soluble Mix Dosing Calculation:

Target Concentration Sulfate in Groundwater*	850	mg/L
Background sulfate in Groundwater	0	mg/L
Target Sulfate Addition from GeoForm®	850	mg/L
Sulfate content in GeoForm® Soluble Mix	22.2	percent
Target Concentration GeoForm Soluble Mix in Groundwater	3,829	mg/L
Mass GeoForm® Soluble Mix Required	1,479	lbs

ELS® Concentrate Dosing Calculation:

H2 demand from COCs and non-target demand	9.8	lbs
H2 demand to reduce sulfate from GeoForm® addition	28	lbs
Total hydrogen demand	37	lbs
Specific H2 capacity of ELS® Concentrate	349	g H2/Kg
Minimum mass ELS® concentrate needed to meet H2 demand	107	lbs
Safety factor**	10	
Mass ELS® Concentrate (100% conc.)	1,026	lbs
Mass ELS® Microemulsion (25% conc.)	4,102	lbs

Volume GeoForm® Reagent & ELS® to Deliver Rounded Based on Selected Packaging Size & Concentration:

	Packaging	Mass per container (lbs)	Number of containers	Rounded volume (lbs)
GeoForm® Soluble Mix	Bags	50	30	1,500
ELS® Liquid Concentrate	50-gallon drum	460	3	1,380
Evonik 5 micron ZVI (40% suspension)	drum	1	500	500

*The target concentration sulfate to add to groundwater could be varied depending on baseline sulfate concentrations, the application type and the degree of geochemical vs. biological reaction desired.

**A safety factor is added to the volume hydrogen donor to account for inherent inefficiencies and to allow for continued rejuventaion of the the reduced mineral zone.

OPTIONAL DHC INOCULANT

Dehalococcoides sp (Dhc) are the only microorganisms demonstrated to completely degrade chlorinated ethenes to non-toxic end products (ethene). Dhc are also capable of degrading other chlorinated organics such as chlorinated ethanes. Bioaugmentation with a Dhc containing consortium is conducted during the substrate injection process, either as a discrete slug of the culture in anaerobic water or distributed through the entire injection solution immediately prior to injection. Dissolved oxygen and chlorine should be removed from the injection solution prior to adding the bioaugmentation culture. The Dhc inoculate will contain at least 1X10^11 cells per liter of Dhc. The recommended target concentration of Dhc in the treatment area is 1x10^7 cells per liter, however the application concentration can be modified based on site conditions (e.g., an existing Dhc population is present).

	Value	Unit
Dechlorinating consortium concentration in inoculant	1.00E+11	DHC/L
Design final concentration after dilution in aquifer	1.00E+07	DHC/L
Volume of Inoculant Required	18	L

ADDITIONAL pH BUFFER

GeoForm® Soluble Reagents includes pH buffers to help maintain the pH during tretament. However, if the groundwater pH is acidic at the baseline, additional pH buffers may be recommended to raise the pH to 7 in order to establish optimal conditions for biogeochemical treatment. The amount of buffer required to raise the pH of the groundwater to 7 will depend on the site-specific buffering capacity of the soil and will have to be determined by conducting a pH titration test.

	Value	Unit	
Baseline pH	NA	SI unit	
Type of pH buffer recommended	Not applicable		
Soil titration amount (if baseline pH needs adjustment only)	0.00	% by soil mass	estimated value
Estimated mass pH buffer to raise pH to 7	0	lbs	calculated value

INSTALLATION

To prepare the injection solution the GeoForm® Soluble Mix will be mixed with ELS® and water in the field. The GeoForm® Soluble Mix is delivered as a dry powder in 50-lb (22-kg) bags. ELS® is available either as a Liquid Microemulsion (25%) or Liquid concentrate (100%) in drums or totes, or as a Dry Concentrate in 44.1-lb (20-kg) boxes.

The GeoForm® solution could be injected via fixed wells or using direct push technology (DPT). The injection concentration / volume of water used to prepare the injection solution may be varied depending on the target injection volume / percent of the effective pore volume targeted for injection. Depending on the application method, between 10% and 100% of the effective porosity is typically targeted during liquid substrate injection, with a higher percent pore fill typically targeted during low-flow injections into wells and injection networks. This is in contrast to applications via DPT where typically around 10 to 25% of the effective pore volume is targeted. To facilitate the desired injection volume, the GeoForm® Soluble Reagents will be diluted with water in the field.

The injection spacing would be determined based on the radius of influence achieved for the specific implementation method and lithology.

Example Injection Design (can be altered):

Below is an example injection outline based on the site information provided. Note that the construction estimates presented below can be readily modified in the field or per recommendations from the injection contractor as required (for example, the concentration of the GeoForm solution could be changed to modify the total injection volume or the injections spacing could be altered based on installation technology and actual radius of influence).

	Value	Unit	Comment
Total mass GeoForm® Mix	1,500	lbs	calculated value
Total mass ELS® concentrate	1,380	lbs	calculated value
Evonik 5 micron ZVI (40% suspension)	500	lbs	calculated value
Percent of effective pore volume targeted for injection	17	%	can be altered
Total volume of water required	7,520	U.S. gallons	calculated value
Approximate volume of solution to inject	7,866	U.S. gallons	calculated value
Resulting GeoForm® Mix concentration in injection solution	2.3%		calculated value
Resulting ELS® concentration in injection solution	2.1%		calculated value
Injection spacing (grid)	22	ft	can be altered
Number of injection points required	4	locations	calculated value
Injection volume per point	1966	U.S. gallons	calculated value
Volume water per point	1880	U.S. gallons	calculated value
Mass GeoForm® Soluble Mix per point	375.0	lbs	calculated value
Mass ELS® concentrate per point	345.0	lbs	calculated value
Injection volume per vertical foot	26	U.S. gallons	calculated value

Review and follow guidance in the appropriate Safety Data Sheet (SDS) with all workers prior to use.

GeoForm® Biogeochemical

EVONIK Leading Beyond Chemistry

Customer:	**SESI**		8-Apr-2026
Contact:	**Sheng Long**	**Prepared by:**	
Site Location:	**Port Chester, NY - MW-13 Area A**	**Fayaz Lakhwala PhD**	
Proposal Number:	**OPP26750**	**1-908-613-2443**	
Application Type:	**Source Zone Treatment**	**Fayaz.Lakhwala@evonik.com**	

GeoForm® Soluble Demand Calculations and Cost Estimate

Please find a reagent cost quotation below for the site and application referenced above. A product description, design assumptions, demand calculations and application guidelines are included as an appendix to this cost proposal.

Item	Quantity	Unit	Unit Price ($USD)	Cost in $USD (FOB Origin)
GeoForm® Soluble Mix	1,500	lbs	$5.50	$8,250
ELS® Liquid Concentrate	1,380	lbs	$3.10	$4,278
Evonik 5 micron ZVI (40% ZVI suspension)	500	lbs	$12.00	$6,000
Optional items:				
DHC Inoculum (incl. minimum)	18	L	$120	$2,160
Estimated Shipping[3]		per delivery		Not included
Estimated Taxes[2]				Not included
Estimated Total				**$20,688**

1) Price valid for 30 days from date at top of document. Terms: net 30 days. Prices are FOB Origin.

2) Please provide a copy of your tax exempt certificate or resale tax number when placing your order. In accordance with the law, applicable state and local taxes will be applied at the time of invoicing if Evonik has not been presented with your fully executed tax exemption documentation.

3) Price excludes shipping. Freight estimates available upon request. Volumes were rounded up based on container size.

4) Return Policy: Within 60 days of sale and following written approval by Evonik, products in their unopened containers, which by analysis meet the original specifications and are in the same condition as they were shipped, will be accepted for return at invoiced price, less a 25% handling charge and return freight paid by buyer. Products that are made to order or custom blended are non-returnable. Returned products that are not received back by Evonik in the same condition as they were shipped or that have been stored outside, may be subject to a higher restocking fees or no refund at all.

5) All sales are per Evonik's Terms and Conditions.

Disclaimer:

The estimated dosage and recommended application methodology described in this document are based on the site information provided to us, but are not meant to constitute a guaranty of performance or a predictor of the speed at which a given site is remediated. The calculations in the Cost Estimate regarding the amount of product to be used in your project are based on stoichiometry or default minimum guideline values, and do not take into account the kinetics, or speed of the reaction. Note that the Stoichiometric mass represents the minimum anticipated amount needed to address the contaminants of concern (COCs). As a result, these calculations should be used as a general approximation for purposes of an initial economic assessment. Evonik recommends that you or your consultants complete a comprehensive remedial design that takes into consideration the precise nature of the COC impact and actual site conditions.

PROPOSAL ATTACHMENTS

GEOFORM® SOLUBLE PRODUCT OVERVIEW

GeoForm® Biogeochemical Reagents are specifically designed to generate reactive iron sulfide minerals *in situ* . GeoForm® includes the key building blocks needed, including a source of sulfate, a source of ferrous iron and electron donor to establish sulfate reducing conditions. GeoForm® Soluble is fully soluble in water and is going to inject and distribute as a liquid, forming long lasting reactive solid minerals upon injection.



GeoForm® Soluble Mix

Packaging:

GeoForm® Soluble is delivered in 2 parts and mixed together with water in the field:

Part 1: GeoForm® Soluble Mix, a water soluble proprietary blend of ferrous iron, sulfate, pH buffer and other additives delivered in 50-lb/22-kg bags.

Part 2: Emulsified Lecithin Substrate, ELS®, available as either a Liquid Concentrate or 25% Liquid Microemulsion.



ELS® Liquid Concentrate and Microemulsion

SITE INFORMATION / DESIGN ASSUMPTIONS

Application type: Source Zone Treatment

Treatment Area Dimensions:	**Value**	**Unit**	**Comment**
Width of targeted zone (perpendicular to gw flow)	45	ft	customer supplied
Length of targeted zone (parallel to gw flow)	30	ft	customer supplied
Depth to top of treatment zone	8	ft bgs	customer supplied
Treatment zone thickness	75	ft	customer supplied
Treatment volume	101,250	ft3	calculated value
Total Porosity	5	%	default value
Groundwater volume	5,063	ft3	calculated value
Soil bulk density	100	lbs/ft3	default value
Soil mass	5,063	ton	calculated value
Transport characteristics:			
Treatment time / design life for one application	3	years	default value
Linear groundwater flow velocity	95	ft/year	calculated value
Effective porosity for groundwater flow	5	%	default value
Soil type	low permeability		customer supplied
Fraction organic carbon in soil, foc	0.010		estimated value

CONTAMINANTS OF CONCERN (COCs)

Contaminant	GW (mg/L)	Soil* (mg/kg)	Total COC Mass** (lb)
PCE	3.8	9.994	110.0
TCE	0.74	0.7918	9.7
DCE	0.3	0.18	2.5

*Unless provided, sorbed concentrations were roughly estimated based on expected groundwater concentrations, foc and Koc values. For a more refined estimate, it is recommended that actual values be verified via direct sampling of the targeted treatment interval.

**The total COC mass was estimated based on concentrations in soil and groundwater within the targeted area plus expected contributions from inflowing groundwater over the projected design life.

GEOCHEMICAL DATA

Competing Electron Acceptors	GW (mg/L)	
Dissolved oxygen	0	customer provided
Nitrate (as N)	0	customer provided
Anticipated bioavailable Mn(IV)*	3	default value
Anticipated bioavailable Fe(III)*	10	default value
Sulfate	0	customer provided

*An estimated projection of dissolved concentrations of Mn and Fe following ERD/ISCR were used to estimate H demand from the reduction of oxidized Fe and Mn minerals (typically only a portion of actual soil concentrations will be reduced).

ORP (mV)	NA
pH	NA

GEOFORM® DEMAND CALCULATIONS

GeoForm® Soluble Mix Dosing Calculation:

Target Concentration Sulfate in Groundwater*	1,050	mg/L
Background sulfate in Groundwater	0	mg/L
Target Sulfate Addition from GeoForm®	1,050	mg/L
Sulfate content in GeoForm® Soluble Mix	22.2	percent
Target Concentration GeoForm Soluble Mix in Groundwater	4,730	mg/L
Mass GeoForm® Soluble Mix Required	1,495	lbs

ELS® Concentrate Dosing Calculation:

H2 demand from COCs and non-target demand	7.1	lbs
H2 demand to reduce sulfate from GeoForm® addition	28	lbs
Total hydrogen demand	35	lbs
Specific H2 capacity of ELS® Concentrate	349	g H2/Kg
Minimum mass ELS® concentrate needed to meet H2 demand	100	lbs
Safety factor**	9	
Mass ELS® Concentrate (100% conc.)	948	lbs
Mass ELS® Microemulsion (25% conc.)	3,793	lbs

Volume GeoForm® Reagent & ELS® to Deliver Rounded Based on Selected Packaging Size & Concentration:

	Packaging	Mass per container (lbs)	Number of containers	Rounded volume (lbs)
GeoForm® Soluble Mix	Bags	50	30	1,500
ELS® Liquid Concentrate	50-gallon drum	460	3	1,380
Evonik 5 micron ZVI (40% ZVI suspension)	drum	500	1	500

*The target concentration sulfate to add to groundwater could be varied depending on baseline sulfate concentrations, the application type and the degree of geochemical vs. biological reaction desired.

**A safety factor is added to the volume hydrogen donor to account for inherent inefficiencies and to allow for continued rejuventaion of the the reduced mineral zone.

OPTIONAL DHC INOCULANT

Dehalococcoides sp (Dhc) are the only microorganisms demonstrated to completely degrade chlorinated ethenes to non-toxic end products (ethene). Dhc are also capable of degrading other chlorinated organics such as chlorinated ethanes. Bioaugmentation with a Dhc containing consortium is conducted during the substrate injection process, either as a discrete slug of the culture in anaerobic water or distributed through the entire injection solution immediately prior to injection. Dissolved oxygen and chlorine should be removed from the injection solution prior to adding the bioaugmentation culture. The Dhc inoculate will contain at least 1X10^11 cells per liter of Dhc. The recommended target concentration of Dhc in the treatment area is 1x10^7 cells per liter, however the application concentration can be modified based on site conditions (e.g., an existing Dhc population is present).

	Value	Unit
Dechlorinating consortium concentration in inoculant	1.00E+11	DHC/L
Design final concentration after dilution in aquifer	1.20E+07	DHC/L
Volume of Inoculant Required	18	L

ADDITIONAL pH BUFFER

GeoForm® Soluble Reagents includes pH buffers to help maintain the pH during tretament. However, if the groundwater pH is acidic at the baseline, additional pH buffers may be recommended to raise the pH to 7 in order to establish optimal conditions for biogeochemical treatment. The amount of buffer required to raise the pH of the groundwater to 7 will depend on the site-specific buffering capacity of the soil and will have to be determined by conducting a pH titration test.

	Value	Unit	
Baseline pH	NA	SI unit	
Type of pH buffer recommended	Not applicable		
Soil titration amount (if baseline pH needs adjustment only)	0.00	% by soil mass	estimated value
Estimated mass pH buffer to raise pH to 7	0	lbs	calculated value

INSTALLATION

To prepare the injection solution the GeoForm® Soluble Mix will be mixed with ELS® and water in the field. The GeoForm® Soluble Mix is delivered as a dry powder in 50-lb (22-kg) bags. ELS® is available either as a Liquid Microemulsion (25%) or Liquid concentrate (100%) in drums or totes, or as a Dry Concentrate in 44.1-lb (20-kg) boxes.

The GeoForm® solution could be injected via fixed wells or using direct push technology (DPT). The injection concentration / volume of water used to prepare the injection solution may be varied depending on the target injection volume / percent of the effective pore volume targeted for injection. Depending on the application method, between 10% and 100% of the effective porosity is typically targeted during liquid substrate injection, with a higher percent pore fill typically targeted during low-flow injections into wells and injection networks. This is in contrast to applications via DPT where typically around 10 to 25% of the effective pore volume is targeted. To facilitate the desired injection volume, the GeoForm® Soluble Reagents will be diluted with water in the field.

The injection spacing would be determined based on the radius of influence achieved for the specific implementation method and lithology.

Example Injection Design (can be altered):

Below is an example injection outline based on the site information provided. Note that the construction estimates presented below can be readily modified in the field or per recommendations from the injection contractor as required (for example, the concentration of the GeoForm solution could be changed to modify the total injection volume or the injections spacing could be altered based on installation technology and actual radius of influence).

	Value	Unit	Comment
Total mass GeoForm® Mix	1,500	lbs	calculated value
Total mass ELS® concentrate	1,380	lbs	calculated value
Total mass Evonik 5 micron ZVI	500	lbs	calculated value
Percent of effective pore volume targeted for injection	21	%	can be altered
Total volume of water required	7,520	U.S. gallons	calculated value
Approximate volume of solution to inject	7,865	U.S. gallons	calculated value
Resulting GeoForm® Mix concentration in injection solution	2.3%		calculated value
Resulting ELS® concentration in injection solution	2.1%		calculated value
Injection spacing (grid)	20	ft	can be altered
Number of injection points required	4	locations	calculated value
Injection volume per point	1966	U.S. gallons	calculated value
Volume water per point	1880	U.S. gallons	calculated value
Mass GeoForm® Soluble Mix per point	375.0	lbs	calculated value
Mass ELS® concentrate per point	345.0	lbs	calculated value
Injection volume per vertical foot	26	U.S. gallons	calculated value

Review and follow guidance in the appropriate Safety Data Sheet (SDS) with all workers prior to use.

GeoForm® Biogeochemical

EVONIK Leading Beyond Chemistry

Customer:	**SESI**		8-Apr-2026
Contact:	**Sheng Long**	**Prepared by:**	
Site Location:	**Port Chester, NY - MW-18 Area D**	**Fayaz Lakhwala PhD**	
Proposal Number:	**OPP26750**	**1-908-613-2443**	
Application Type:	**Source Zone Treatment**	**Fayaz.Lakhwala@evonik.com**	

GeoForm® Soluble Demand Calculations and Cost Estimate

Please find a reagent cost quotation below for the site and application referenced above. A product description, design assumptions, demand calculations and application guidelines are included as an appendix to this cost proposal.

Item	Quantity	Unit	Unit Price ($USD)	Cost in $USD (FOB Origin)
GeoForm® Soluble Mix	350	lbs	$5.50	$1,925
ELS® Liquid Concentrate	460	lbs	$3.10	$1,426
Evonik 5 micron ZVI (40% ZVI suspension)	500	lbs	$12.00	$6,000
Optional items:				
DHC Inoculum (incl. minimum)	0	L	$120	$0
Estimated Shipping[3]		per delivery		Not included
Estimated Taxes[2]				Not included
Estimated Total				**$9,351**

1) Price valid for 30 days from date at top of document. Terms: net 30 days. Prices are FOB Origin.

2) Please provide a copy of your tax exempt certificate or resale tax number when placing your order. In accordance with the law, applicable state and local taxes will be applied at the time of invoicing if Evonik has not been presented with your fully executed tax exemption documentation.

3) Price excludes shipping. Freight estimates available upon request. Volumes were rounded up based on container size.

4) Return Policy: Within 60 days of sale and following written approval by Evonik, products in their unopened containers, which by analysis meet the original specifications and are in the same condition as they were shipped, will be accepted for return at invoiced price, less a 25% handling charge and return freight paid by buyer. Products that are made to order or custom blended are non-returnable. Returned products that are not received back by Evonik in the same condition as they were shipped or that have been stored outside, may be subject to a higher restocking fees or no refund at all.

5) All sales are per Evonik's Terms and Conditions.

Disclaimer:

The estimated dosage and recommended application methodology described in this document are based on the site information provided to us, but are not meant to constitute a guaranty of performance or a predictor of the speed at which a given site is remediated. The calculations in the Cost Estimate regarding the amount of product to be used in your project are based on stoichiometry or default minimum guideline values, and do not take into account the kinetics, or speed of the reaction. Note that the Stoichiometric mass represents the minimum anticipated amount needed to address the contaminants of concern (COCs). As a result, these calculations should be used as a general approximation for purposes of an initial economic assessment. Evonik recommends that you or your consultants complete a comprehensive remedial design that takes into consideration the precise nature of the COC impact and actual site conditions.

PROPOSAL ATTACHMENTS

GEOFORM® SOLUBLE PRODUCT OVERVIEW

GeoForm® Biogeochemical Reagents are specifically designed to generate reactive iron sulfide minerals *in situ* . GeoForm® includes the key building blocks needed, including a source of sulfate, a source of ferrous iron and electron donor to establish sulfate reducing conditions. GeoForm® Soluble is fully soluble in water and is going to inject and distribute as a liquid, forming long lasting reactive solid minerals upon injection.



GeoForm® Soluble Mix

Packaging:

GeoForm® Soluble is delivered in 2 parts and mixed together with water in the field:

Part 1: GeoForm® Soluble Mix, a water soluble proprietary blend of ferrous iron, sulfate, pH buffer and other additives delivered in 50-lb/22-kg bags.

Part 2: Emulsified Lecithin Substrate, ELS®, available as either a Liquid Concentrate or 25% Liquid Microemulsion.



ELS® Liquid Concentrate and Microemulsion

SITE INFORMATION / DESIGN ASSUMPTIONS

Application type: Source Zone Treatment

Treatment Area Dimensions:	**Value**	**Unit**	**Comment**
Width of targeted zone (perpendicular to gw flow)	20	ft	customer supplied
Length of targeted zone (parallel to gw flow)	15	ft	customer supplied
Depth to top of treatment zone	5	ft bgs	customer supplied
Treatment zone thickness	74	ft	customer supplied
Treatment volume	22,200	ft3	calculated value
Total Porosity	5	%	default value
Groundwater volume	1,110	ft3	calculated value
Soil bulk density	100	lbs/ft3	default value
Soil mass	1,110	ton	calculated value
Transport characteristics:			
Treatment time / design life for one application	3	years	default value
Linear groundwater flow velocity	95	ft/year	calculated value
Effective porosity for groundwater flow	5	%	default value
Soil type	low permeability		customer supplied
Fraction organic carbon in soil, foc	0.010		estimated value

CONTAMINANTS OF CONCERN (COCs)

Contaminant	GW (mg/L)	Soil* (mg/kg)	Total COC Mass** (lb)
PCE	0.3	0.789	2.0
TCE	0.3	0.321	1.0
DCE	0.02	0.012	0.0

*Unless provided, sorbed concentrations were roughly estimated based on expected groundwater concentrations, foc and Koc values. For a more refined estimate, it is recommended that actual values be verified via direct sampling of the targeted treatment interval.

**The total COC mass was estimated based on concentrations in soil and groundwater within the targeted area plus expected contributions from inflowing groundwater over the projected design life.

GEOCHEMICAL DATA

Competing Electron Acceptors	GW (mg/L)	
Dissolved oxygen	0	customer provided
Nitrate (as N)	0	customer provided
Anticipated bioavailable Mn(IV)*	3	default value
Anticipated bioavailable Fe(III)*	10	default value
Sulfate	0	customer provided

*An estimated projection of dissolved concentrations of Mn and Fe following ERD/ISCR were used to estimate H demand from the reduction of oxidized Fe and Mn minerals (typically only a portion of actual soil concentrations will be reduced).

ORP (mV)	NA
pH	NA

GEOFORM® DEMAND CALCULATIONS

GeoForm® Soluble Mix Dosing Calculation:

Target Concentration Sulfate in Groundwater*	1,000	mg/L
Background sulfate in Groundwater	0	mg/L
Target Sulfate Addition from GeoForm®	1,000	mg/L
Sulfate content in GeoForm® Soluble Mix	22.2	percent
Target Concentration GeoForm Soluble Mix in Groundwater	4,505	mg/L
Mass GeoForm® Soluble Mix Required	312	lbs

ELS® Concentrate Dosing Calculation:

H2 demand from COCs and non-target demand	0.6	lbs
H2 demand to reduce sulfate from GeoForm® addition	6	lbs
Total hydrogen demand	6	lbs
Specific H2 capacity of ELS® Concentrate	349	g H2/Kg
Minimum mass ELS® concentrate needed to meet H2 demand	18	lbs
Safety factor**	11	
Mass ELS® Concentrate (100% conc.)	208	lbs
Mass ELS® Microemulsion (25% conc.)	832	lbs

Volume GeoForm® Reagent & ELS® to Deliver Rounded Based on Selected Packaging Size & Concentration:

	Packaging	Mass per container (lbs)	Number of containers	Rounded volume (lbs)
GeoForm® Soluble Mix	Bags	50	7	350
ELS® Liquid Concentrate	50-gallon drum	460	1	460
Evonik 5 micron ZVI (40% ZVI suspension)	drum	500	1	500

*The target concentration sulfate to add to groundwater could be varied depending on baseline sulfate concentrations, the application type and the degree of geochemical vs. biological reaction desired.

**A safety factor is added to the volume hydrogen donor to account for inherent inefficiencies and to allow for continued rejuventaion of the the reduced mineral zone.

OPTIONAL DHC INOCULANT

Dehalococcoides sp (Dhc) are the only microorganisms demonstrated to completely degrade chlorinated ethenes to non-toxic end products (ethene). Dhc are also capable of degrading other chlorinated organics such as chlorinated ethanes. Bioaugmentation with a Dhc containing consortium is conducted during the substrate injection process, either as a discrete slug of the culture in anaerobic water or distributed through the entire injection solution immediately prior to injection. Dissolved oxygen and chlorine should be removed from the injection solution prior to adding the bioaugmentation culture. The Dhc inoculate will contain at least 1X10^11 cells per liter of Dhc. The recommended target concentration of Dhc in the treatment area is 1x10^7 cells per liter, however the application concentration can be modified based on site conditions (e.g., an existing Dhc population is present).

	Value	Unit
Dechlorinating consortium concentration in inoculant	1.00E+11	DHC/L
Design final concentration after dilution in aquifer	0.00E+00	DHC/L
Volume of Inoculant Required	0	L

*Note: The minimum shipping volume is 15 L (one small keg) exceeds the calculated requirement and was therefore used in the above quotation.

ADDITIONAL pH BUFFER

GeoForm® Soluble Reagents includes pH buffers to help maintain the pH during tretament. However, if the groundwater pH is acidic at the baseline, additional pH buffers may be recommended to raise the pH to 7 in order to establish optimal conditions for biogeochemical treatment. The amount of buffer required to raise the pH of the groundwater to 7 will depend on the site-specific buffering capacity of the soil and will have to be determined by conducting a pH titration test.

	Value	Unit	
Baseline pH	NA	SI unit	
Type of pH buffer recommended	Not applicable		
Soil titration amount (if baseline pH needs adjustment only)	0.00	% by soil mass	estimated value
Estimated mass pH buffer to raise pH to 7	0	lbs	calculated value

INSTALLATION

To prepare the injection solution the GeoForm® Soluble Mix will be mixed with ELS® and water in the field. The GeoForm® Soluble Mix is delivered as a dry powder in 50-lb (22-kg) bags. ELS® is available either as a Liquid Microemulsion (25%) or Liquid concentrate (100%) in drums or totes, or as a Dry Concentrate in 44.1-lb (20-kg) boxes.

The GeoForm® solution could be injected via fixed wells or using direct push technology (DPT). The injection concentration / volume of water used to prepare the injection solution may be varied depending on the target injection volume / percent of the effective pore volume targeted for injection. Depending on the application method, between 10% and 100% of the effective porosity is typically targeted during liquid substrate injection, with a higher percent pore fill typically targeted during low-flow injections into wells and injection networks. This is in contrast to applications via DPT where typically around 10 to 25% of the effective pore volume is targeted. To facilitate the desired injection volume, the GeoForm® Soluble Reagents will be diluted with water in the field.

The injection spacing would be determined based on the radius of influence achieved for the specific implementation method and lithology.

Example Injection Design (can be altered):

Below is an example injection outline based on the site information provided. Note that the construction estimates presented below can be readily modified in the field or per recommendations from the injection contractor as required (for example, the concentration of the GeoForm solution could be changed to modify the total injection volume or the injections spacing could be altered based on installation technology and actual radius of influence).

	Value	Unit	Comment
Total mass GeoForm® Mix	350	lbs	calculated value
Total mass ELS® concentrate	460	lbs	calculated value
Total mass Evonik 5 micron ZVI	500	lbs	calculated value
Percent of effective pore volume targeted for injection	20	%	can be altered
Total volume of water required	1,600	U.S. gallons	calculated value
Approximate volume of solution to inject	1,697	U.S. gallons	calculated value
Resulting GeoForm® Mix concentration in injection solution	2.5%		calculated value
Resulting ELS® concentration in injection solution	3.3%		calculated value
Injection spacing (grid)	15	ft	can be altered
Number of injection points required	2	locations	calculated value
Injection volume per point	849	U.S. gallons	calculated value
Volume water per point	800	U.S. gallons	calculated value
Mass GeoForm® Soluble Mix per point	175.0	lbs	calculated value
Mass ELS® concentrate per point	230.0	lbs	calculated value
Injection volume per vertical foot	11	U.S. gallons	calculated value

Review and follow guidance in the appropriate Safety Data Sheet (SDS) with all workers prior to use.

Appendix B:

Citizen Participation Plan

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

Brownfield Cleanup Program

Citizen Participation Plan
for
Grand Union Hotel Bowling Alley Site
May 2022

Site #C360222
140 and 148-150 Westchester Avenue
Port Chester
Westchester County, New York 10573

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Note: The information presented in this Citizen Participation Plan was current as of the date of its approval by the New York State Department of Environmental Conservation. Portions of this Citizen Participation Plan may be revised during the site's investigation and cleanup process.

Applicant: **Port Chester OZ Fund III QOZB, LLC**
Site Name: **Grand Union Hotel Bowling Alley Site**
Site Address: **140 and 148-150 Westchester Avenue, Port Chester, NY**
Site County: **Westchester County**
Site Number: C360222

1. What is New York's Brownfield Cleanup Program?

New York's Brownfield Cleanup Program (BCP) works with private developers to encourage the voluntary cleanup of contaminated properties known as "brownfields" so that they can be reused and developed. These uses include recreation, housing, and business.

A *brownfield* is any real property that is difficult to reuse or redevelop because of the presence or potential presence of contamination. A brownfield typically is a former industrial or commercial property where operations may have resulted in environmental contamination. A brownfield can pose environmental, legal, and financial burdens on a community. If a brownfield is not addressed, it can reduce property values in the area and affect economic development of nearby properties.

The BCP is administered by the New York State Department of Environmental Conservation (NYSDEC) which oversees Applicants who conduct brownfield site investigation and cleanup activities. An Applicant is a person who has requested to participate in the BCP and has been accepted by NYSDEC. The BCP contains investigation and cleanup requirements, ensuring that cleanups protect public health and the environment. When NYSDEC certifies that these requirements have been met, the property can be reused or redeveloped for the intended use.

For more information about the BCP, go online at:
http://www.dec.ny.gov/chemical/8450.html .

2. Citizen Participation Activities

Why NYSDEC Involves the Public and Why It Is Important

NYSDEC involves the public to improve the process of investigating and cleaning up contaminated sites, and to enable citizens to participate more fully in decisions that affect their health, environment, and social well-being. NYSDEC provides opportunities for citizen involvement and encourages early two-way communication with citizens before decision makers form or adopt final positions.

Involving citizens affected and interested in site investigation and cleanup programs is important for many reasons. These include:

- Promoting the development of timely, effective site investigation and cleanup programs that protect public health and the environment

- Improving public access to, and understanding of, issues and information related to a particular site and that site's investigation and cleanup process

- Providing citizens with early and continuing opportunities to participate in NYSDEC's site investigation and cleanup process

- Ensuring that NYSDEC makes site investigation and cleanup decisions that benefit from input that reflects the interests and perspectives found within the affected community

- Encouraging dialogue to promote the exchange of information among the affected/interested public, State agencies, and other interested parties that strengthens trust among the parties, increases understanding of site and community issues and concerns, and improves decision making.

This Citizen Participation (CP) Plan provides information about how NYSDEC will inform and involve the public during the investigation and cleanup of the site identified above. The public information and involvement program will be carried out with assistance, as appropriate, from the Applicant.

Project Contacts

Appendix A identifies NYSDEC project contact(s) to whom the public should address questions or request information about the site's investigation and cleanup program. The public's suggestions about this CP Plan and the CP program for the site are always welcome. Interested people are encouraged to share their ideas and suggestions with the project contacts at any time.

Locations of Reports and Information

The locations of the reports and information related to the site's investigation and cleanup program also are identified in Appendix A. These locations provide convenient access to important project documents for public review and comment. Some documents may be placed on the NYSDEC web site. If this occurs, NYSDEC will inform the public in fact sheets distributed about the site and by other means, as appropriate.

Site Contact List

Appendix B contains the site contact list. This list has been developed to keep the community informed about, and involved in, the site's investigation and cleanup process. The site contact list will be used periodically to distribute fact sheets that provide updates about the status of the project. These will include notifications of upcoming activities at the site (such as fieldwork), as well as availability of project documents and announcements about public comment periods.
The site contact list includes, at a minimum:

- Chief executive officer and planning board chairperson of each county, city, town and village in which the site is located;
- Residents, owners, and occupants of the site and properties adjacent to the site;
- The public water supplier which services the area in which the site is located;
- Any person who has requested to be placed on the site contact list;
- The administrator of any school or day care facility located on or near the site for purposes of posting and/or dissemination of information at the facility;
- Location(s) of reports and information.

The site contact list will be reviewed periodically and updated as appropriate. Individuals and organizations will be added to the site contact list upon request. Such requests should be submitted to the NYSDEC project contact(s) identified in Appendix A. Other additions to the site contact list may be made at the discretion of the NYSDEC project manager, in consultation with other NYSDEC staff as appropriate.

Note: The first site fact sheet (usually related to the draft Remedial Investigation Work Plan) is distributed both by paper mailing through the postal service and through DEC Delivers, its email listserv service. The fact sheet includes instructions for signing up with the appropriate county listserv to receive future notifications about the site. See http://www.dec.ny.gov/chemical/61092.html .

Subsequent fact sheets about the site will be distributed exclusively through the listserv, except for households without internet access that have indicated the need to continue to receive site information in paper form. Please advise the NYSDEC site project manager identified in Appendix A if that is the case. Paper mailings may continue during the investigation and cleanup process for some sites, based on public interest and need.

CP Activities

The table at the end of this section identifies the CP activities, at a minimum, that have been and will be conducted during the site's investigation and cleanup program. The

flowchart in Appendix D shows how these CP activities integrate with the site investigation and cleanup process. The public is informed about these CP activities through fact sheets and notices distributed at significant points during the program. Elements of the investigation and cleanup process that match up with the CP activities are explained briefly in Section 5.

- **Notices and fact sheets** help the interested and affected public to understand contamination issues related to a site, and the nature and progress of efforts to investigate and clean up a site.

- **Public forums, comment periods and contact with project managers** provide opportunities for the public to contribute information, opinions and perspectives that have potential to influence decisions about a site's investigation and cleanup.

The public is encouraged to contact project staff at any time during the site's investigation and cleanup process with questions, comments, or requests for information.

This CP Plan may be revised due to changes in major issues of public concern identified in Section 3 or in the nature and scope of investigation and cleanup activities. Modifications may include additions to the site contact list and changes in planned citizen participation activities.

Technical Assistance Grant

NYSDEC must determine if the site poses a significant threat to public health or the environment. This determination generally is made using information developed during the investigation of the site, as described in Section 5.

If the site is determined to be a significant threat, a qualifying community group may apply for a Technical Assistance Grant (TAG). The purpose of a TAG is to provide funds to the qualifying group to obtain independent technical assistance. This assistance helps the TAG recipient to interpret and understand existing environmental information about the nature and extent of contamination related to the site and the development/implementation of a remedy.

An eligible community group must certify that its membership represents the interests of the community affected by the site, and that its members' health, economic well-being or enjoyment of the environment may be affected by a release or threatened release of contamination at the site.

The site is located in an Environmental Justice Area. Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color,

national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Environmental justice efforts focus on improving the environment in communities, specifically minority and low-income communities, and addressing disproportionate adverse environmental impacts that may exist in those communities.

The site includes a community with a sizable Hispanic-American population, therefore, all future fact sheets will be translated into Spanish.

As of the date the declaration (page 2) was signed by the NYSDEC project manager, the significant threat determination for the site had not yet been made.

To verify the significant threat status of the site, the interested public may contact the NYSDEC project manager identified in Appendix A.

For more information about TAGs, go online at
http://www.dec.ny.gov/regulations/2590.html

Note: The table identifying the citizen participation activities related to the site's investigation and cleanup program follows on the next page:

Citizen Participation Activities	Timing of CP Activity(ies)
Application Process:	
• Prepare site contact list • Establish document repository(ies)	At time of preparation of application to participate in the BCP.
• Publish notice in Environmental Notice Bulletin (ENB) announcing receipt of application and 30-day public comment period • Publish above ENB content in local newspaper • Mail above ENB content to site contact list • Conduct 30-day public comment period	When NYSDEC determines that BCP application is complete. The 30-day public comment period begins on date of publication of notice in ENB. End date of public comment period is as stated in ENB notice. Therefore, ENB notice, newspaper notice, and notice to the site contact list should be provided to the public at the same time.
After Execution of Brownfield Site Cleanup Agreement (BCA):	
• Prepare Citizen Participation (CP) Plan	Before start of Remedial Investigation **Note:** Applicant must submit CP Plan to NYSDEC for review and approval within 20 days of the effective date of the BCA.
Before NYSDEC Approves Remedial Investigation (RI) Work Plan:	
• Distribute fact sheet to site contact list about proposed RI activities and announcing 30-day public comment period about draft RI Work Plan	Before NYSDEC approves RI Work Plan. If RI Work Plan is submitted with application, public comment periods will be combined and public notice will include fact sheet. Thirty-day public comment period

Citizen Participation Activities	Timing of CP Activity(ies)
• Conduct 30-day public comment period	begins/ends as per dates identified in fact sheet.
After Applicant Completes Remedial Investigation:	
• Distribute fact sheet to site contact list that describes RI results	Before NYSDEC approves RI Report
Before NYSDEC Approves Remedial Work Plan (RWP):	
• Distribute fact sheet to site contact list about draft RWP and announcing 45-day public comment period • Public meeting by NYSDEC about proposed RWP (if requested by affected community or at discretion of NYSDEC project manager) • Conduct 45-day public comment period	Before NYSDEC approves RWP. Forty-five day public comment period begins/ends as per dates identified in fact sheet. Public meeting would be held within the 45-day public comment period.
Before Applicant Starts Cleanup Action:	
• Distribute fact sheet to site contact list that describes upcoming cleanup action	Before the start of cleanup action.
After Applicant Completes Cleanup Action:	
• Distribute fact sheet to site contact list that announces that cleanup action has been completed and that NYSDEC is reviewing the Final Engineering Report • Distribute fact sheet to site contact list announcing NYSDEC approval of Final Engineering Report and issuance of Certificate of Completion (COC)	At the time the cleanup action has been completed. **Note:** The two fact sheets are combined when possible if there is not a delay in issuing the COC.

3. Major Issues of Public Concern

This section of the CP Plan identifies major issues of public concern that relate to the site. Additional major issues of public concern may be identified during the course of the site's investigation and cleanup process.

There will be areas on the Site where soil excavation is necessary. Therefore, once the remediation commences, there may be concerns regarding odors, noise or truck traffic coming from the Site. However, these impacts will be mitigated through implementation of a Health and Safety Plan and Soil Management Plan approved by the Department, which will be designed to minimize these impacts. A Community Air Monitoring Plan (CAMP) will also be implemented to monitor dust and vapors to ensure the community is not impacted. CAMP implementation involves the placement of air monitoring stations downwind and upwind of where work is occurring to capture both dust and vapor emissions. If dust or emissions exceed a set threshold established by DEC and the Department of Health, then work must cease and the cause of the issue must be corrected before work can proceed.

4. Site Information

Appendix C contains a map identifying the location of the site.

Site Description

- **140 and 148-150 Westchester Avenue**
- **Setting – urban**
- **Site size – 0.449 acres**
- **Adjacent properties – residential, commercial**

History of Site Use, Investigation, and Cleanup

The Site consists of two lots with a different historic uses on each lot. In 1895, Lot 65 was occupied by Young's Hotel and Young's Livery. By 1902, a saloon and carriage house were added to the hotel. In 1908, the hotel building was occupied by the Grand Union Hotel. By 1915, another building was constructed behind the hotel, which was used as a hall and by 1918, the hall was also used as a bowling alley. The former hotel operations may have used dry cleaning solvents and the bowling alley may have also used solvents to clean the lanes because the Site's groundwater has fairly significant solvent related contamination. The former bowling alley was identified as a pool in maps from 1934. The lot appears to be in a similar configuration in maps from 1942, but the uses are not apparent. By 1950, the pool hall building was used as by the American Legion Club House. Aerial

photographs from 1966 through 1971 depict a clearing located behind two of the large buildings on Lot 65. By 1974, there are no longer buildings present on Lot 65 and by 1985 the lot was developed into a parking lot. Aerial photographs from 1991 through 1996 depict a parking lot with a patch of barren soil in the northeastern portion of the lot. The soil patch was present until approximately 2008 when it was covered by asphalt. Maps from 2011 until the present depict no significant changes from the 2008 map.

As of 1902, a tin smith shop had been present on Lot 17, which was replaced by a blacksmith shop. A carpet cleaning store replaced the blacksmith shop which by 1919 was back to being used as a tin shop. By 1934, the tin shop was no longer present but the site uses were not apparent from accessible historical records. These prior operations may have affected the soil and groundwater at the Site. From 1950's through the 1990's, the on-site buildings were used as stores. In 1994, one of the buildings contained apartments on the upper levels. Between 1995 and 2006 there were no significant changes in the lot configuration or lots uses.

In June 2021, a subsurface investigation of soil, soil vapor, and groundwater identified the contaminants of concern as Semi-Volatile Organic Compounds ("SVOCs"), metals and pesticides in soil, and Volatile Organic Compounds ("VOCs"), SVOCs, and metals in groundwater. The groundwater sample located in the vicinity of the former hotel/bowling alley/ paint shop/warehouse, exhibited the highest concentration of contaminants. Additional investigation was deemed warranted to determine the full extent of contamination at the Site.

5. Investigation and Cleanup Process

Application

The Applicant has applied for and been accepted into New York's Brownfield Cleanup Program as a Volunteer which means that the Applicant was not responsible for the disposal or discharge of the contaminants or whose ownership or operation of the site took place after the discharge or disposal of contaminants. The Volunteer must fully characterize the nature and extent of contamination onsite, and must conduct a "qualitative exposure assessment," a process that characterizes the actual or potential exposures of people, fish and wildlife to contaminants on the site and to contamination that has migrated from the site.

The Applicant in its Application proposes that the site will be used for unrestricted purposes.

To achieve this goal, the Applicant will conduct investigation activities at the site with

oversight provided by NYSDEC. The Brownfield Cleanup Agreement executed by NYSDEC and the Applicant sets forth the responsibilities of each party in conducting these activities at the site.

Investigation

The Applicant will conduct an investigation of the site officially called a “remedial investigation” (RI). This investigation will be performed with NYSDEC oversight. The Applicant must develop a remedial investigation workplan, which is subject to public comment.

The site investigation has several goals:

1) define the nature and extent of contamination in soil, surface water, groundwater and any other parts of the environment that may be affected;
2) identify the source(s) of the contamination;
3) assess the impact of the contamination on public health and the environment; and
4) provide information to support the development of a proposed remedy to address the contamination or the determination that cleanup is not necessary.

The Applicant has submitted a draft “Remedial Investigation Work Plan” to NYSDEC for review and approval. NYSDEC made the draft plan available to the public review during a 30-day public comment period which occurred from May 4th through June 3rd, 2022. However, the public can submit comments at any time.

When the investigation is complete, the Applicant will prepare and submit a report that summarizes the results. This report also will recommend whether cleanup action is needed to address site-related contamination. The investigation report is subject to review and approval by NYSDEC.

NYSDEC will use the information in the investigation report to determine if the site poses a significant threat to public health or the environment. If the site is a “significant threat,” it must be cleaned up using a remedy selected by NYSDEC from an analysis of alternatives prepared by the Applicant and approved by NYSDEC. If the site does not pose a significant threat, the Applicant may select the remedy from the approved analysis of alternatives.

Interim Remedial Measures

An Interim Remedial Measure (IRM) is an action that can be undertaken at a site when a source of contamination or exposure pathway can be effectively addressed before the site investigation and analysis of alternatives are completed. If an IRM is likely to represent all or a significant part of the final remedy, NYSDEC will require a 30-day

public comment period.

Remedy Selection

When the investigation of the site has been determined to be complete, the project likely would proceed in one of two directions:

1. The Applicant may recommend in its investigation report that no action is necessary at the site. In this case, NYSDEC would make the investigation report available for public comment for 45 days. NYSDEC then would complete its review, make any necessary revisions, and, if appropriate, approve the investigation report. NYSDEC would then issue a "Certificate of Completion" (described below) to the Applicant.

or

2. The Applicant may recommend in its investigation report that action needs to be taken to address site contamination. After NYSDEC approves the investigation report, the Applicant may then develop a cleanup plan, officially called a "Remedial Work Plan". The Remedial Work Plan describes the Applicant's proposed remedy for addressing contamination related to the site.

When the Applicant submits a draft Remedial Work Plan for approval, NYSDEC would announce the availability of the draft plan for public review during a 45-day public comment period.

Cleanup Action

NYSDEC will consider public comments, and revise the draft cleanup plan if necessary, before approving the proposed remedy. The New York State Department of Health (NYSDOH) must concur with the proposed remedy. After approval, the proposed remedy becomes the selected remedy. The selected remedy is formalized in the site Decision Document.

The Applicant may then design and perform the cleanup action to address the site contamination. NYSDEC and NYSDOH oversee the activities. When the Applicant completes cleanup activities, it will prepare a final engineering report that certifies that cleanup requirements have been achieved or will be achieved within a specific time frame. NYSDEC will review the report to be certain that the cleanup is protective of public health and the environment for the intended use of the site.

Certificate of Completion

When NYSDEC is satisfied that cleanup requirements have been achieved or will be

achieved for the site, it will approve the final engineering report. NYSDEC then will issue a Certificate of Completion (COC) to the Applicant. The COC states that cleanup goals have been achieved, and relieves the Applicant from future liability for site-related contamination, subject to certain conditions. The Applicant would be eligible to redevelop the site after it receives a COC.

Site Management

The purpose of site management is to ensure the safe reuse of the property if contamination will remain in place. Site management is the last phase of the site cleanup program. This phase begins when the COC is issued. Site management incorporates any institutional and engineering controls required to ensure that the remedy implemented for the site remains protective of public health and the environment. All significant activities are detailed in a Site Management Plan.

An *institutional control* is a non-physical restriction on use of the site, such as a deed restriction that would prevent or restrict certain uses of the property. An institutional control may be used when the cleanup action leaves some contamination that makes the site suitable for some, but not all uses.

An *engineering control* is a physical barrier or method to manage contamination. Examples include: caps, covers, barriers, fences, and treatment of water supplies.

Site management also may include the operation and maintenance of a component of the remedy, such as a system that pumps and treats groundwater. Site management continues until NYSDEC determines that it is no longer needed.

Appendix A -
Project Contacts and Locations of Reports and Information

Project Contacts

For information about the site's investigation and cleanup program, the public may contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC):

Greta White
Project Manager
NYSDEC
625 Broadway
Albany, NY 12233-7014
Greta.white@dec.ny.gov

New York State Department of Health (NYSDOH):

Steven Berninger
Project Manager
NYSDOH
Empire State Plaza
Corning Tower Room 1787
Albany, NY 12237
beei@health.ny.gov

Locations of Reports and Information

The facilities identified below are being used to provide the public with convenient access to important project documents:

Port Chester-Rye Brook Library
Robin Lettieri, Director
1 Haseco Avenue
Port Chester, New York 10573
(914) 939-6710

Hours:

Mon	9am-9pm
Tues	9am-8pm
Thurs-Sat	9am-5pm
Sunday	Closed

Appendix B - Site Contact List

Federal and State Officials		
Chuck E. Schumer U.S. Senate 780 Third Avenue, Suite 2301 New York, NY 10017	Kirsten Gillibrand U.S. Senate 780 Third Avenue, Suite 2601 New York, NY 10017	Shelley B. Mayer NYS Senate District 37 222 Grace Church Street, Suite 300 Port Chester, NY 10573
Mondaire Jones NYS House of Representative - 17th District 222 Mamaroneck Avenue, Suite 312 White Plains, NY 10605	Sarah Crowell NYS Department of Planning One Commerce Plaza, 99 Washington Ave, Suite 1010 Albany, NY 12231	George Latimer Westchester County Executive 148 Martine Avenue White Plains, NY 10601
Richard Hyman Westchester County Planning Board, Chair 148 Martine Avenue White Plains, NY 10601	Norm Rosenblum Town of Rye, Mayor 222 Grace Church Street, 3rd Floor Port Chester, NY 10573	Gary Zuckerman Supervisor for the Town of Rye 222 Grace Church Street, 3rd Floor Port Chester, NY 10573
Luis A. Marino Village of Port Chester, Mayor 222 Grace Church Street Port Chester, NY 10573	Michael Scarola Village of Port Chester Planning Commission, Chair 222 Grace Church Street, Suite 202 Port Chester, NY 10573	Steven Otis Assemblyman, District 91 222 Grace Church Street Port Chester, NY 10573
Media Outlets		
The Journal News Media Outlet 1133 Westchester Avenue, Suite N110 White Plains, NY 10601	News 12 Westchester News12wc@news12.com 6 Executive Plaza Yonkers, NY 10701	
Public Water Supplier		
United Water Westchester Rate 2 District Town of Rye Public Water Supplier 148 Martine Avenue White Plains, NY 10601		

Schools and Daycare Centers		
Jennifer Coggio Holy Rosary School, Assistant Principal 18 Central Avenue Port Chester, NY 10573	Judy Diaz John F. Kennedy Elementary School, Principal 40 Olivia Street Port Chester, NY 10573	Deirdre McDermott Corpus Christi-Holy Rosary School, Principal 135 South Regent Street Port Chester, NY 10573
Ivan Tolentino Thomas A. Edison School, Principal 132 Rectory Street Port Chester, NY 10573	Keith Allen Port Chester High School, Principal 1 Tamarack Road Port Chester, NY 10573	Marcela Arismendi Ladybug Family Daycare, Director 95 Grace Chruch Street Port Chester, NY 10573
Andrea Leite Tots Place, Director 8 Bent Avenue Port Chester, NY 10573	Marcela Arismendi Ladybug Family Preschool 141 William Street Port Chester, NY 10573	Maria Caballero Sunny Side Daycare Center 27 Smith Street Port Chester, NY 10573
Zolia M. Bravo Garzon Happy Corner Day Care Center Inc 80 South Regent Street Port Chester, NY 10573	Carolyn Kelly Port Chester Children's Place 400 Westchester Avenue Port Chester, NY 10573	Rosa Delgado Rossy's little Angels Family Day Care 43 Soundview Street Port Chester, NY 10573
Nidia Serrano Tater Tots Daycare 131 Neuton Avenue Port Chester, NY 10573	Lilliam Frias Lyon Park Daycare 21 Parkway Drive Port Chester, NY 10573	Adrian Veloz Uncle Luis Daycare 25 Parkway Drive Port Chester, NY 10573
Rosweny Hidalgo Preschool College Family Daycare 17 Edison Place, Apartment 1L Port Chester, NY 10573	Ilse Palacios Sweet Second Home Family Daycare 5 Brook Road Port Chester, NY 10573	
Adjacent Property Owners/Operators		
148-150 Westchester Avenue, LLC Site Owner (148-150 Westchester Avenue) 420 Westchester Avenue Port Chester, NY 10573	Keyman Locksmith LLC Site Operator (148-150 Westchester) 152 Westchester Avenue Port Chester, NY 10573	Dream Nail Salon Site Operator (144-150 Westchester) 148 Westchester Avenue Port Chester, NY 10573
140 Owners LLC Site Owner (140 Westchester Avenue)	11 South Pearl Street LLC Adjacent Property Owner of 11 Pearl Street	15 South Pearl Street Parking LLC

33 New Broad Street Port Chester, NY 10573	31 Pearl Street Port Chester, NY 10573	Adjacent Property Owner of Pearl Street 40 Pearl Street Port Chester, NY 10573
40 Pearl Street Inc. Adjacent Property Owner of 31 Pearl Street 31-37 Pearl Street Port Chester, NY 10573	Village of Port Chester Adjacent Property Owner of Village of Port Chester 222 Grace Street Port Chester, NY 10573	29 New Broad St. Realty Corp. Adjacent Property Owner of 29 New Broad Street 29 New Broad Street Port Chester, NY 10573
Church of the Living God Inc. Adjacent Property Owner of 9 New Broad Street 2 Poningo Street Port Chester, NY 10573	Port Chester Realty Inc. Adjacent Property Owner of 144-122 Westchester Avenue 282 Ridgeway White Plains, NY 10605	Metro Trans Authority Adjacent Property Owner of Broad Street 420 Lexington Avenue New York, NY 10017
DMMJ Realty Corp. Adjacent Property Owner of 143 Westchester Avenue 10 Broad Street Port Chester, NY 10573	Shree Laxmi Realty, Inc. Adjacent Property Owner of 145 Westchester Avenue 9 Amsterdam Avenue Bronxville, NY 10708	The Capitol Theatre LLC Adjacent Property Owner/Operator of 151 Westchester Avenue 104 West 29th Street, 11th Floor New York, NY 10001
Delia Enterprises Inc. Adjacent Property Owner of 153-157 Westchester Avenue 153 Westchester Avenue Port Chester, NY 10573	181 Westchester Ave LLC Adjacent Property Owner of 181 Westchester Avenue P.O. Box 1068 Larchmont, NY 10538	Adjacent Property Owner/Operator of 19 Smith Street 19 Smith Street Port Chester, NY 10573
Adjacent Property Owner of 10 Pearl Street 40 Pearl Street Port Chester, NY 10573	Island Park Auto Body Adjacent Property Operator of 29 New Broad Street 29 New Broad Street Port Chester, NY 10573	CK Trading Adjacent Property Operator of 144-122 Westchester Avenue 114 Westchester Avenue Port Chester, NY 10573
International Farm Convenience Store Adjacent Property Operator of 144-122 Westchester Avenue 116 Westchester Avenue Port Chester, NY 10573	Taqueria La Picardia Adjacent Property Operator of 144-122 Westchester Avenue 118 Westchester Avenue Port Chester, NY 10573	Number One Chinese Take Out Adjacent Property Operator of 144-122 Westchester Avenue Port Chester, NY 10573

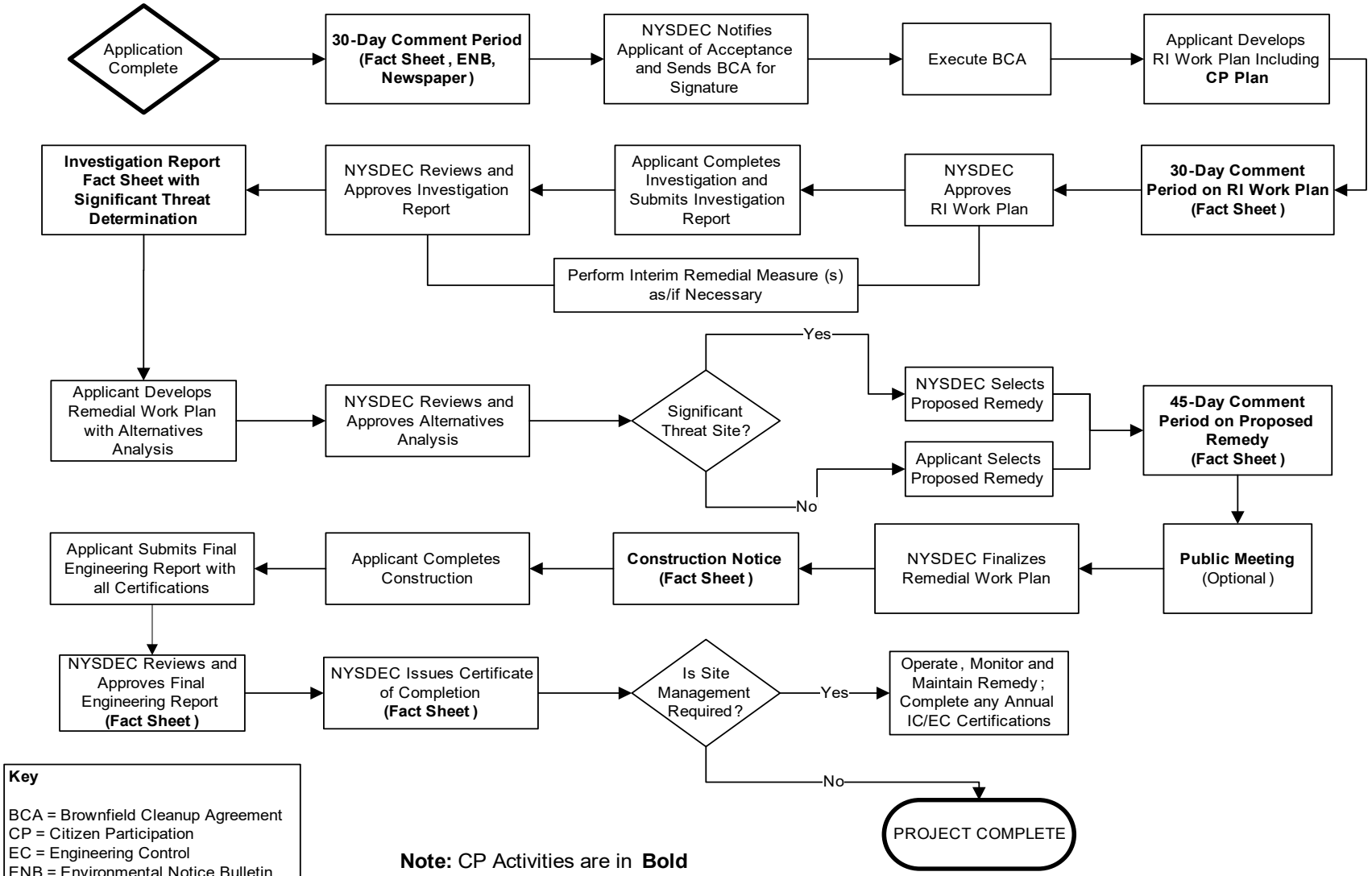
El Tio Adjacent Property Operator of 143 Westchester Avenue 143 Westchester Avenue Port Chester, NY 10573	Melissa Meat & Products Adjacent Property Operator of 153-157 Westchester Avenue 157 Westchester Avenue Port Chester, NY 10573	T&J Restaurant & Pizzeria Adjacent Property Operator of 10 Pearl Street 10 Pearl Street Port Chester, NY 10573
La Pupusa Loca Adjacent Property Operator of 181 Westchester Avenue 165 Westchester Avenue Port Chester, NY 10573	Panka Peruvian Bistro Adjacent Property Operator of 181 Westchester Avenue 167 Westchester Avenue Port Chester, NY 10573	Gentle Touch Laser 181 Westchester Avenue Port Chester, NY 10573
Inca & Gaucho Adjacent Property Operator of 181 Westchester Avenue 173 Westchester Avenue Port Chester, NY 10573	Upholstery & Carpet PC Adjacent Property Operator of 181 Westchester Avenue 6 Pearl Street Port Chester, NY 10573	Quality Ninety Nine Cents Store Adjacent Property Operator of 181 Westchester Avenue 193 Westchester Avenue Port Chester, NY 10573
La Marqueta Meat & Produce Adjacent Property Operator of 181 Westchester Avenue 197 Westchester Avenue Port Chester, NY 10573	Elissa Held Corporation Adjacent Property Operator of 181 Westchester Avenue 168 Irving Avenue, Suite 200a Port Chester, NY 10573	Eye and Candee Beauty Adjacent Property Operator of 181 Westchester Avenue 168 Irving Avenue Port Chester, NY 10573
Jamboree Juice Bar Adjacent Property Operator of 181 Westchester Avenue 168-B Irving Avenue, Suite 102a Port Chester, NY 10573	Whole Body Myofascial Adjacent Property Operator of 181 Westchester Avenue 168B Irving Avenue, Suite 203G Port Chester, NY 10573	Rolfs Elert Office Adjacent Property Operator of 181 Westchester Avenue 168B Irving Avenue, Suite 301 Port Chester, NY 10573
Westchester County Apostille Adjacent Property Operator of 181 Westchester Avenue 101 Westchester Avenue, 3rd Floor Port Chester, NY 10573	Kreations beauty Salon Adjacent Property Operator of 181 Westchester Avenue 189 Westchester Avenue Port Chester, NY 10573	Total Wireless Store Adjacent Property Operator of 181 Westchester Avenue 191 Westchester Avenue Port Chester, NY 10573
64 Solar	Colortone Audio Visual	

Adjacent Property Operator of 181 Westchester Avenue 181 Westchester Avenue Port Chester, NY 10573	Adjacent Property Operator of 181 Westchester Avenue 181 Westchester Avenue, Suite 408B Port Chester, NY 10573	

Appendix C - Site Location Map



Appendix D– Brownfield Cleanup Program Process



Key

BCA = Brownfield Cleanup Agreement
CP = Citizen Participation
EC = Engineering Control
ENB = Environmental Notice Bulletin
IC = Institutional Control
RI = Remedial Investigation

Note: CP Activities are in **Bold**

Division of Environmental Remediation

Remedial Programs
Scoping Sheet for Major Issues of Public Concern (see instructions)

Site Name: Grand Union Hotel Bowling Alley Site

Site Number: C360222

Site Address and County: 140 and 148-150 Westchester Ave., Port Chester, Westchester County

Remedial Party(ies): Port Chester OZ Fund III QOZB, LLC

Note: For Parts 1. – 3. the individuals, groups, organizations, businesses and units of government identified should be added to the site contact list as appropriate.

Part 1. List major issues of public concern and information the community wants. Identify individuals, groups, organizations, businesses and/or units of government related to the issue(s) and information needs.
The list of potential impacts contained in the CPP are typical impacts of remediation on brownfield sites

How were these issues and/or information needs identified?
See response above.

Part 2. List important information needed **from** the community, if applicable. Identify individuals, groups, organizations, businesses and/or units of government related to the information needed.
Nothing is needed from the community at this time

How were these information needs identified?
NA

Part 3. List major issues and information that need to be communicated **to** the community. Identify individuals, groups, organizations, businesses and/or units of government related to the issue(s) and/or information.
Communication of each step in the BCP process must be communicated in Fact Sheets and public hearings if required. Site-related documents will be provided in Spanish as well as English

How were these issues and/or information needs identified?
This is part of the CPP process

Part 4. Identify the following characteristics of the affected/interested community. This knowledge will help to identify and understand issues and information important to the community, and ways to effectively develop and implement the site citizen participation plan (mark all that apply):

a. Land use/zoning at and around site:
☒ **Residential** ☐ **Agricultural** ☐ **Recreational** ☒ **Commercial** ☐ **Industrial**

b. Residential type around site:
☒ **Urban** ☐ **Suburban** ☐ **Rural**

c. Population density around site:
☒ **High** ☐ **Medium** ☐ **Low**

d. Water supply of nearby residences:
☒ **Public** ☐ **Private Wells** ☐ **Mixed**

e. Is part or all of the water supply of the affected/interested community currently impacted by the site?
☐ **Yes** ☒ **No**

Provide details if appropriate:
Click here to enter text.

f. Other environmental issues significantly impacted/impacting the affected community?
☐ **Yes** ☒ **No**

Provide details if appropriate:
Click here to enter text.

g. Is the site and/or the affected/interested community wholly or partly in an Environmental Justice Area?
☒ **Yes** ☐ **No**

h. Special considerations:
☒ **Language** ☐ **Age** ☐ **Transportation** ☐ **Other**

Explain any marked categories in **h:**
Large Hispanic Population.

Part 5. The site contact list must include, at a minimum, the individuals, groups, and organizations identified in Part 2. of the Citizen Participation Plan under 'Site Contact List'. Are *other* individuals, groups, organizations, and units of government affected by, or interested in, the site, or its remedial program? (Mark and identify all that apply, then adjust the site contact list as appropriate.)

☐ **Non-Adjacent Residents/Property Owners:** Click here to enter text.

☐ **Local Officials:** Click here to enter text.

☐ **Media:** Click here to enter text.

☐ **Business/Commercial Interests:** Click here to enter text.

☐ **Labor Group(s)/Employees:** Click here to enter text.

☐ **Indian Nation:** Click here to enter text.

☐ **Citizens/Community Group(s):** Click here to enter text.

☐ **Environmental Justice Group(s):** Click here to enter text.

☐ **Environmental Group(s):** Click here to enter text.

☐ **Civic Group(s):** Click here to enter text.

☐ **Recreational Group(s):** Click here to enter text.

☐ **Other(s):** Click here to enter text.

Prepared/Updated By: Linda R. Shaw, Esq. **Date:** June 7, 2022

Reviewed Approved By: Click here to enter text. **Date:** Click here to enter text.

Appendix C:

Environmental Footprint Analysis

SESI
CONSULTING ENGINEERS

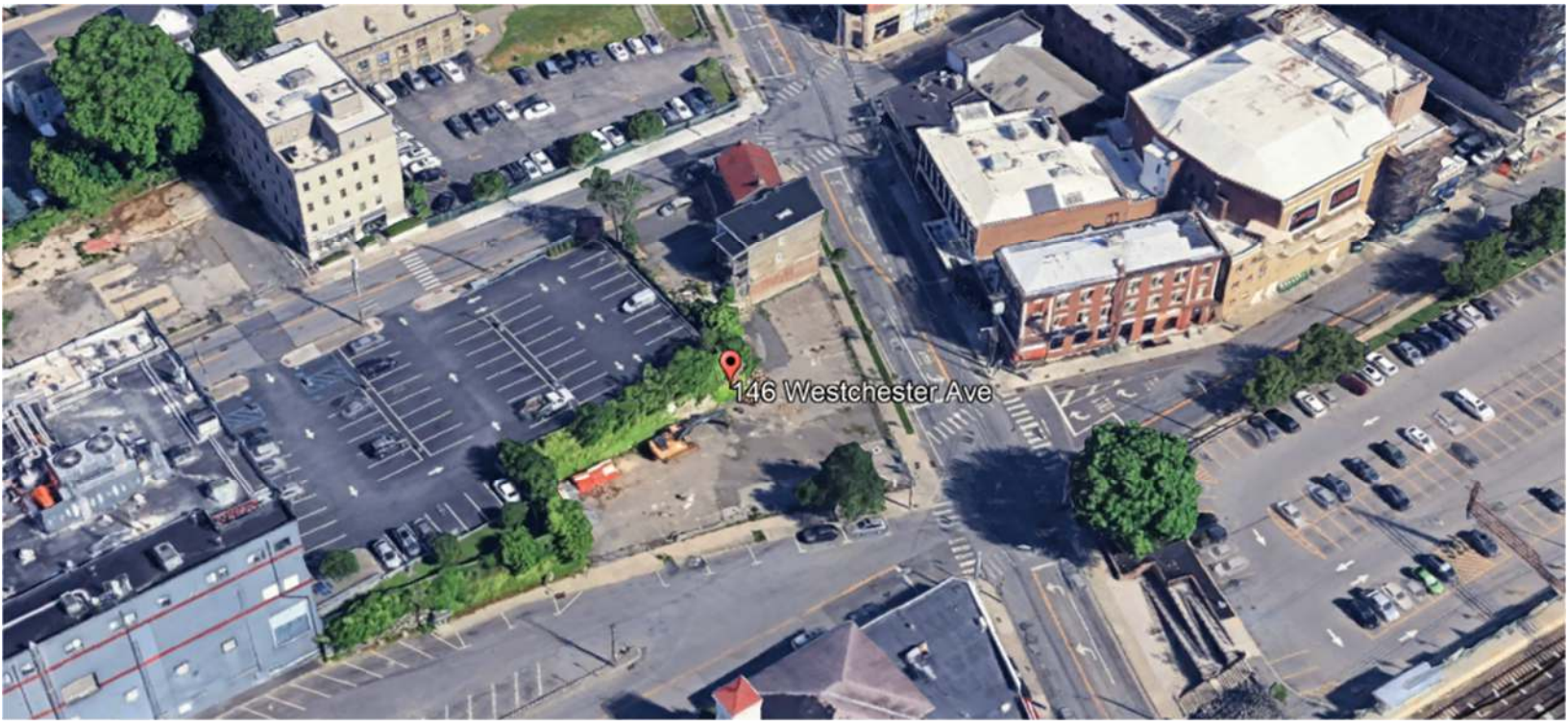
Geotechnical
Environmental
Site Civil

959 Route 46E, Fl 3, Ste 300
Parsippany, NJ 07054
973.808.9050
www.sesi.org

Remedial Action Work Plan
Environmental Footprint Analysis

For:

Grand Union Hotel Bowling Alley Site
146 Westchester Avenue
Port Chester, Westchester County, NY
BCP No. C360222



Prepared for:

Port Chester OZ Fund III QOZB, LLC
June 2026

SESI Contact:
Sheng Long
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11895A

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1.0 PURPOSE

This environmental footprint analysis (EFA) serves to quantitatively evaluate the potential environmental and social impacts, specifically accident risks, associated with the Remedial Action Work Plan (RAWP). This sustainability assessment utilized SiteWise version 3.2 (NAVFAC 2018), a specialized tool designed to measure various quantifiable sustainability metrics.

SiteWise operates through a series of Excel sheets, generating a detailed baseline assessment of sustainability metrics. These include greenhouse gases (GHGs), energy consumption, electricity usage from both renewable and non-renewable sources, criteria air pollutants such as sulfur oxides (SO_x), oxides of nitrogen (NO_x), and particulate matter (PM_{10}), water usage, resource consumption, and accident risk. The analysis considers several key inputs: (1) the production of all necessary materials for SMP activities; (2) the transportation of these materials, equipment, and personnel to and from the site; (3) all on-site activities, including equipment operation; and (4) the comprehensive management of waste generated by these activities. The quantitative metrics reported include GHGs in metric tons of carbon dioxide equivalents (CO_2e), water usage in gallons, energy usage in millions of British thermal units (MMBTU), criteria air pollutants in metric tons, and accident risk (risk of injury and fatality).

To ensure relevance, the sustainability footprint assessment for the RAWP focused exclusively on elements with significant sustainability impacts, with a lower footprint indicating reduced negative effects on environmental and social metrics. The primary activities evaluated encompassed material production, transportation of personnel and equipment, equipment use for monitoring well installation and injection, groundwater monitoring, and on-site labor hours to estimate accident risks during these operations. It is important to note that SiteWise calculates these footprints using industry averages, published emission factors, and generalized data sources, meaning the results may not precisely reflect actual emissions but are valuable for comparative analysis.

The assumptions used for the SiteWise evaluation are as follows:

- The environmental footprint for production of the equipment used, or the production of vehicles used for transportation, is not considered.
- Water use for consumable manufacturing is not included in this analysis. Therefore, the water use for the associated activities may be underestimated.
- Small amounts of clean deionized water (less than two [2] gallons per quarter) may be used for cleaning dedicated sampling equipment.
- Site monitoring will not disturb the land and/or ecosystems.

Note that SiteWise calculates environmental and risk footprints based on industry averages, published emissions factors and generalized data sources. The footprint results may not be representative of actual emissions and may only be used for comparative purposes only.

2.0 RESULTS AND CONCLUSIONS

The quantitative assessment of the potential environmental impact and social impact (accident risks) of RAWP activities is summarized in **Table 1** and **Chart 1** through **8**. **Table 1** presents the environmental footprint summary of remedial activities. Greenhouse gas (GHG) emissions are primarily associated with material production, which accounts for approximately 64.60% of the total project GHG emissions, followed by equipment use and miscellaneous activities (19.23%) and personnel transportation (14.34%). Energy consumption is also dominated by material

production, representing approximately 99.00% of the total project energy demand, reflecting the embodied energy required for manufacturing remedial materials.

All onsite NOx, SOx, and PM10 emissions are generated by equipment use and miscellaneous activities, accounting for 100% of onsite emissions of these pollutants due to the operation of construction equipment and other field activities. When considering total life-cycle emissions, equipment use and miscellaneous activities remain the largest contributor to NOx emissions (73.44%) and PM10 emissions (64.05%), while material production contributes the majority of SOx emissions (74.06%) due to upstream manufacturing processes.

The project's water consumption is entirely associated with equipment use and miscellaneous activities, accounting for 100% of total water usage. Similarly, all electrical consumption is attributed to equipment operation during field implementation.

The social impact assessment indicates that personnel transportation contributes the largest share of fatality risk (59.50%), while equipment use and miscellaneous activities account for the majority of injury risk (66.92%), reflecting the inherent occupational hazards associated with field equipment operation and construction activities.

Overall, the results indicate that material production represents the largest contributor to the project's overall GHG emissions and energy consumption, whereas equipment use and miscellaneous activities are the dominant contributors to onsite air emissions, water use, electricity consumption, NOx and PM10 emissions, and injury risk. Consequently, optimization of material selection and reduction of equipment operating time would provide the greatest opportunity to reduce the overall environmental footprint of the proposed remedial action.

Should the efforts reveal contaminant concentrations that require further evaluation, this phase will collect the necessary information to inform potential treatment and/or control measures in subsequent stages. This thorough investigative approach, which includes defining the scope and parameters of potential contamination, inherently aligns with Green Remediation principles by ensuring that future remedial actions are precisely targeted and optimized, thereby minimizing the overall environmental footprint and resource expenditure in the long term.

Table 1: Environmental Footprint Summary

Activities	CO_2 Emissions	Percent Total	Onsite NOx emissions	Percent Total	Onsite SOx Emissions	Percent Total	Onsite PM_{10} Emissions	Percent Total	Total NOx emissions	Percent Total	Total SOx Emissions	Percent Total
	metric ton	%	metric ton	%	metric ton	%	metric ton	%	metric ton	%	metric ton	%
Material Productions	870.27	64.60	NA	-	NA	-	NA	-	8.2E-01	24.1	9.1E-01	74.1
Transportation-Personnel	193.17	14.34	NA	-	NA	-	NA	-	7.7E-02	2.3	2.5E-03	0.2
Transportation-Equip/materials	12.69	0.94	NA	-	NA	-	NA	-	4.0E-03	0.1	7.1E-05	0.0
Equipment Use and Misc	259.06	19.23	2.3E+00	100.0	2.4E-01	100.0	2.9E-01	100.0	2.5E+00	73.4	3.2E-01	25.7
Residual Handling	12.00	0.89	0.0E+00	-	0.0E+00	-	0.0E+00	-	3.8E-03	0.1	1.1E-04	0.0
Total	1,347.20	100	2.35E+00	100.0	2.41E-01	100	2.92E-01	100	3.39E+00	100	1.22E+00	100

Activities	Total PM_{10} Emissions	Percent Total	Total Energy Used	Total Energy used	Percent Total	Accident Risk Fatality	Percent Total	Accident Risk Injury	Percent Total	Water Usage	Percent Total	Electrical Usage	Lost Hours - Injury	Percent Total
	metric ton	%	MMBTU	MWH	%		%		%	gallons	%	MWH		%
Material Productions	1.6E-01	33.2	5.8E+05	NA	99.00	NA	NA	NA	NA	NA	NA	NA	NA	NA
Transportation-Personnel	1.3E-02	2.6	2.4E+03	NA	0.4	6.5E-03	59.5	5.2E-01	32.4	NA	NA	NA	4.2E+00	32.4
Transportation-Equip/materials	3.5E-04	0.1	1.7E+02	NA	0.0	6.6E-05	0.6	5.3E-03	0.3	NA	NA	NA	4.2E-02	0.3
Equipment Use and Misc	3.1E-01	64.0	3.1E+03	1.4E-03	0.5	4.3E-03	39.3	1.1E+00	66.9	3000084.77	100.00	1.66E-01	8.7E+00	66.9
Residual Handling	3.2E-04	0.1	1.6E+02	NA	0.0	6.6E-05	0.6	5.3E-03	0.3	NA	NA	NA	4.2E-02	0.3
Total	4.90E-01	100	5.91E+05	1.39E-03	100	1.1E-02	100	1.6E+00	100	3.00E+06	100	1.66E-01	1.29E+01	100.0

Chart 1: GHG Emissions

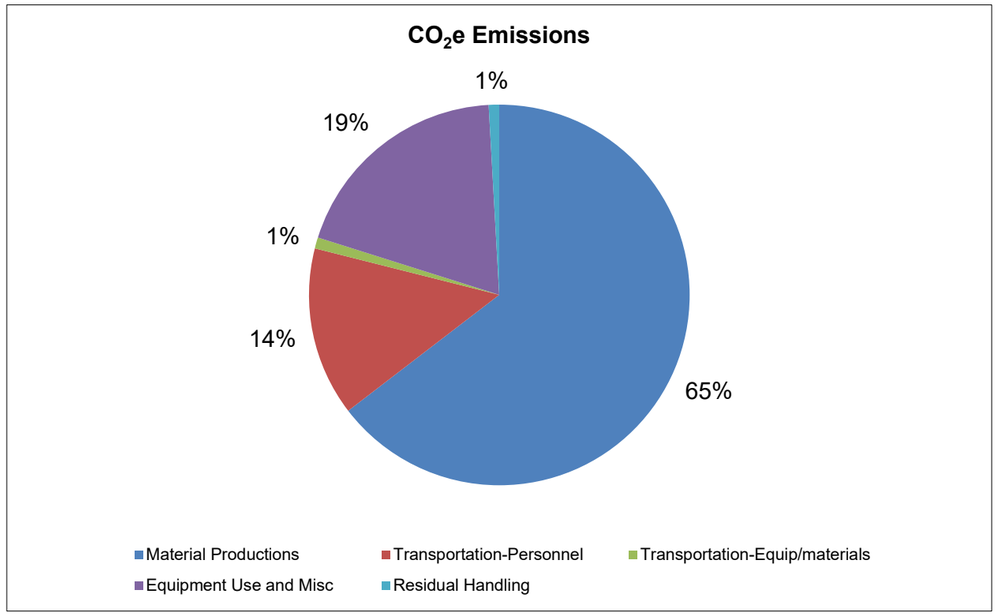


Chart 2: Total Energy Used

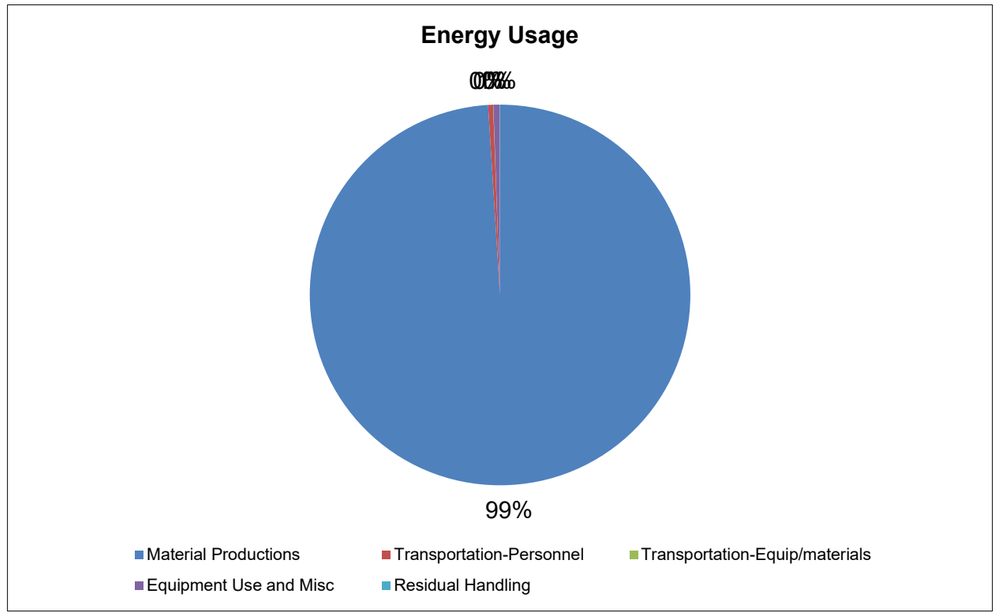


Chart 3: Total NO_x Emissions

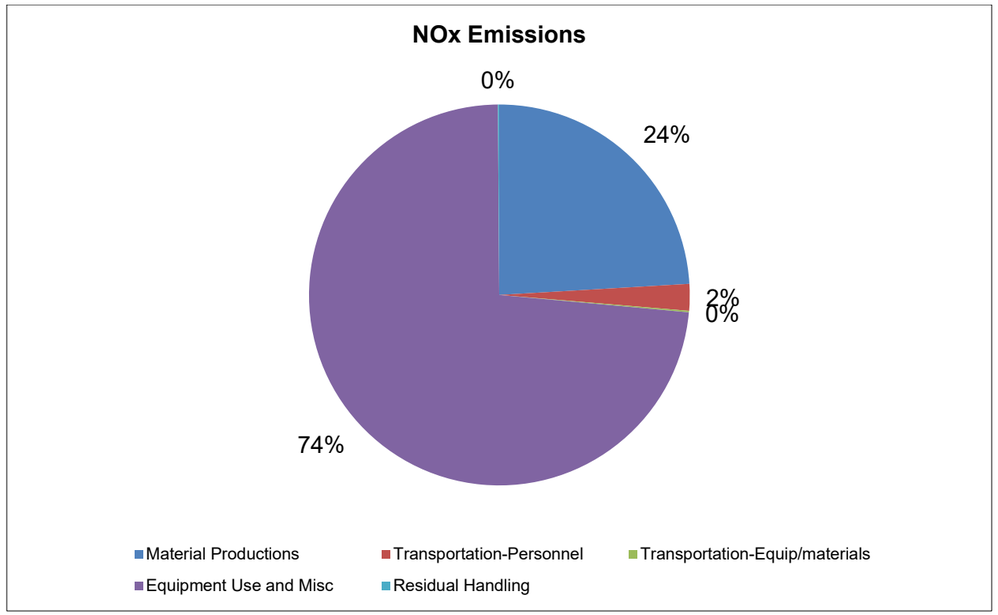


Chart 4: Total SO_x Emissions

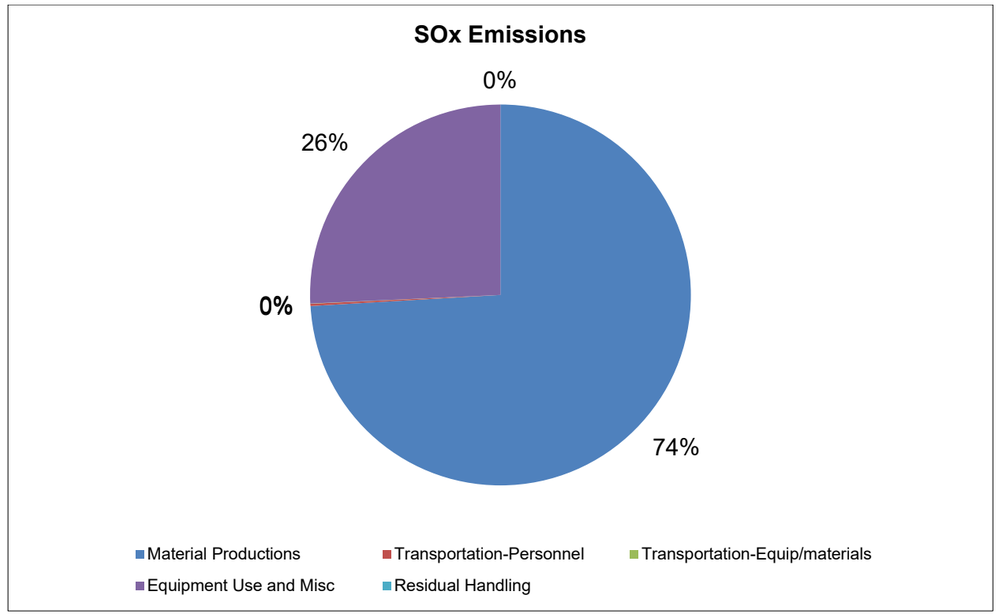


Chart 5: Total PM_{10} Emissions

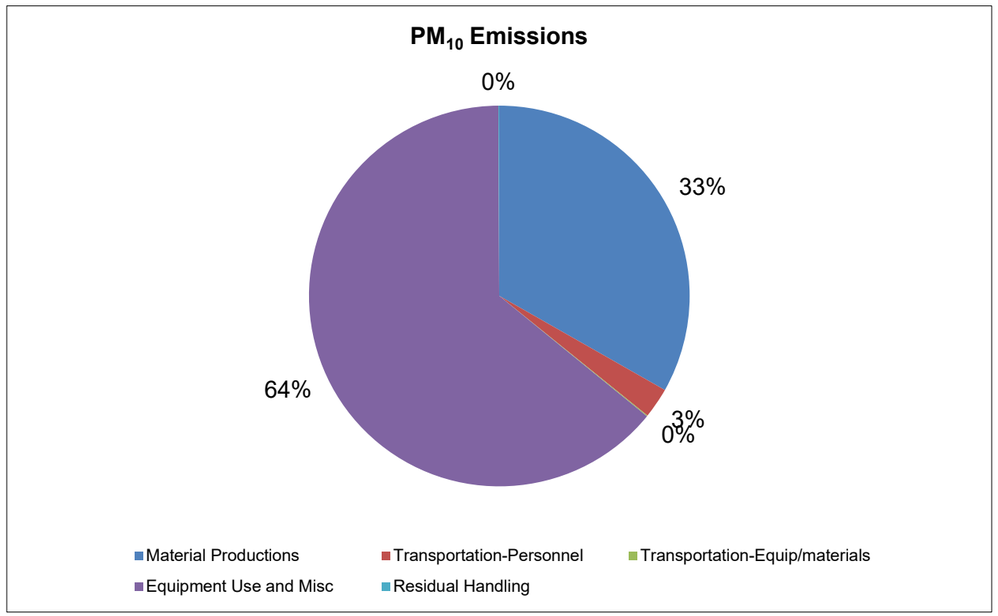


Chart 6: Accident Risk – Fatality

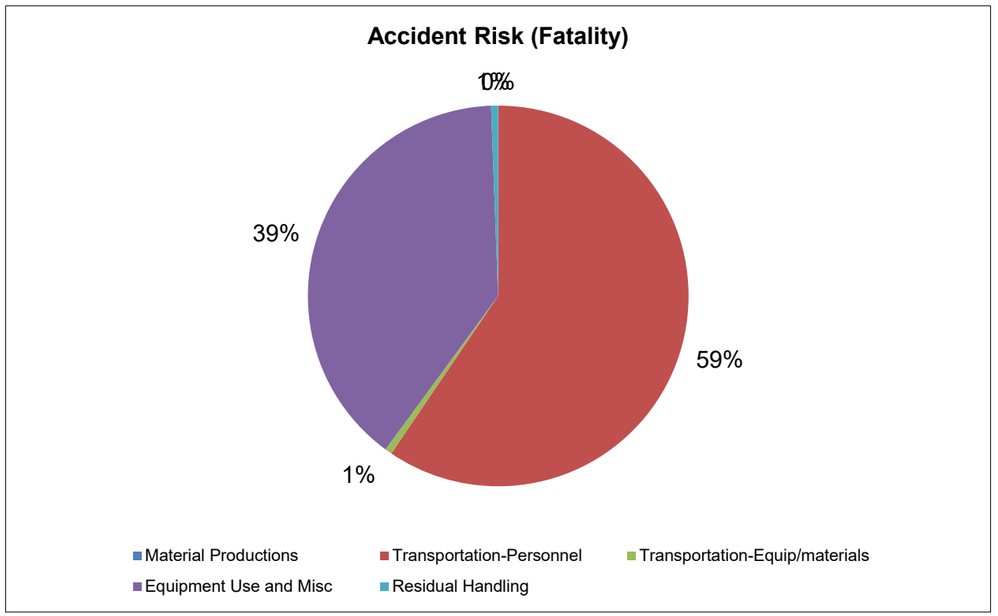


Chart 7: Accident Risk – Injury

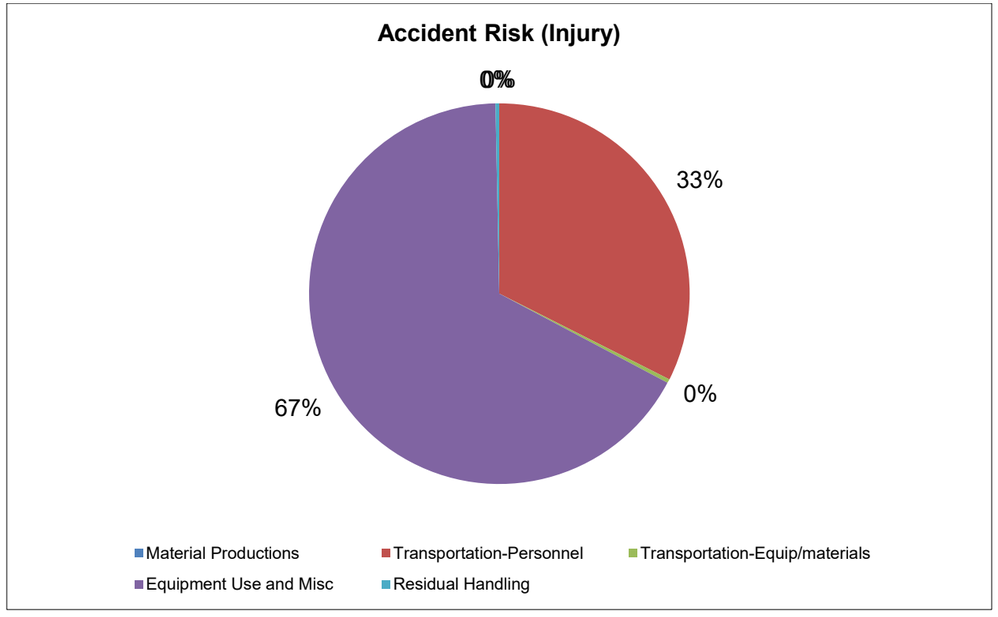
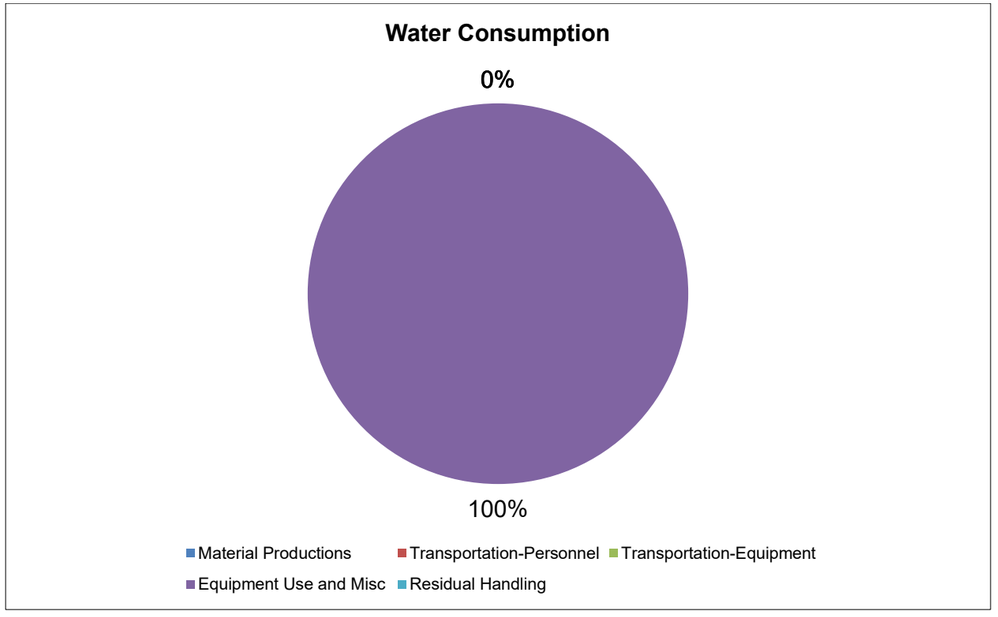


Chart 8: Water Consumption



Appendix D:

Health and Safety Plan

SESI
CONSULTING ENGINEERS

SITE-SPECIFIC HEALTH AND SAFETY PLAN

Grand Union Hotel Bowling Alley Site
140 and 148-150 Westchester Ave.
Port Chester, New York 10573
NYSDEC BCP Site # C360222

Prepared For:

Port Chester OZ Fund III QOZB, LLC
181 Westchester Ave. Suite 301a
Port Chester, New York 10573

Prepared By:

SESI CONSULTING ENGINEERS
959 Route 46E, 3rd Floor
Parsippany, New Jersey 07054

Project No.: 11895A

April 2025/Revised June 2026

Disclaimer: *This Health and Safety Plan (HASP) is based upon information provided [and, if applicable, conditions discovered during a site visit], and is limited by the project scope.*

The HASP should be periodically reviewed and updated based on a number of factors, including but not limited to: (1) changes in applicable governmental requirements; (2) changes in procedures at the site; and (3) site conditions which were unknown to SESI Consulting Engineers (SESI) as of the time the HASP was prepared.

This HASP has been prepared for the sole and exclusive use of Client listed above, and may not be relied upon by any other person without the express written consent and authorization of SESI.

SITE-SPECIFIC HEALTH AND SAFETY PLAN

For

Grand Union Hotel Bowling Alley Site
146 Westchester Ave.
Port Chester, Westchester County, New York 10573
NYSDEC BCP Site # C360222

Prepared by: _____ Date: June 2026

Sheng Long
SESI- Project Engineer

Approved by: _____ Date: June 2026

Andrew Schweitzer, P.E.
SESI-Senior Project Manager

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LIST OF ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
COC	Constituent(s) of Concern
CRZ	Contamination Reduction Zone
EZ	Exclusion Zone
FS	Field Supervisor
GFCI	Ground Fault Circuit Interrupter
HASP	Health and Safety Plan
HSM	Health and Safety Manager
LEL	Lower Explosive Limit
MSDS	Material Safety Data Sheet
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyls
PEL	Permissible Exposure Limit
PID	Photoionization Detector
PM	Project Manager
PO	Project Officer
PPE	Personal Protective Equipment
SESI	SESI Consulting Engineers
SSO	Site Safety Officer
SVOC	Semi-Volatile Organic Compound
SZ	Support Zone
TLV	Threshold Limit Value
USCG	United States Coast Guard
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 INTRODUCTION

1.1 OBJECTIVE

The objective of this Health and Safety Plan (HASP) is to provide a mechanism for establishing safe working conditions during activities at the Grand Union Hotel Bowling Alley Site (BCP# C360222), located at 146 Westchester Avenue, Port Chester, New York (the Site). The safety organization, procedures, and protective equipment have been established based on an analysis of potential physical, chemical, and biological hazards. Specific hazard control methodologies have been evaluated and selected to minimize the potential of injury, illness, or other hazardous incidents.

The HASP was written to meet the requirements of all applicable Federal, State, and local health and safety regulations, including 29 CFR 1910.120. The HASP is based on current knowledge regarding the specific chemical and physical hazards that are known or anticipated at the Site. This HASP is a dynamic document, for which changes and/or revisions may be realized as changes in scope and/or Site conditions are encountered. Should revised documents be produced, said revised documents will refer to the specific changes and why they were made.

1.2 SITE AND FACILITY DESCRIPTION

The Site is located at 146 Westchester Avenue, Port Chester, New York. The Site consists of approximately .4486 acres. The Site is identified on the tax map as 143.30-2-70. It previously consisted of two (2) parcels identified as Block 2, Lots 17 and 65. The portion formerly known as Block 2, Lot 17 has been redeveloped as a 12-story mixed-use building consisting of approximately 234,849 square feet (sf).

The Site is bound to the east by New Broad Street and commercial/residential properties. The Site is bound to the south by JP Upholstery Shop, to the west by Pearl Street and a parking lot and to the north by Westchester Avenue, restaurants, a local theater, and apartments.

1.3 POLICY STATEMENT

The policy of SESI Consulting Engineers (SESI) is to provide a safe and healthful work environment. No aspect of operations is of greater importance than injury and illness prevention. A fundamental principle of safety management is that all injuries, illnesses, and

incidents are preventable. SESI will take every reasonable step to eliminate or control hazards in order to minimize the possibility of injury, illness, or incident.

This HASP prescribes the procedures that must be followed by SESI personnel during activities at the site. Operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without the prior approval of the Project Manager (PM) and the Health and Safety Manager (HSM). This document will be reviewed periodically by the HSM to ensure that it is current and technically correct. Any changes in site conditions and/or the scope of work will require a review and modification to this HASP. Such changes will be completed in the form of an addendum or a revision to the plan.

The provisions of this plan are mandatory for all SESI personnel and are advisory for all contractors, and subcontractors assigned to the project***. Subcontractors will be responsible for preparing their own site-specific HASPs that meet the basic requirements outlined in this HASP.*** All visitors to SESI work areas at the Site must abide by the requirements of this plan.

1.4 REFERENCES

This HASP complies with applicable Occupational Safety and Health Administration (OSHA) regulations, United States Environmental Protection Agency (USEPA) regulations, and SESI health and safety policies and procedures. This plan follows the guidelines established in the following:

- *Standard Operating Safety Guides*, USEPA (Publication 9285.1-03, June 1992).
- *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*, NIOSH, OSHA, USCG, USEPA (86116, October 1985).
- *Title 29 of the Code of Federal Regulations* (CFR), Part 1910.
- *Title 29 of the Code of Federal Regulations* (CFR), Part 1926.
- *Pocket Guide to Chemical Hazards*, DHHS, PHS, CDC, NIOSH (2004).
- *Threshold Limit Values*, ACGIH (2005).
- *Guide to Occupational Exposure Values*, ACGIH (2005).
- *Quick Selection Guide to Chemical Protective Clothing*, Forsberg, K. and S.Z. Mansdorf, 2nd Ed. (1993).

1.5 DEFINITIONS

The following definitions (listed alphabetically) are applicable to this HASP:

- *Contamination Reduction Zone (CRZ)* - Area between the exclusion zone and support zone that provides a transition between contaminated and clean areas. Decontamination stations are located in this zone.
- *Exclusion Zone (EZ)* - Any portions of the site where hazardous substances are, or are reasonably suspected to be present, and pose an exposure hazard to on-site personnel.
- *Incident* - All losses, including first aid cases, injuries, illnesses, spills/leaks, equipment and property damage, motor vehicle accidents, regulatory violations, fires, and business interruptions.
- *On-Site Personnel* - All SESI and subcontractors involved with the project.
- *Project* - All on-site work performed under the scope of work.
- *Site* - The area described in Section 1.2, Site and Facility Description, where the work is to be performed by SESI personnel and subcontractors.
- *Support Zone (SZ)* - All areas of the site except the EZ and CRZ. The SZ surrounds the CRZ and EZ. Support equipment and break areas are located in this zone.
- *Subcontractor* - Includes contractor personnel hired by SESI.
- *Visitor* - All other personnel, except the on-site personnel.
- *Work Area* - The portion of the site where work activities are actively being performed. This area may change daily as work progresses and includes the SZ, CRZ, and EZ. If the work area is located in an area on the site that is not contaminated, or suspected of being contaminated, the entire work area may be a SZ.

2.0 PROJECT SCOPE OF WORK

This HASP contains information for the following tasks that SESI is anticipated to conduct at the Site. Should additional and/or different tasks be identified, amendments to this HASP will be required to address these changed items.

- Mobilization;
- Excavation of Contaminated Soil;
- End Point Sampling of Soil;
- Installation of a Vapor Barrier and elements for SSDS for Building;
- Groundwater Remediation
- Groundwater Sampling;
- Decontamination and Demobilization.

3.0 ROLES AND RESPONSIBILITIES

3.1 ALL PERSONNEL

All SESI project personnel must adhere to the procedures outlined in this HASP during the performance of their work. Each person is responsible for completing tasks safely and reporting any unsafe acts or conditions to their supervisor. No person may work in a manner that conflicts with these procedures. After due warnings, the PM will dismiss from the site any SESI employee or subcontractor who violates safety procedures.

All SESI project personnel will receive training in accordance with applicable regulations and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. In addition, all SESI personnel will attend an initial hazard briefing prior to beginning work at the Site.

The roles of key safety personnel and subcontractors are outlined in the following sections. Key project personnel and contacts are summarized in **Table 3.1** on page 11.

3.2 KEY SAFETY PERSONNEL

3.2.1 PROJECT OFFICER (PO)

The PO is responsible for providing resources to assure project activities are completed in accordance with this HASP, and for meeting all regulatory and contractual requirements.

3.2.2 PROJECT MANAGER (PM)

The PM is responsible for verifying that project activities are completed in accordance with the requirements of this HASP. The PM is responsible for confirming that the Field Supervisor (FS) has the equipment, materials, and qualified personnel to fully implement the safety requirements of this HASP, and/or that subcontractors assigned to this project meet the requirements established by SESI. It is also the responsibility of the PM to:

- Consult with the HSM on site health and safety issues;
- Verify that subcontractors meet health and safety requirements prior to commencing work;
- Verify that all incidents are thoroughly investigated;
- Approve, in writing, addenda or modifications of this HASP; and
- Suspend work or modify work practices, as necessary, for personal safety, protection of property, and regulatory compliance.

3.2.3 HEALTH AND SAFETY MANAGER (HSM)

The HSM or his designee, the health and safety manager (HSM), has overall responsibility for the technical health and safety aspects of the project, including review and approval of this HASP. Inquiries regarding health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The HSM or his designee must approve changes or addenda to this HASP.

3.2.4 SITE SAFETY OFFICER (SSO)

The SSO is responsible for field health and safety issues, including the execution of this HASP. Questions in the field regarding health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The SSO will advise the PM on health and safety issues and will establish and coordinate the project air-monitoring program if one is deemed necessary (see Section 5.1, Air Monitoring). The SSO is the primary site contact on health and safety matters. It is the responsibility of the SSO to:

- Provide on-site technical assistance, if necessary;
- Participate in all accident/incident reports and ensure that they are reported to the HSM, client, and PM within 24 hours;
- Coordinate site and personal air monitoring as required, including equipment maintenance and calibration;
- Conduct site safety orientation training and safety meetings;
- Verify that project personnel have received the required physical examinations and medical certifications;
- Review site activities with respect to compliance with this HASP;
- Maintain required health and safety documents and records; and
- Assist the FS in instructing field personnel on project hazards and protective procedures.

3.2.5 FIELD SUPERVISOR (FS)

The FS is responsible for implementing this HASP, including communicating requirements to on-Site personnel and subcontractors. The FS will be responsible for informing the PM of changes in the work plan, procedures, or Site conditions so that those changes may be addressed in this HASP. Other responsibilities are to:

- Consult with the SSO on site health and safety issues;
- Stop work, as necessary, for personal safety, protection of property, and regulatory compliance;

- Obtain a site map and determine and post routes to medical facilities and emergency telephone numbers;
- Notify local public emergency representatives (as appropriate) of the nature of the site operations, and post their telephone numbers (i.e., local fire department personnel who would respond for a confined space rescue);
- Observe on-Site project personnel for signs of ill health effects;
- Investigate and report any incidents to the SSO;
- Verify that all on-Site personnel have had applicable training;
- Verify that on-Site personnel are informed of the physical, chemical, and biological hazards associated with the Site activities, and the procedures and protective equipment necessary to control the hazards; and
- Issue/obtain any required work permits (hot work, confined space, etc.).

3.2.6 FIELD PERSONNEL (FP)

All SESI field personnel are responsible for following the Health and Safety procedures specified in this HASP and work practices specified in applicable operation procedures. Some specific responsibilities include, but are not limited to:

- Reading and understanding the HASP;
- Reporting all accidents, incidents, injuries, or illnesses to the FS;
- Complying with the requests of the SSO;
- Immediately communicating newly identified hazards or noncompliance issues to the FS or SSO; and
- Stopping work in cases of immediate danger.

3.3 SUBCONTRACTORS

Subcontractors and their personnel must understand and comply with applicable regulations and Site requirements established in this HASP. Subcontractors will prepare their own Site-specific HASP that must be consistent with the requirements of this HASP.

All subcontractor personnel will receive training in accordance with applicable regulations and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. All subcontractor personnel will attend an initial hazard briefing prior to beginning work at the Site. Additionally, on-Site subcontractor personnel must conduct daily Site safety meetings.

Subcontractors must designate individuals to function as the PM, HSM, SSO, and FS. In some firms the HSM to be carried out by the PM. This is acceptable provided the PM has the required knowledge, training, and experience to properly address all hazards associated with the work, and to prepare, approve, and oversee the execution of the Site-

specific HASP. A subcontractor may designate the same person to perform the duties of both the SSO and the FS. However, depending on the level of complexity of a contractor's scope of work, it may be infeasible for one person to perform both functions satisfactorily.

3.4 STOP WORK AUTHORITY

Every SESI employee and subcontractor is empowered, expected, and has the responsibility to stop the work of another co-worker if the working conditions or behaviors are considered unsafe.

3.5 ALL ON-SITE PERSONNEL

All on-Site SESI personnel (including SESI subcontractors) must read and acknowledge their understanding of their respective HASPs before commencing work and abide by the requirements of the plans. All on-Site SESI personnel shall sign their HASP Acknowledgement Form following their review of their HASP.

All SESI project personnel will receive training in accordance with applicable regulations and be familiar with the requirements and procedures contained in this HASP prior to initiating site activities. In addition, all on-Site personnel will attend an initial hazard briefing provided by the SSO prior to beginning work at the site and conduct daily safety meetings thereafter.

On-Site personnel will immediately report the following to the FS or SSO:

- Personal injuries and illnesses no matter how minor;
- Unexpected or uncontrolled release of chemical substances;
- Symptoms of chemical exposure;
- Unsafe or hazardous situations;
- Unsafe or malfunctioning equipment;
- Changes in site conditions that may affect the health and safety of project personnel;
- Damage to equipment or property; and
- Situations or activities for which they are not properly trained.

3.6 VISITORS

All SESI personnel and subcontractors visiting the Site must check in with the FS. Visitors will be cautioned to avoid skin contact with surfaces, soils, groundwater, or other materials that may impacted or be suspected to be impacted by COCs.

Visitors requesting to observe work at the site must wear appropriate personal protective equipment (PPE) prior to entry to the work area and must have the appropriate training and medical clearances to do so. If respiratory protective devices are necessary, visitors who wish to enter the work area must have been respirator-trained and fit tested for a respirator within the past 12 months.

Table 3.1 – Key Safety Personnel

SESI Personnel		
Role	**Name**	**Telephone No.**
Project Principal	Fuad Dahan, P.E., PhD	973-808-9050
Project Manager (PM)	Andrew Schweitzer, P.E.	973-808-9050
Principal Engineer	Andrew Schweitzer, P.E.	973-808-9050
Remedial Action Project Manager	Andrew Schweitzer, P.E.	973-808-9050
Field Team Leader	Sheng Long	973-808-9050
Quality Assurance Officer	Joe Scardino	973-808-9050
Field Personnel	TBD	

4.0 PERSONAL PROTECTIVE EQUIPMENT

4.1 LEVELS OF PROTECTION

PPE is required to safeguard site personnel from various hazards. Varying levels of protection may be required depending on the levels of COCs and the degree of physical hazard. This section presents the various levels of protection and defines the conditions of use for each level. A summary of the levels is presented in **Table 4.1** on page 13.

4.1.1 LEVEL D PROTECTION

The minimum level of protection that will be required of project personnel at the site will be Level D, which will be worn when site conditions or air monitoring indicates no inhalation hazard exists. The following equipment will be used:

- Work clothing as prescribed by weather;
- Steel toe work boots, meeting American National Standards Institute (ANSI) Z41;
- Safety glasses or goggles, meeting ANSI Z87;
- Leather work gloves and/or nitrile surgical gloves;
- Hard hat, meeting ANSI Z89, when falling object hazards are present;
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used); and
- PFD if working on or near the water.

4.1.2 MODIFIED LEVEL D PROTECTION

Modified Level D will be used when airborne contaminants are not present at levels of concern, but site activities present an increased potential for skin contact with contaminated materials. Modified Level D consists of:

- Nitrile gloves worn over nitrile surgical gloves;
- Latex/polyvinyl chloride (PVC) overboots when contact with COC-impacted media is anticipated;
- Steel toe work boots, meeting ANSI Z41;
- Safety glasses or goggles, meeting ANSI Z87;
- Face shield in addition to safety glasses or goggles when projectiles or splash hazards exist (e.g. during Power Washing activities);
- Hard hat, meeting ANSI Z89, when falling object hazards are present;
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used);
- Tyvek® suit (polyethylene coated Tyvek® suits for handling liquids) when body contact with COC-impacted media is anticipated; and
- PFD if working on or near the water.

4.1.3 LEVEL C PROTECTION

Level C protection will be required when the airborne concentration of COC reaches one-half of the OSHA Permissible Exposure Limit or ACGIH TLV. The following equipment will be used for Level C protection:

- Full-face, air-purifying respirator with combination organic vapor/HEPA cartridges;
- Polyethylene-coated Tyvek® suit, with ankles and cuffs taped to boots and gloves;
- Nitrile gloves worn over nitrile surgical gloves;
- Steel toe work boots, meeting ANSI Z41;
- Chemical-resistant boots with steel toes or latex/PVC overboots over steel toe boots;
- Hard hat, meeting ANSI Z89;
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used); and
- PFD if working on or near the water.

4.2 SELECTION OF PPE

Equipment for personal protection will be selected based on the potential for contact, site conditions, ambient air quality, and the judgment of supervising Site personnel and health and safety professionals. The PPE used will be chosen to be effective against the COCs present on the Site.

4.3 SITE RESPIRATORY PROTECTION PROGRAM

Respiratory protection is an integral part of employee health and safety at the Site due to potentially hazardous concentrations of airborne COCs. The Site respiratory protection program will consist of the following (as a minimum):

- All on-Site personnel who may use respiratory protection will have an assigned respirator.
- All on-Site personnel who may use respiratory protection will have been fit tested and trained in the use of a full-face air-purifying respirator within the past 12 months. Documentation of the fit test must be provided to the SSO prior to commencement of work.
- All on-Site personnel who may use respiratory protection must within the past year have been medically certified as being capable of wearing a respirator. Documentation of the medical certification must be provided to the SSO, prior to commencement of Site work.
- Only cleaned, maintained, NIOSH-approved respirators will be used.
- If respirators are used, the respirator cartridge is to be properly disposed of at the end of each work shift, or when load-up or breakthrough occurs.
- Contact lenses are not to be worn when a respirator is worn.

- All on-Site personnel who may use respiratory protection must be clean-shaven. Mustaches and sideburns are permitted, but they must not touch the sealing surface of the respirator.
- Respirators will be inspected, and a negative pressure test performed prior to each use.
- After each use, the respirator will be wiped with a disinfectant, cleansing wipe. When used, the respirator will be thoroughly cleaned at the end of the work shift. The respirator will be stored in a clean plastic bag, away from direct sunlight in a clean, dry location, in a manner that will not distort the face piece.

4.4 USING PPE

Depending upon the level of protection selected, specific donning and doffing procedures may be required. The procedures presented in this section are mandatory if Modified Level D or Level C PPE is used. All personnel entering the EZ must put on the required PPE in accordance with the requirements of this HASP. When leaving the EZ, PPE will be removed in accordance with the procedures listed, to minimize the spread of COCs.

4.4.1 DONNING PROCEDURES

These procedures are mandatory only if Modified Level D or Level C PPE is used on the Site:

- Remove bulky outerwear. Remove street clothes and store in clean location;
- Put on work clothes or coveralls;
- Put on the required chemical protective coveralls;
- Put on the required chemical protective boots or boot covers;
- Tape the legs of the coveralls to the boots with duct tape;
- Put on the required chemical protective gloves;
- Tape the wrists of the protective coveralls to the gloves;
- Don the required respirator and perform appropriate fit check (Level C);
- Put hood or head covering over-head and respirator straps and tape hood to facepiece (Level C); and
- Don remaining PPE, such as safety glasses or goggles and hard hat.

When these procedures are instituted, one person must remain outside the work area to ensure that each person entering has the proper protective equipment.

4.4.2 DOFFING PROCEDURES

The following procedures are only mandatory if Modified Level D or Level C PPE is required for the Site. Whenever a person leaves the work area, the following decontamination sequence will be followed:

- Upon entering the CRZ, rinse contaminated materials from the boots or remove contaminated boot covers;
- Clean reusable protective equipment;
- Remove protective garments, equipment, and respirator (Level C). All disposable clothing should be placed in plastic bags, which are labeled with contaminated waste labels;
- Wash hands, face, and neck (or shower if necessary);
- Proceed to clean area and dress in clean clothing; and
- Clean and disinfect respirator for next use.

All disposable equipment, garments, and PPE must be bagged in plastic bags, labeled for disposal. See Section 6.2, Decontamination, for detailed information on decontamination stations.

4.5 SELECTION MATRIX

The level of personal protection selected will be based on air monitoring of the work environment and an assessment by the FS and SSO of the potential for skin contact with COCs. The PPE selection matrix is presented in **Table 4.1** below. This matrix is based on information available at the time this plan was written. The Airborne Contaminant Action Levels in **Table 5.1** on page 15, Airborne Contaminant Action Levels, should be used to verify that the PPE prescribed in these matrices is appropriate.

Table 4.1 – PPE Selection Matrix

Task	Anticipated Level of Protection
Mobilization	Level D
Subsurface Intrusive Activities (Excavation, Drilling)	Modified Level D/Level C
Earthwork/Grading	Level D
Chemical Sampling / Delineation	Modified Level D/Level C
Decontamination	Modified Level D
Demobilization	Level D

5.0 AIR AND NOISE MONITORING

5.1 AIR MONITORING

Air monitoring, sampling, and testing will be conducted to determine employee exposure to airborne constituents. The monitoring results will dictate work procedures and the selection of PPE. The SESI SSO will be responsible for defining appropriate air monitoring procedures and for utilizing the air monitoring results to determine appropriate procedures and PPE for project personnel. Air monitoring results should be recorded in field notebooks or on an air monitoring log (see Attachment 1 for a copy of the Air Monitoring Log). Any deviations from the procedures listed here should be documented and explained in the Air Monitoring Log.

The monitoring devices to be used are a PDR1000 particulate monitor (or equivalent) and a Rae Systems MultiRAE detector (PID with a 11.7 eV lamp/oxygen/LEL/hydrogen sulfide sensors). Colorimetric detector tubes may be utilized to estimate airborne concentrations of benzene and should be onsite during any activities that may result in elevated PID readings including drilling, excavating, and groundwater sampling.

Air monitoring will be conducted continuously with the LEL/Oxygen meter during drilling in areas where flammable vapors or gases are suspect. All work activity must stop where tests indicate the concentration of flammable vapors exceeds 10% of the LEL at a location with a potential ignition source. Such an area must be ventilated to reduce the concentration to an acceptable level.

5.2 NOISE MONITORING

Noise monitoring may be conducted as required. Hearing protection is mandatory for all employees in noise hazardous areas, such as around heavy equipment. As a general rule, sound levels that cause speech interference at normal conversation distance should require the use of hearing protection.

5.3 MONITORING EQUIPMENT MAINTENANCE AND CALIBRATION

All direct-reading instrumentation calibrations should be conducted under the approximate environmental conditions the instrument will be used. Instruments must be calibrated before and after use, noting the reading(s) and any adjustments that are necessary. All air monitoring equipment calibrations, including the standard used for calibration, must be

documented on a calibration log or in the field notebook. All completed health and safety documentation/forms must be reviewed by the SSO and maintained by the FS.

All air monitoring equipment will be maintained and calibrated in accordance with the specific manufacturer's procedures. Preventive maintenance and repairs will be conducted in accordance with the respective manufacturer's procedures. When applicable, only manufacturer-trained and/or authorized personnel will be allowed to perform instrument repairs or preventive maintenance.

If an instrument is found to be inoperative or suspected of giving erroneous readings, the SSO must be responsible for immediately removing the instrument from service and obtaining a replacement unit. If the instrument is essential for safe operation during a specific activity, that activity must cease until an appropriate replacement unit is obtained. The SSO will be responsible for ensuring a replacement unit is obtained and/or repairs are initiated on the defective equipment.

5.4 ACTION LEVELS

Table 5.1 below presents airborne contaminant action levels that will be used to determine the procedures and protective equipment necessary based on conditions as measured at the Site.

Table 5.1 – Airborne Contaminant Action Levels

Parameter	Reading	Action
Total Hydrocarbons	0 ppm to ≤ 1 ppm	Normal operations; continue hourly breathing zone monitoring
	> 1 ppm to 5 ppm	Increase monitoring frequency to every 15 minutes and use benzene detector tube to screen for the presence of benzene
	≥ 5 ppm to ≤ 50 ppm	Upgrade to Level C PPE; continue screening for benzene
	> 50 ppm	Stop work; investigate cause of reading
	At any reading > 5 ppm	Monitor perimeter per CAMP
Benzene	≥ 1 ppm to 5 ppm	Upgrade to Level C PPE
	> 5 ppm	Stop work; investigate cause of reading
Dust	0 to .05 mg/m3	Normal operations
	0.05 to 0.1 mg/m3	Begin soil wetting procedure (Level C protection would be needed beyond this point)
	> 0.15 mg/m3	Stop work, fully implement dust control plan

Parameter	Reading	Action
Oxygen	≤ 19.5%	Stop work, evacuate confined spaces/work area, investigate cause of reading, and ventilate area
	> 19.5% to < 23.5%	Normal operations
	≥ 23.5%	Stop work, evacuate confined spaces/work area, investigate cause of reading, and ventilate area
Carbon Monoxide	0 ppm to ≤ 20 ppm	Normal operations
	> 20 ppm	Stop work, evacuate confined spaces/work area, investigate cause of reading, and ventilate area
Hydrogen Sulfide	0 ppm to ≤ 5 ppm	Normal operations
	> 5 ppm	Stop work, evacuate confined spaces/work area, investigate cause of reading, and ventilate area
Flammable Vapors (LEL)	< 10% LEL	Normal operations
	≥ 10% LEL	Stop work, ventilate area, investigate source of vapors

6.0 WORK ZONES AND DECONTAMINATION

6.1 WORK ZONES

6.1.1 AUTHORIZATION TO ENTER

Only personnel with the appropriate training and medical certifications (if respirators are required) will be allowed to work at the project Site. The FS will maintain a list of authorized persons; only personnel on the authorized persons list will be allowed to enter the site work areas.

6.1.2 SITE ORIENTATION AND HAZARD BRIEFING

No person will be allowed in the work area during Site operations without first being given a Site orientation and hazard briefing. This orientation will be presented by the FS or SSO and will consist of a review of this HASP. This review must cover the chemical, physical, and biological hazards, protective equipment, safe work procedures, and emergency procedures for the project. Following this initial meeting, daily safety meetings will be held each day before work begins.

All people entering the Site work areas, including visitors, must document their attendance at this briefing, as well as the daily safety meetings on the forms included with this plan.

6.1.3 CERTIFICATION DOCUMENTS

A training and medical file may be established for the project and kept on Site during all Site operations. Specialty training, such as first aid/cardiopulmonary resuscitation (CPR) certificates, as well as current medical clearances for all project field personnel required to wear respirators, will be maintained within that file. All project personnel must provide their training and medical documentation to the SSO prior to starting work.

6.1.4 ENTRY LOG

A log-in/log-out sheet will be maintained at the Site by the FS. Personnel must sign in and out on a log sheet as they enter and leave the work area, and the FS may document entry and exit in the field notebook.

6.1.5 ENTRY REQUIREMENTS

In addition to the authorization, hazard briefing, and certification requirements listed above, no person will be allowed in any SESI work area unless they are wearing the minimum PPE as described in Section 4.0.

6.1.6 EMERGENCY ENTRANCE AND EXIT

People who must enter the work area on an emergency basis will be briefed of the hazards by the FS or SSO. All activities will cease in the event of an emergency. People exiting the work area because of an emergency will gather in a designated safe area for a head count. The FS is responsible for ensuring that all people who entered the work area have exited in the event of an emergency.

6.1.7 CONTAMINATION CONTROL ZONES

Contamination control zones are maintained to prevent the spread of contamination and to prevent unauthorized people from entering hazardous areas.

6.1.8 EXCLUSION ZONE (EZ)

An EZ may consist of a specific work area or may be the entire area of potential contamination. All employees entering an EZ must use the required PPE and must have the appropriate training and medical clearance for hazardous waste work. The EZ is the defined area where there is a possible respiratory and/or contact health hazard. Cones, caution tape, or a posted site diagram will identify the location of each EZ.

6.1.9 CONTAMINATION REDUCTION ZONE

The CRZ or transition area will be established, if necessary, to perform decontamination of personnel and equipment. All personnel entering or leaving the EZ will pass through this area to prevent any cross-contamination. Tools, equipment, and machinery will be decontaminated in a specific location. The decontamination of all personnel will be performed on Site adjacent to the EZ. Personal protective outer garments and respiratory protection will be removed in the CRZ and prepared for cleaning or disposal. This zone is the only appropriate corridor between the EZ and the support zone (SZ) discussed below.

6.1.10 SUPPORT ZONE (SZ)

The SZ is a clean area outside the CRZ located to prevent employee exposure to hazardous substances. Eating and drinking will be permitted in the support area only after proper decontamination. Smoking may be permitted in the SZ, subject to Site requirements.

6.1.11 POSTING

Work areas will be prominently marked and delineated using cones, caution tape, or a posted Site diagram.

6.1.12 SITE INSPECTIONS

The FS will conduct a daily inspection of Site activities, equipment, and procedures to verify that the required elements are in place.

6.2 DECONTAMINATION

6.2.1 PERSONNEL DECONTAMINATION

All personnel wearing Modified Level D or Level C protective equipment in the EZ must undergo personal decontamination prior to entering the SZ. The personnel decontamination area will consist of the following stations at a minimum:

- *Station 1*: Personnel leaving the contaminated zone will remove the gross contamination from their outer clothing and boots.
- *Station 2*: Personnel will remove their outer garment and gloves and dispose of it in properly labeled containers. Personnel will then decontaminate their hard hats, and boots with an aqueous solution of detergent or other appropriate cleaning solution. These items are then hand carried to the next station.
- *Station 3*: Personnel will thoroughly wash their hands and face before leaving the CRZ. Respirators will be sanitized and then placed in a clean plastic bag.

6.2.2 EQUIPMENT DECONTAMINATION

All vehicles that have entered the EZ will be decontaminated at the decontamination pad prior to leaving the zone. If the level of vehicle contamination is low, decontamination may be limited to rinsing of tires and wheel wells with water. If the vehicle is significantly contaminated, steam cleaning or pressure washing of vehicles and equipment may be required.

6.2.3 PERSONAL PROTECTIVE EQUIPMENT DECONTAMINATION

Where and whenever possible, single-use, external protective clothing must be used for work within the EZ or CRZ. This protective clothing must be disposed of in properly labeled containers. Reusable protective clothing will be rinsed at the site with detergent and water. The rinsate will be collected for disposal.

When removed from the CRZ, the respirator will be thoroughly cleaned with soap and water. The respirator face piece, straps, valves, and covers must be thoroughly cleaned at

the end of each work shift, and ready for use prior to the next shift. Respirator parts may be disinfected with a solution of bleach and water (mixed at 2% bleach by volume), or by using a spray disinfectant.

7.0 TRAINING AND MEDICAL SURVEILLANCE

7.1 TRAINING

7.1.1 GENERAL

All on-Site project personnel who work in areas where they may be exposed to Site contaminants must be trained as required by OSHA Regulation 29 CFR 1910.120 (HAZWOPER). Field employees also must receive a minimum of three (3) days of actual field experience under the direct supervision of a trained, experienced supervisor. Personnel who completed their initial training more than 12 months prior to the start of the project must have completed an eight (8)-hour refresher course within the past 12 months. The FS must have completed an additional eight (8) hours of supervisory training and must have a current first-aid/CPR certificate (See Attachment 2).

7.1.2 BASIC 40-HOUR COURSE

The following is a list of the topics typically covered in a 40-hour HAZWOPER training course:

- General safety procedures;
- Physical hazards (fall protection, noise, heat stress, cold stress);
- Names and job descriptions of key personnel responsible for site health and safety;
- Safety, health, and other hazards typically present at hazardous waste sites;
- Use, application, and limitations of PPE;
- Work practices by which employees can minimize risks from hazards;
- Safe use of engineering controls and equipment on site;
- Medical surveillance requirements;
- Recognition of symptoms and signs which might indicate overexposure to hazards;
- Worker right-to-know (Hazard Communication OSHA 1910.1200);
- Routes of exposure to contaminants;
- Engineering controls and safe work practices;
- Components of a health and safety program and a site-specific HASP;
- Decontamination practices for personnel and equipment;
- Confined-space entry procedures; and
- General emergency response procedures.

7.1.3 SUPERVISOR COURSE

Management and supervisors must receive an additional eight (8) hours of training, which typically includes:

- General site safety and health procedures;
- PPE programs; and
- Air monitoring techniques.

7.1.4 SITE-SPECIFIC TRAINING

Site-specific training will be accomplished by on-site personnel reading this HASP, and through a thorough site briefing by the PM, FS, or SSO on the contents of this HASP before work begins. The review must include a discussion of the chemical, physical, and biological hazards; the protective equipment and safety procedures; and emergency procedures.

7.1.5 DAILY SAFETY MEETINGS

Daily safety meetings will be held to cover the work to be accomplished, the hazards anticipated, the PPE and procedures required to minimize site hazards, and emergency procedures. The FS or SSO should present these meetings prior to beginning the day's fieldwork. No work will be performed in an EZ before a daily safety meeting has been held. An additional safety meeting must also be held prior to new tasks, or if new hazards are encountered. The daily safety meetings will be logged in the field notebook.

7.1.6 FIRST AID AND CPR

At least one (1) employee current in first aid/CPR will be assigned to the work crew and will be on the Site during operations. Site records will document the presence of this individual. Refresher training in first aid (triennially) and CPR (annually) is required to keep the certificate current. These individuals must also receive training regarding the precautions and protective equipment necessary to protect against exposure to blood-borne pathogens.

7.2 MEDICAL SURVEILLANCE

7.2.1 MEDICAL EXAMINATION

All personnel who are potentially exposed to Site contaminants must participate in a medical surveillance program as defined by OSHA at 29 CFR 1910.120 (f).

7.2.2 PRE-PLACEMENT MEDICAL EXAMINATION

All potentially exposed personnel must have completed a comprehensive medical examination prior to assignment, and periodically thereafter as defined by applicable regulations. The pre-placement and periodic medical examinations typically include the following elements:

- Medical and occupational history questionnaire;
- Physical examination;
- Complete blood count, with differential;
- Liver enzyme profile;

- Chest X-ray, at a frequency determined by the physician;
- Pulmonary function test;
- Audiogram;
- Electrocardiogram for persons older than 45 years of age, or if indicated during the physical examination;
- Drug and alcohol screening, as required by job assignment;
- Visual acuity; and
- Follow-up examinations, at the discretion of the examining physician or the corporate medical director.

The examining physician provides the employee with a letter summarizing his findings and recommendations, confirming the worker's fitness for work and ability to wear a respirator. Documentation of medical clearance will be available for each employee during all project Site work.

Subcontractors will certify that all their employees have successfully completed a physical examination by a qualified physician. The physical examinations must meet the requirements of 29 CFR 1910.120 and 29 CFR 1910.134. Subcontractors will supply copies of the medical examination certificate for each on-site employee.

7.2.3 OTHER MEDICAL EXAMINATIONS

In addition to pre-employment, annual, and exit physicals, personnel may be examined:

- At employee request after known or suspected exposure to toxic or hazardous materials; and
- At the discretion of the SSO, HSM, or occupational physician in anticipation of, or after known or suspected exposure to toxic or hazardous materials.

7.2.4 PERIODIC EXAM

Following the placement examination, all employees must undergo a periodic examination, similar in scope to the placement examination. For employees potentially exposed over 30 days per year, the frequency of periodic examinations will be annual. For employees potentially exposed less than 30 days per year, the frequency for periodic examinations will be 24 months.

7.2.5 MEDICAL RESTRICTION

When the examining physician identifies a need to restrict work activity, the employee's supervisor must communicate the restriction to the employee and the SSO. The terms of the restriction will be discussed with the employee and the supervisor.

8.0 GENERAL SAFETY PRACTICES

8.1 GENERAL SAFETY RULES

General safety rules for site activities include, but are not limited to, the following:

- At least one copy of this HASP must be in a location at the site that is readily available to personnel, and all project personnel shall review the plan prior to starting work.
- Consume or use food, beverages, chewing gum, and tobacco products only in the SZ or other designated area outside the EZ and CRZ. Cosmetics shall not be applied in the EZ or CRZ.
- Wash hands before eating, drinking, smoking, or using toilet facilities.
- Wear all PPE as required and stop work and replace damaged PPE immediately.
- Secure disposable coveralls, boots, and gloves at the wrists and legs and ensure closure of the suit around the neck.
- Upon skin contact with materials that may be impacted by COCs, remove contaminated clothing and wash the affected area immediately. Contaminated clothing must be changed. Any skin contact with materials potentially impacted by COCs must be reported to the FS or SSO immediately. If needed, medical attention should be sought.
- Practice contamination avoidance. Avoid contact with surfaces either suspected or known to be impacted by COCs, such as standing water, mud, or discolored soil. Equipment must be stored on elevated or protected surfaces to reduce the potential for incidental contamination.
- Remove PPE as required in the CRZ to limit the spread of COC-containing materials.
- At the end of each shift or as required, dispose of all single-use coveralls, soiled gloves, and respirator cartridges in designated receptacles designated for this purpose.
- Removing soil containing site COCs from protective clothing or equipment with compressed air, shaking, or any other means that disperses contaminants into the air is prohibited.
- Inspect all non-disposable PPE for contamination in the CRZ. Any PPE found to be contaminated must be decontaminated or disposed of appropriately.
- Recognize emergency signals used for evacuation, injury, fire, etc.
- Report all injuries, illnesses, and unsafe conditions or work practices to the FS or SSO.
- Use the “buddy system” during all operations requiring Level C PPE, and when appropriate, during Modified Level D operations.
- Obey all warning signs, tags, and barriers. Do not remove any warnings unless authorized to do so.
- Use, adjust, alter, and repair equipment only if trained and authorized to do so, and in accordance with the manufacturer’s directions.
- Personnel are to perform only tasks for which they have been properly trained and will advise their supervisor if they have been assigned a task for which they are not trained.
- The presence or consumption of alcoholic beverages or illicit drugs during the workday, including breaks, is strictly prohibited. Notify your supervisor if you must

take prescription or over-the-counter drugs that indicate they may cause drowsiness or, that you should not operate heavy equipment.
- Remain upwind during site activities whenever possible.

8.2 BUDDY SYSTEM

On-Site personnel must use the buddy system as required by operations. Use of the "buddy system" is required during all operations requiring Level C to Level A PPE, and when appropriate, during Level D operations. Crewmembers must observe each other for signs of chemical exposure, and heat or cold stress. Indications of adverse effects include, but are not limited to:

- Changes in complexion and skin coloration;
- Changes in coordination;
- Changes in demeanor;
- Excessive salivation and pupillary response; and
- Changes in speech pattern.

Crewmembers must also be aware of the potential exposure to possible safety hazards, unsafe acts, or non-compliance with safety procedures.

Field personnel must inform their partners or fellow crewmembers of non-visible effects of exposure to toxic materials that they may be experiencing. The symptoms of such exposure may include, but are not limited to:

- Headaches;
- Dizziness;
- Nausea;
- Blurred vision;
- Cramps; and
- Irritation of eyes, skin, or respiratory tract.

If protective equipment or noise levels impair communications, prearranged hand signals must be used for communication. Personnel must stay within line of sight of another team member.

8.3 HEAT STRESS

Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, etc., as well as the physical and conditioning characteristics of the individual. Since heat stress is one of the most common illnesses associated with

heavy outdoor work conducted with direct solar load and, in particular, because wearing PPE can increase the risk of developing heat stress, workers must be capable of recognizing the signs and symptoms of heat-related illnesses. Personnel must be aware of the types and causes of heat-related illnesses and be able to recognize the signs and symptoms of these illnesses in both themselves and their co-workers.

Heat rashes are one of the most common problems in hot work environments. Commonly known as prickly heat, a heat rash is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

Heat cramps are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused both by too much or too little salt.

Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution (plus or minus 0.3% NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for six (6) to eight (8) hours in heavy protective gear, a loss of sodium may occur. Drinking commercially available carbohydrate electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

Heat exhaustion occurs from increased stress on various body organs due to inadequate blood circulation, cardiovascular insufficiency, or dehydration. Signs and symptoms include pale, cool, moist skin; heavy sweating; dizziness; nausea; headache, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment.

Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended;

moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, which is a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment, be given fluid replacement, and be encouraged to get adequate rest.

Heat stroke is the most serious form of heat stress. Heat stroke occurs when the body's system of temperature regulation fails and the body's temperature rises to critical levels. This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict. Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature, e.g., a rectal temperature of 41°C (105.8°F). If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of workload and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protestations, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or exhaustion, that person may be predisposed to additional heat injuries.

8.4 HEAT STRESS SAFETY PRECAUTIONS

Heat stress monitoring and work rest cycle implementation should commence when the ambient adjusted temperature exceeds 72°F. A minimum work rest regimen and procedures for calculating ambient adjusted temperature are described in **Table 8.1** below.

Table 8.1 – Work/Rest Schedule

Adjusted Temperature[b]	Work/Rest Regimen Normal Work Ensemble[c]	Work/Rest Regimen Impermeable Ensemble
90ºF (32.2ºC) or above	After each 45 minutes of work	After each 15 minutes of work
87.5º - 90ºF (30.8º-32.2ºC)	After each 60 minutes of work	After each 30 minutes of work
82.5º - 87.5ºF (28.1º - 30.8ºC)	After each 90 minutes of work	After each 60 minutes of work
77.5º - 82.5ºF (25.3º - 28.1ºC)	After each 120 minutes of work	After each 90 minutes of work
72.5º - 77.5ºF (30.8º - 32.2ºC)	After each 150 minutes of work	After each 120 minutes of work

a. For work levels of 250 kilocalories/hour (Light-Moderate Type of Work)
b. Calculate the adjusted air temperature (ta adj) by using this equation: ta adj °F = ta °F + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)
c. A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.
d. The information presented above was generated using the information provided in the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV) Handbook.

In order to determine if the work rest cycles are adequate for the personnel and specific Site conditions, additional monitoring of individual heart rates will be conducted during the rest cycle. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one third and maintain the same rest period.

Additionally, one or more of the following control measures can be used to help control heat stress and are mandatory if any Site worker has a heart rate (measure immediately prior to rest period) exceeding 115 beats per minute:

- Site workers will be encouraged to drink plenty of water and electrolyte replacement fluids throughout the day.
- On-site drinking water will be kept cool (50 to 60°F).
- A work regimen that will provide adequate rest periods for cooling down will be established, as required.
- All personnel will be advised of the dangers and symptoms of heat stroke, heat exhaustion, and heat cramps.
- Cooling devices, such as vortex tubes or cooling vests, should be used when personnel must wear impermeable clothing in conditions of extreme heat.
- Employees should be instructed to monitor themselves and co-workers for signs of heat stress and to take additional breaks as necessary.

- A shaded rest area must be provided. All breaks should take place in the shaded rest area.
- Employees must not be assigned to other tasks during breaks.
- Employees must remove impermeable garments during rest periods. This includes white Tyvek-type garments.

All employees must be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress disorders.

8.5 COLD STRESS

Cold stress normally occurs in temperatures at or below freezing, or under certain circumstances, in temperatures of 40°F. Extreme cold for a short time may cause severe injury to exposed body surfaces or result in profound generalized cooling, causing death. Areas of the body that have high surface area-to-volume ratio, such as fingers, toes, and ears, are the most susceptible. Two (2) factors influence the development of a cold weather injury: ambient temperature and the velocity of the wind. For instance, 10°F with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at -18°F. An equivalent chill temperature chart relating the actual dry bulb temperature and wind velocity is presented in **Table 8.2** below.

Table 8.2– Wind Chill Temperature Chart

Estimated Wind Speed (in mph)	**Actual Temperature Reading (ºF)**											
	50	**40**	**30**	**20**	**10**	**0**	**-10**	**-20**	**-30**	**-40**	**-50**	**-60**
	Equivalent Chill Temperature (ºF)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect.)	**LITTLE DANGER Maximum danger of false sense of security.**				**INCREASING DANGER Danger from freezing of exposed flesh within one minute.**			**GREAT DANGER Flesh may freeze within 30 seconds.**				
	Trench foot and immersion foot may occur at any point on this chart.											

[This chart was developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA (Source: ACGIH Threshold Limit Values for Chemical Substances and Physical Agents)].

Local injury resulting from cold is included in the generic term frostbite. There are several degrees of tissue damage associated with frostbite. Frostbite of the extremities can be categorized into:

- *Frost Nip or Incipient Frostbite* - characterized by sudden blanching or whitening of skin.
- *Superficial Frostbite* - skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- *Deep Frostbite* - tissues are cold, pale, and solid; extremely serious injury.

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. It can be fatal. Its symptoms are usually exhibited in five stages: 1) shivering; 2) apathy, listlessness, sleepiness, and (sometimes) rapid cooling of the body to less than 95°F; 3) unconsciousness, glassy stare, slow pulse, and slow respiratory rate; 4) freezing of the extremities; and 5) death. Trauma sustained in freezing or sub-zero conditions requires special attention because an injured worker is predisposed to secondary cold injury. Special provisions must be made to prevent hypothermia and secondary freezing of damaged tissues in addition to providing for first aid treatment. To avoid cold stress, site personnel must wear protective clothing appropriate for the level of cold and physical activity. In addition to protective clothing, preventive safe work practices, additional training, and warming regimens may be utilized to prevent cold stress.

8.6 SAFETY PRECAUTIONS FOR COLD STRESS PREVENTION

For air temperature of 0°F or less, mittens should be used to protect the hands. For exposed skin, continuous exposure should not be permitted when air speed and temperature results in a wind chill temperature of -25°F.

At air temperatures of 36°F or less, field personnel who become immersed in water or whose clothing becomes wet must be immediately provided with a change of clothing and be treated for hypothermia.

If work is done at normal temperature or in a hot environment before entering the cold, the field personnel must ensure that their clothing is not wet as a consequence of sweating. Wet field personnel must change into dry clothes prior to entering the cold area.

If the available clothing does not give adequate protection to prevent hypothermia or frostbite, work must be modified or suspended until adequate clothing is made available or until weather conditions improve.

Field personnel handling evaporative liquid (e.g., gasoline, alcohol, or cleaning fluids) at air temperatures below 40°F must take special precaution to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling.

8.7 SAFE WORK PROCEDURES

Direct contact between bare skin and cold surfaces (< 20°F) should be avoided. Metal tool handles and/or equipment controls should be covered by thermal insulating material.

For work performed in a wind chill temperature at or below 10°F, workers should be under constant protective observation (buddy system). The work rate should be established to prevent heavy sweating that will result in wet clothing. For heavy work, rest periods must be taken in heated shelters and workers should be provided with an opportunity to change into dry clothing if needed.

Field personnel should be provided the opportunity to become accustomed to cold-weather working conditions and required protective clothing. Work should be arranged in such a way that sitting or standing still for long periods is minimized.

During the warming regimen (rest period), field personnel should be encouraged to remove outer clothing to permit sweat evaporation or to change into dry work clothing. Dehydration, or loss of body fluids, occurs insidiously in the cold environment and may increase susceptibility to cold injury due to a significant change in blood flow to the extremities. Fluid replacement with warm, sweet drinks and soups is recommended. The intake of coffee should be limited because of diuretic and circulatory effects.

8.8 BIOLOGICAL HAZARDS

Biological hazards may include poison ivy, snakes, thorny bushes and trees, ticks, mosquitoes, spiders, and other pests.

8.8.1 TICK BORNE DISEASES

Lyme Disease - The disease commonly occurs in summer and is transmitted by the bite of infected ticks. "Hot spots" in the United States include New York, New Jersey, Pennsylvania, Massachusetts, Connecticut, Rhode Island, Minnesota, and Wisconsin.

Erlichiosis - The disease also commonly occurs in summer and is transmitted by the bite of infected ticks. "Hot spots" in the United States include New York, Massachusetts, Connecticut, Rhode Island, Minnesota, and Wisconsin.

These diseases are transmitted primarily by the deer tick, which is smaller and redder than the common wood tick. The disease may be transmitted by immature ticks, which are small and hard to see. The tick may be as small as a period on this page.

Symptoms of Lyme disease include a rash or a peculiar red spot, like a bull's eye, which expands outward in a circular manner. The victim may have headache, weakness, fever, a stiff neck, and swelling and pain in the joints, and eventually, arthritis. Symptoms of erlichiosis include muscle and joint aches, flu-like symptoms, but there is typically no skin rash.

Rocky Mountain Spotted Fever (RMSF) - This disease is transmitted via the bite of an infected tick. The tick must be attached 4 to 6 hours before the disease-causing organism (Rickettsia rickettsii) becomes reactivated and can infect humans. The primary symptom of RMSF is the sudden appearance of a moderate-to-high fever. The fever may persist for two to three weeks. The victim may also have a headache, deep muscle pain, and chills. A rash appears on the hands and feet on about the third day and eventually spreads to all parts of the body. For this reason, RMSF may be confused with measles or meningitis. The disease may cause death, if untreated, but if identified and treated promptly, death is uncommon.

Control - Tick repellant containing diethyltoluamide (DEET) should be used when working in tick-infested areas, and pant legs should be tucked into boots. In addition, workers should search the entire body every three or four hours for attached ticks. Ticks should be removed promptly and carefully without crushing, since crushing can squeeze the disease-

causing organism into the skin. A gentle and steady pulling action should be used to avoid leaving the head or mouth parts in the skin. Hands should be protected with surgical gloves when removing ticks.

8.8.2 POISONOUS PLANTS

Poisonous plants may be present in the work area. Personnel should be alerted to its presence and instructed on methods to prevent exposure.

Control - The main control is to avoid contact with the plant, cover arms and hands, and frequently wash potentially exposed skin. Particular attention must be given to avoiding skin contact with objects or protective clothing that have touched the plants. Treat every surface that may have touched the plant as contaminated, and practice contamination avoidance. If skin contact is made, the area should be washed immediately with soap and water and observed for signs of reddening.

8.8.3 SNAKES

The possibility of encountering snakes exists, specifically for personnel working in wooded/vegetated areas. Snake venoms are complex and include proteins, some of which have enzymatic activity. The effects produced by venoms include neurotoxic effects with sensory, motor, cardiac, and respiratory difficulties; cytotoxic effects on red blood cells, blood vessels, heart muscle, kidneys, and lungs; defects in coagulation; and effects from local release of substances by enzymatic actions. Other noticeable effects of venomous snakebites include swelling, edema, and pain around the bite, and the development of ecchymosis (the escape of blood into tissues from ruptured blood vessels).

Control - To minimize the threat of snakebites, all personnel walking through vegetated areas must be aware of the potential for encountering snakes, and the need to avoid actions potentiating encounters, such as turning over logs, etc. If a snakebite occurs, an attempt should be made to safely identify the snake via size and markings. The victim must be transported to the nearest hospital within 30 minutes; first aid consists of applying a constriction band and washing the area around the wound to remove any unabsorbed venom.

8.8.4 SPIDERS

Personnel may encounter spiders during work activities.

Two spiders are of concern: the black widow and the brown recluse. Both prefer dark sheltered areas such as basements, equipment sheds and enclosures, and around woodpiles or other scattered debris. The black widow is shiny black, approximately one inch long, and has a distinctive red hourglass marking on the underside of its body. The black widow is found throughout the United States. The bite of a black widow is seldom fatal to healthy adults, but effects include respiratory distress, nausea, vomiting, and muscle spasms. The brown recluse is smaller than the black widow and gets its name from its brown coloring and behavior. It has a distinctive violin shape on the top of its body. The brown recluse is more prevalent in the southern United States. The bite of the brown recluse is painful and the bite site ulcerates and takes many weeks to heal completely.

Control - To minimize the threat of spider bites, all personnel walking through vegetated areas must be aware of the potential for encountering these arachnids. Personnel need to avoid actions that may result in encounters, such as turning over logs, and placing hands in dark places such as behind equipment or in corners of equipment sheds or enclosures. If a spider bite occurs, the victim must be transported to the nearest hospital as soon as possible; first aid consists of applying ice packs and washing the area around the wound to remove any unabsorbed venom.

8.9 NOISE

Exposure to noise over the OSHA action level can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increases with the intensity and duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on site.

Control - All personnel must wear hearing protection, with a Noise Reduction Rating (NRR) of at least 20, when noise levels exceed 85 dBA. When it is difficult to hear a co-worker at normal conversation distance, the noise level is approaching or exceeding 85 dBA, and hearing protection is necessary. All site personnel who may be exposed to noise must also

receive baseline and annual audiograms and training as to the causes and prevention of hearing loss. Noise monitoring is discussed in Section 5.2, Noise Monitoring.

Whenever possible, equipment that does not generate excessive noise levels will be selected for this project. If the use of noisy equipment is unavoidable, barriers or increased distance will be used to minimize worker exposure to noise, if feasible.

8.10 SPILL CONTROL

All personnel must take every precaution to minimize the potential for spills during site operations. All on-site personnel shall immediately report any discharge, no matter how small, to the FS.

Spill control equipment and materials will be located on the Site at locations that present the potential for discharge. All sorbent materials used for the cleanup of spills will be containerized and labeled appropriately. In the event of a spill, the FS will follow the provisions in Section 10.0, Emergency Procedures, to contain and control released materials and to prevent their spread to off-Site areas.

All petroleum spills that occur within New York State (NYS) must be reported to the NYS Spill Hotline (1-800-457-7362) within two (2) hours of discovery, except spills that meet **all of the following criteria:**

1. The quantity is known to be less than five (5) gallons; and
2. The spill is contained and under the control of the spiller; and
3. The spill has not and will not reach the State's water or any land; and
4. The spill is cleaned up within two (2) hours of discovery.

A spill is considered to have not impacted land if it occurs on a paved surface such as asphalt or concrete. A spill in a dirt or gravel parking lot is considered to have impacted land and is reportable.

8.11 SANITATION

Site sanitation will be maintained according to OSHA requirements.

8.11.1 BREAK AREA

Breaks must be taken in the SZ, away from the active work area after Site personnel go through decontamination procedures. There will be no smoking, eating, drinking, or chewing gum or tobacco in any area other than the SZ.

8.11.2 POTABLE WATER

The following rules apply to all field operations:

- An adequate supply of potable water will be provided at each project site. Potable water must be kept away from hazardous materials or media, and contaminated clothing or equipment.
- Portable containers used to dispense drinking water must be capable of being tightly closed and must be equipped with a tap dispenser. Water must not be consumed directly from the container (drinking from the tap is prohibited) nor may it be removed from the container by dipping.
- Containers used for drinking water must be clearly marked and shall not be used for any other purpose.
- Disposable drinking cups must be provided. A sanitary container for dispensing cups and a receptacle for disposing of used cups is required.

8.11.3 SANITARY FACILITIES

Access to facilities for washing before eating, drinking, or smoking, or alternate methods such as waterless hand-cleaner and paper towels will be provided.

8.11.4 LAVATORY

If permanent toilet facilities are not available, an appropriate number of portable chemical toilets will be provided. This requirement does not apply to mobile crews or to normally unattended Site locations so long as employees at these locations have transportation immediately available to nearby toilet facilities.

8.12 EMERGENCY EQUIPMENT

Adequate emergency equipment for the activities being conducted on site and as required by applicable sections of 29 CFR 1910 and 29 CFR 1926 will be on site prior to the commencement of project activities. Personnel will be provided with access to emergency equipment, including, but not limited to, the following:

- Fire extinguishers of adequate size, class, number, and location as required by applicable sections of 29 CFR 1910 and 1926;
- Industrial first aid kits of adequate size for the number of personnel on site; and

- Emergency eyewash and/or shower if required by operations being conducted on Site.

8.13 LOCKOUT/TAGOUT PROCEDURES

Only fully qualified and trained personnel will perform maintenance procedures. Before maintenance begins, lockout/tagout procedures per OSHA 29 CFR 1910.147 will be followed.

Lockout is the placement of a device that uses a positive means, such as lock, to hold an energy or material-isolating device such that the equipment cannot be operated until the lockout device is removed. If a device cannot be locked out, a tagout system shall be used. Tagout is the placement of a warning tag on an energy or material isolating device indicating that the equipment controls may not be operated until the personnel who attached the tag remove the tag.

8.14 ELECTRICAL SAFETY

Electricity may pose a particular hazard to Site workers due to the use of portable electrical equipment. If wiring or other electrical work is needed, a qualified electrician must perform it.

General electrical safety requirements include:

- All electrical wiring and equipment must be a type listed by Underwriters Laboratories (UL), Factory Mutual Engineering Corporation (FM), or other recognized testing or listing agency.
- All installations must comply with the National Electrical Safety Code (NESC), the National Electrical Code (NEC), or USCG regulations.
- Portable and semi-portable tools and equipment must be grounded by a multi-conductor cord having an identified grounding conductor and a multi-contact polarized plug-in receptacle.
- Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double insulated tools must be distinctly marked and listed by UL or FM.
- Live parts of wiring or equipment must be guarded to prevent persons or objects from touching them.
- Electric wire or flexible cord passing through work areas must be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching.
- All circuits must be protected from overload.

- Temporary power lines, switchboxes, receptacle boxes, metal cabinets, and enclosures around equipment must be marked to indicate the maximum operating voltage.
- Plugs and receptacles must be kept out of water unless of an approved submersible construction.
- All extension cord outlets must be equipped with ground fault circuit interrupters (GFCI).
- Attachment plugs or other connectors must be equipped with a cord grip and be constructed to endure rough treatment.
- Extension cords or cables must be inspected prior to each use and replaced if worn or damaged. Cords and cables must not be fastened with staples, hung from nails, or suspended by bare wire.
- Flexible cords must be used only in continuous lengths without splice, with the exception of molded or vulcanized splices made by a qualified electrician.

8.15 LIFTING SAFETY

Using proper lifting techniques may prevent back strain or injury. The fundamentals of proper lifting include:

- Consider the size, shape, and weight of the object to be lifted. A mechanical lifting device or additional persons must be used to lift an object if it cannot be lifted safely alone.
- The hands and the object should be free of dirt or grease that could prevent a firm grip.
- Gloves must be used, and the object inspected for metal slivers, jagged edges, burrs, or rough or slippery surfaces.
- Fingers must be kept away from points that could crush or pinch them, especially when putting an object down.
- Feet must be placed far enough apart for balance. The footing should be solid and the intended pathway should be clear.
- The load should be kept as low as possible, close to the body with the knees bent.
- To lift the load, grip firmly and lift with the legs, keeping the back as straight as possible.
- A worker should not carry a load that he or she cannot see around or over.
- When putting an object down, the stance and position are identical to that for lifting; the legs are bent at the knees, and the back is straight as the object is lowered.

8.16 LADDER SAFETY

When portable ladders are used for access to an upper landing surface, the ladder side rails shall extend at least three (3) feet (9 m) above the upper landing surface to which the ladder is used to gain access; or, when such an extension is not possible because of the ladder's length, then the ladder shall be secured at its top to a rigid support that will not deflect, and a grasping device, such as a grabrail, shall be provided to assist employees in

mounting and dismounting the ladder. In no case shall the extension be such that ladder deflection under a load would, by itself, cause the ladder to slip off its support.

- Ladders shall be maintained free of oil, grease, and other slipping hazards.
- Ladders shall not be loaded beyond the maximum intended load for which they were built, or beyond their manufacturer's rated capacity.
- Ladders shall be used only for the purpose for which they were designed.
- Non-self-supporting ladders shall be used at an angle such that the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder (the distance along the ladder between the foot and the top support).
- Wood job-made ladders with spliced side rails shall be used at an angle such that the horizontal distance is one-eighth the working length of the ladder.
- Fixed ladders shall be used at a pitch no greater than 90 degrees from the horizontal, as measured to the back side of the ladder.
- Ladders shall be used only on stable and level surfaces unless secured to prevent accidental displacement.
- Ladders shall not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental displacement. Slip-resistant feet shall not be used as a substitute for care in placing, lashing, or holding a ladder that is used upon slippery surfaces, including, but not limited to, flat metal or concrete surfaces that are constructed so they cannot be prevented from becoming slippery.
- Ladders placed in any location where they can be displaced by workplace activities or traffic, such as in passageways, doorways, or driveways, shall be secured to prevent accidental displacement, or a barricade shall be used to keep the activities or traffic away from the ladder.
- The area around the top and bottom of ladders shall be kept clear.
- The top of a non-self-supporting ladder shall be placed with the two rails supported equally unless it is equipped with a single support attachment.
- Ladders shall not be moved, shifted, or extended while occupied.
- Ladders shall have non-conductive side rails if they are used where the employee or the ladder could contact exposed energized electrical equipment.
- The top, top step, or the step labeled that it or any step above it should not be used as a step.
- Cross-bracing on the rear section of stepladders shall not be used for climbing unless the ladders are designed and provided with steps for climbing on both front and rear sections.
- Ladders shall be inspected by the HSM for visible defects on a daily basis and after any occurrence that could affect their safe use.
- Portable ladders with structural defects, such as, but not limited to, broken or missing rungs, cleats, or steps; broken or split rails; corroded components; or other faulty or defective components shall either be immediately marked in a manner that readily identifies them as defective or be tagged with "Do Not Use" or similar language and shall be withdrawn from service.
- Fixed ladders with structural defects, such as, but not limited to, broken or missing rungs, cleats, or steps; broken or split rails; or corroded components; shall be withdrawn from service.

- Ladder repairs shall restore the ladder to a condition meeting its original design criteria, before the ladder is returned to use.
- Single-rail ladders shall not be used.
- When ascending or descending a ladder, the user shall face the ladder.
- Each employee shall use at least one hand to grasp the ladder when progressing up and/or down the ladder.
- An employee shall not carry any object or load that could cause the employee to lose balance and fall.

8.17 TRAFFIC SAFETY

The project Site may be located adjacent to a public roadway where exposure to vehicular traffic is likely. Traffic may also be encountered as vehicles enter and exit the area. To minimize the likelihood of project personnel and activities being affected by traffic, the following procedures will be implemented.

Cones must be placed along the shoulder of the roadway starting 100 feet from the work area to alert passing motorists to the presence of personnel and equipment. A “Slow” or “Men Working” sign must be placed at the first cone. Barricades with flashing lights should be placed between the roadway and the work area.

During activities along a roadway, equipment will be aligned parallel to the roadway to the extent feasible, facing into the oncoming traffic so as to place a barrier between the work crew and the oncoming traffic. All crewmembers must remain behind the equipment and the traffic barrier.

All Site personnel who are potentially exposed to vehicular traffic must wear an outer layer of orange warning garments, such as vests, jackets, or shirts. If work is performed in hours of dusk or darkness, workers will be outfitted with reflective garments either orange, white (including silver-coated reflective coatings or elements that reflect white light), yellow, fluorescent red-orange, or fluorescent yellow-orange.

The flow of traffic into and out of the adjacent business must be assessed, and precautions taken to warn motorists of the presence of workers and equipment. Where possible, vehicles should be aligned to provide physical protection of people and equipment.

9.0 SITE-SPECIFIC HAZARDS AND CONTROL MEASURES

9.1 EVALUATION OF HAZARDS

The evaluation of hazards is provided as a quick reference as to the known conditions for the Site, wherein the level of detail for each of the subsections is identified.

9.1.1 HAZARD CHARACTERISTICS

Existing information for Site:
__X__ Detailed _____ Preliminary _____ None

Hazardous/Contaminated Material Form(s):
__X__ Solid __X__ Liquid _____ Sludge ___ Gas X Vapor

Containment Type(s):
_____ Drum _____ Tank _____ Pit _____ Debris
_____ Pond _____ Lagoon Other: None known

Hazardous Material Characteristics:
__X__ Volatile _____ Corrosive _____ Reactive _____ Radioactive
_____ Ignitable __X__ Toxic __X__ Unknown

Routes of Exposure:
__X__ Oral __X__ Dermal __X__ Eye __X__ Respiratory

9.1.2 POTENTIAL HEALTH AND SAFETY HAZARDS

__X__ Heat
__X__ Cold
__X__ Confined space entry
_____ Oxygen depletion
_____ Asphyxiation
__X__ Excavation
__X__ Cave-ins
__X__ Falls, slippage
__X__ Heavy equipment
_____ Other: Potential Ignition Hazard
__X__ Congested areas
__X__ General Construction
__X__ Physical injury
__X__ Electrical hazards
__X__ Handling and product transfer
__X__ Fire
__X__ Explosion
__X__ Biological Hazards
- __X__ Plants – Poison Ivy, Poison Oak
- __X__ Insects – Ticks
- __X__ Insects – Mosquitoes
- __X__ Insects – Bees and Wasps
- __X__ Rats and Mice

_____ Non-ionizing Radiation (i.e. UV, IR, etc.)

9.2 FIELD ACTIVITIES, HAZARDS AND CONTROL PROCEDURES

The following task-specific safety analyses identify potential health, safety, and environmental hazards associated with each type of field activity. Because of the complex and changing nature of field projects, supervisors must continually inspect the Site to

identify hazards that may affect on-Site personnel, the community, or the environment. The FS must be aware of these changing conditions and discuss them with the PM whenever these changes impact employee health, safety, the environment, or performance of the project. The FS will keep on-Site personnel informed of the changing conditions, and the PM will write and/or approve addenda or revisions to this HASP as necessary.

9.2.1 MOBILIZATION/CONSTRUCTION STAKEOUT

Description of Tasks

Site mobilization will include establishing excavation locations, determining the location of utilities and other installations, and establishing work areas. Mobilization will also include setting up equipment and establishing a temporary site office. A break area will be set up outside of regulated work areas. Mobilization may involve clearing areas for the SZ and CRZ. During this initial phase, project personnel will walk the Site to confirm the existence of anticipated hazards and identify safety and health issues that may have arisen since the writing of this plan.

Hazard Identification

The hazards of this phase of activity are associated with heavy equipment operation, manual materials handling, installation of temporary on-site facilities, and manual site preparation.

Manual materials handling and manual site preparation may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. Installation of temporary field office and support facilities may expose personnel to electrical hazards, underground and overhead utilities, and physical injury due to the manual lifting and moving of materials. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

Controls
Control procedures for these hazards are discussed in Section 8.0, General Safety Practices.

9.2.2 DEMOLITION/SITE-CLEARING

Description of Tasks
Site clearance will involve manual or mechanical removal of objects impeding access to the construction footprint. These obstructions are both natural and man-made items and will include, but not be limited to, fabricated metal and concrete structures, trees, vegetation, rubble, and miscellaneous trash/debris.

Hazard Identification
Hazards associated with demolition and site clearance include personnel working in and around potentially unstable structures, or locations of potential contact with hazardous chemicals, utilities, and/or falling objects. This task will involve manual, as well as mechanical demolition/clearance efforts so exertion and equipment hazards exist.

Controls
PPE – Personnel shall be protected from hazards of irritant and toxic plants and suitably instructed in the first aid treatment available.

Preparatory Operations – Prior to permitting employees to start demolition operations, an engineering survey shall be made, by a licensed Professional Engineer, of the structure to determine the stability of the structure. Any adjacent structure shall where personnel may be exposed shall also be similarly checked. The PO shall have in writing evidence that such a survey has been performed. All structural instabilities shall be shored or braced, under the supervision of a licensed Professional Engineer, prior to access by an FP.

Utilities – All electric, gas, water, steam, sewer, and other service lines shall be shut off, caped, or otherwise controlled, outside the building line before demolition work is started. In each case, any utility company that is involved shall be notified in advance. If it is necessary to maintain any power, water or other utilities during demolition, such lines shall be temporarily relocated, as necessary.

Hazardous Substances – It shall also be determined if any type of hazardous chemicals, gases, explosives, flammable materials, or similarly dangerous substances have been used in any pipes, tanks, or other equipment on the property. When the presence of any such substances is apparent or suspected, testing and purging shall be performed and the hazard eliminated before demolition is started.

Falling Debris/Objects – No material shall be dropped to any point lying outside the exterior walls of the structure unless the area is effective protected. Access to the area where falling objects/debris may be encountered must be gated and controlled.

Structural Collapse – Structural or load supporting members on any floor shall not be cut or removed until all stories above such a floor have been demolished and removed. Walls, which are to serve as retaining walls against which debris will be piled, shall not be so used unless capable of safely supporting the imposed load. Mechanical equipment shall not be used on floors or working surfaces unless such floors or surfaces are not of sufficient strength to support the imposed load.

Rollover Guards – All equipment used in site clearing operations shall be equipped with rollover guards meeting the applicable requirements. In addition, rider-operated equipment shall be equipped with an overhead and rear canopy guard meeting the applicable requirements.

Inspections – During demolition, continuing inspections by a licensed Professional Engineer shall be made as the work progresses to detect hazards resulting from weakened or deteriorated floors, walls, or loosened material. No FP shall be permitted to work where such hazards exist until they are corrected by shoring, bracing, or other effective means.

9.2.3 EXCAVATION AND CUT/FILL OPERATIONS

9.2.3.1 EXCAVATION TRENCHING

Description of Tasks

This task includes the excavation of contaminated soils and superficial debris. Excavation depths vary across the Site.

Hazard Identification

The hazards of this activity are associated with heavy equipment operation, subsurface intrusion, manual materials handling, stockpiling, and disposal. Subsurface intrusion presents hazards associated with negotiating buried utilities, cave-ins of the excavated areas, and regress methods for personnel working inside the excavated areas. Disruption of contaminated soil also presents a health hazard.

Controls

Underground Utilities – The estimated locations of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during the excavation work, shall be determined prior to opening an excavation. Utility companies or owners shall be contacted ("Call Before You Dig") within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation.

When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by save and acceptable means. While the excavation is open, underground installations shall be protected, supported, or removed, as necessary, to safeguard site personnel.

Cave-Ins – Project personnel in an excavation shall be protected from cave-ins by an adequate protective system, except when:

- Excavations are made entirely in stable rock or excavations are less than five feet in depth and examination of the ground by the SSO provides no indication of a potential cave-in.
- Protective systems shall have the capacity to resist, without failure, all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

Project personnel shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least two feet from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary.

Daily inspections of excavations, the adjacent areas, and protective systems shall be made by the SSO for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the SSO prior to the start of work and as needed throughout operations. Inspections shall also be made after every rainstorm or other hazard-increasing occurrence. These inspections are only required when project personnel exposure can be reasonably anticipated.

Where the SSO finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed personnel shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety.

Excavation Egress – A stairway, ladder, ramp, or other safe means of egress shall be located in trench excavations that are four feet or more in depth so as to require no more than 25 feet or lateral travel for project personnel.

9.2.3.2 HEAVY EQUIPMENT OPERATION

Description of Tasks
Heavy equipment to be used for this task include, but are not limited to, excavators, dozers, dump trucks, and water sprayers (if required).

Hazard Identification
The most common type of accident that occurs in material handling operations is the "caught between" situation when a load is being handled and an object gets caught between two moving parts of the equipment. Operation of the heavy construction equipment may produce harmful noise.

Controls
Equipment Inspection – All vehicles in use shall be checked prior to operation to ensure that all parts, equipment, and accessories that affect safe operations are in proper operating condition and free from defects. All defects shall be corrected before the vehicle is placed in service.

Ground Guides – No personnel shall use any motor vehicle, earthmoving, or compacting equipment having an obstructed view to the rear, unless:

- The vehicle has a reverse signal alarm distinguishable from the surrounding noise level; or
- The vehicle is backed up only when an observer signals that it is safe to do so.

Blocking – Heavy machinery, equipment, or parts thereof that are suspended or held aloft shall be substantially blocked to prevent falling or shifting before employees are permitted to work under or between them.

Noise – Control measures for noise are addressed in Section 8.9.

Traffic – Control measures for traffic are addressed in Section 8.17.

9.2.3.3 DISTURBANCE/HANDLING OF CONTAMINATED MATERIAL

Description of Tasks

After the contaminated soil is excavated from the Site, the material will be stockpiled, dried, and transported off Site. Excavated contaminated soil cannot be backfilled at the Site and meet the requirements for a Track 1 cleanup.

Hazard Identification

The hazards associated with materials handling include contact of the contaminated material with project personnel, or cross contamination with other site soil.

Controls

Cross Contamination – Following excavation, contaminated soil stockpiles will be placed on a structure constructed to separate the material from the site soil and collect any groundwater leachate. The material shall be covered to prevent storm water erosion or migration of contaminants through storm water.

Air Monitoring – Air and particulate monitoring will be conducted during soil excavation activities to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors or particulates in a concentration causing concern, personnel will upgrade to Level C protection. Refer to Section 5.1, Air Monitoring, for a description of air monitoring requirements and action levels. Air monitoring protocols are also presented in the Community Air Monitoring Plan (Appendix G of this RIWP). A description of each level of personal protection is included in Section 4.0, Personal Protective Equipment.

Traffic – Control measures for traffic are addressed in Section 8.17.

9.2.4 DRILLING/SUBSURFACE INTRUSION ACTIVITIES

Description of Tasks

Site mobilization will include establishing excavation locations, determining the location of utilities and other installations, and establishing work areas. Mobilization will also include setting up equipment and establishing a temporary Site office. A break area will be set up outside of regulated work areas. Mobilization may involve clearing areas for the SZ and CRZ. During this initial phase, project personnel will walk the Site to confirm the existence of anticipated hazards and identify safety and health issues that may have arisen since the writing of this plan.

Hazard Identification

The primary physical hazards for this activity are associated with the use of soil boring and grouting equipment. The equipment is hydraulically powered and uses static force and dynamic percussion force to advance sampling and penetrating tubes.

Accidents can occur as a result of improperly placing the equipment on uneven or unstable terrain or failing to adequately secure the equipment prior to the start of operations. Overhead utility lines can create hazardous conditions if contacted by the equipment. Underground installations such as electrical lines, conduit, and product lines pose a significant hazard if contacted.

Controls

Geoprobe and Drill Rig Safety Procedures - The operator of the equipment must possess required state or local licenses to perform such work. All members of the crew shall receive Site-specific training prior to beginning work.

The operator is responsible for the safe operation of the rig, as well as the crew's adherence to the requirements of this HASP. The operator must ensure that all safety equipment is in proper condition and is properly used. The members of the crew must follow all instructions of the operator, wear all personal protective equipment, and be aware of all hazards and control procedures. The operator and crew must participate in the Daily Safety Meetings and be aware of all emergency procedures.

Equipment Inspection - Each day, prior to the start of work, the rig and associated equipment must be inspected by the operator. The following items must be inspected:

- Vehicle condition;
- Proper storage of equipment;
- Condition of all hydraulic lines;
- Fire extinguisher; and
- First aid kit.

Equipment Set Up - The drill rig must be properly blocked and leveled prior to raising the derrick. The wheels which remain on the ground must be chocked. The leveling jacks shall not be raised until the derrick is lowered. The rig shall be moved only after the derrick has been lowered.

All well sites will be inspected by the driller prior to the location of the rig to verify a stable surface exists. This is especially important in areas where soft, unstable terrain is common.

The drill rig must be properly blocked and leveled prior to raising the derrick. Blocking provides a more stable drilling structure by evenly distributing the weight of the rig. Proper blocking ensures that differential settling of the rig does not occur.

When the ground surface is soft or otherwise unstable, wooden blocks, at least 24" by 24" and 4" to 8" thick shall be placed between the jack swivels and the ground. The emergency brake shall be engaged, and the wheels that are on the ground shall be chocked.

Rules for Intrusive Activity - Before beginning any intrusive activity, the existence and location of underground pipe, conduit, electrical equipment, and other installations will be determined. This will be done, if possible, by contacting the appropriate client representative to mark the location of the lines. “Call Before You Dig” will verify the potential for encountering subsurface utilities. If the client’s knowledge of the area is incomplete, an appropriate device, such as a magnetometer, will be used to locate the line.

Combustible gas readings of the general work area will be made regularly in areas where and/or during operations when the presence of flammable vapors or gases is suspected, such as during intrusive activities (see Section 5.1). Operations must be suspended and

corrective action taken if the airborne flammable concentration reaches 10% of the LEL in the immediate area (a one-foot radius) of the point of drilling, or near any other ignition sources.

Overhead Electrical Clearances - If equipment is operated in the vicinity of overhead power lines, the power to the lines must be shut off or the equipment must be positioned and blocked such that no part, including cables, can come within the minimum clearances as follows:

Nominal System Voltage	Minimum Required Clearance
0-50kV	10 feet
51-100kV	12 feet
101-200kV	15 feet
201-300kV	20 feet
301-500kV	25 feet
501-750kV	35 feet
751-1,000kV	45 feet

When the drill rig is in transit, with the boom lowered and no load, the equipment clearance must be at least 4 feet for voltages less than 50kV, 10 feet for voltages of 50 kV to 345 kV, and 16 feet for voltages above 345 kV.

Hoisting Operations - Drillers should never engage the rotary clutch without watching the rotary table, and ensuring it is clear of personnel and equipment.

Unless the drawworks is equipped with an automatic feed control, the brake should not be left unattended without first being tied down.

Drill pipe, auger strings or casing should be picked up slowly. Drill pipe should not be hoisted until the driller is sure that the pipe is latched in the elevator, or the derrickman has signaled that he may safely hoist the pipe.

During instances of unusual loading of the derrick or mast, such as when making an unusually hard pull, only the driller should be on the rig floor; no one else should be on the rig or derrick.

The brakes on the drawworks of the drill rig should be tested by the driller each day. The brakes should be thoroughly inspected by a competent individual each week.

A hoisting line with a load imposed should not be permitted to be in direct contact with any derrick member or stationary equipment, unless it has been specifically designed for line contact.

Workers should never stand near the borehole whenever any wire line device is being run.

Hoisting control stations should be kept clean and controls labeled as to their functions.

Catline Operations - Only experienced workers will be allowed to operate the cathead controls. The kill switch must be clearly labeled and operational prior to operation of the catline. The cathead area must be kept free of obstructions and entanglements.
The operator should not use more wraps than necessary to pick up the load. More than one layer of wrapping is not permitted.

Personnel should not stand near, step over, or go under a cable or catline which is under tension.

Employees rigging loads on catlines shall:

- Keep out from under the load;
- Keep fingers and feet where they will not be crushed;
- Be sure to signal clearly when the load is being picked;
- Use standard visual signals only and not depend on shouting to coworkers; and
- Make sure the load is properly rigged, since a sudden jerk in the catline will shift or drop the load.

Wire Rope - When two wires are broken or rust or corrosion is found adjacent to a socket or end fitting, the wire rope shall be removed from service or re-socketed. Special attention shall be given to the inspection of end fittings on boom support, pendants, and guy ropes.

Wire rope removed from service due to defects shall be cut up or plainly marked as being unfit for further use as rigging.

Wire rope clips attached with U-bolts shall have the U-bolts on the dead or short end of the rope; the clip nuts shall be re-tightened immediately after initial load carrying use and at frequent intervals thereafter.

When a wedge socket fastening is used, the dead or short end of the wire rope shall have a clip attached to it or looped back and secured to itself by a clip; the clip shall not be attached directly to the live end.

Protruding ends of strands in splices on slings and bridles shall be covered or blunted.

Except for eye splices in the ends of wires and for endless wire rope slings, wire rope used in hoisting, lowering, or pulling loads, shall consist of one continuous piece without knot or splice.

An eye splice made in any wire rope shall have not less that five full tucks.

Wire rope shall not be secured by knots. Wire rope clips shall not be used to splice rope.

Eyes in wire rope bridles, slings, or bull wires shall not be formed by wire clips or knots.
Pipe/Auger Handling - Pipe and auger sections shall be transported by cart or carried by two persons. Individuals should not carry auger or pipe sections without assistance.

Workers should not be permitted on top of the load during loading, unloading, or transferring of pipe or rolling stock.

Employees should be instructed never to try to stop rolling pipe or casing; they should be instructed to stand clear of rolling pipe.

Slip handles should be used to lift and move slips. Employees are not permitted to kick slips into position.

When pipe is being hoisted, personnel should not stand where the bottom end of the pipe could whip and strike them.

Pipe and augers stored in racks, catwalks or on flatbed trucks should be secured to prevent rolling.

9.2.5 SUBSURFACE CHEMICAL SAMPLE/COLLECTION ANALYSIS

Description of Tasks
This sub-task consists of the collection of soil samples for subsequent field and laboratory analysis. The physical hazards of soil sampling are primarily associated with the sample collection methods, procedures utilized, and the environment itself.

Hazard Identification
Incidental contact with COCs is the primary hazard associated with sampling the stabilized material. This contact may occur through the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. The primary hazards associated with these sampling procedures are not potentially serious; however, other operations in the area, or the conditions under which samples must be collected, may present chemical and physical hazards. The hazards directly associated with sampling procedures are generally limited to strains/sprains and potential eye hazards. Potential chemical hazards may include contact with media containing Site COCs and potential contact with chemicals used for equipment decontamination.

Controls
PPE – To control dermal exposure during sampling activities, a minimum of Level D protection will be worn. If necessary, based on field observations and site conditions, air monitoring may be conducted during sediment sampling activities. If the results of air monitoring indicate the presence of airborne contaminants in a concentration causing concern, personnel will upgrade to Level C protection. Refer to Section 5.1, Air Monitoring, for a description of air monitoring requirements and action levels. Air monitoring protocols are also presented in the Community Air Monitoring Plan (Appendix G of this RIWP). A description of each level of personal protection is included in Section 4.0, Personal Protective Equipment.

9.2.6 UST CLOSURE

9.2.6.1 WORKING IN CONFINED SPACES

Description of Tasks
The project may involve the closure of several USTs.

Hazard Identification
Closure activities may require the entrance into confined spaces to facilitate cleaning and removal of the USTs.

Controls
All personnel required to enter confined or enclosed spaces must be instructed as to the nature of the hazards involved, the necessary precautions to be taken, and in the use of required protective and emergency equipment. The PO shall comply with all specific regulations that apply to work in dangerous or potentially dangerous areas. All personnel entering the confined space will have achieved the appropriate OSHA training and the operation will be permitted, as necessary.

9.2.6.2 WORKING WITH COMPRESSED AIR

Description of Tasks
The proposed method of purging the USTs includes the injection of compressed gas into the tank and attached piping network.

Hazard Identification
Uncontrolled release of the highly pressured air can cause injury to FP during this task. Cylinders must also be properly managed to ensure they are not compromised during storage and/or use.

Controls
Pressure Regulation – Compressed air used for cleaning purposes shall be reduced to less than 30 pounds per square inch and then only with effective chip guarding and personal protective equipment.

Cylinder Storage – Valve protection caps shall be in place and secured when compressed gas cylinders are transported, moved, or stored. Cylinder valves shall be closed when work is finished and when cylinders are empty or are moved. Compressed gas cylinders shall be secured in an upright position at all times, except if necessary for short periods of time when cylinders are actually being hoisted or carried. Cylinders shall be placed in a location where they cannot become part of an electrical circuit.

9.2.7 DECONTAMINATION

All equipment will be decontaminated before leaving the Site. Personnel involved in decontamination activities may be inadvertently exposed to skin contact with contaminated materials and chemicals brought from the EZ. Personnel involved in decontamination activities must wear PPE that is, at a minimum, one level below the level worn by personnel working in the EZ.

9.2.8 DEMOBILIZATION

Demobilization involves the removal of all tools, equipment, supplies, and vehicles brought to the site. The hazards of this phase of activity are associated with heavy equipment operation and manual materials handling.

Manual materials handling may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. Heavy equipment operation presents noise and vibration hazards, and hot surfaces, to operators. Personnel in the vicinity of heavy equipment operation may be exposed to physical hazards resulting in fractures, contusions, and lacerations and may be exposed to high noise levels. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, and heat-or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

Control procedures for these hazards are discussed in Section 8.0, General Safety Practices.

9.3 CHEMICAL HAZARDS

The chemical hazards associated with site operations are related to inhalation, ingestion, and skin exposure to Site COCs. Concentrations of airborne COCs during Site tasks may be measurable and will require air monitoring during certain operations. Air monitoring

requirements for Site tasks are outlined in Section 5.1. Air monitoring protocols are also presented in the Community Air Monitoring Plan (Appendix G of this RIWP).

COCs at the Site include heavy metals, some VOC compounds, some SVOC compounds, PCBs, pesticides and PFOS.

The potential for inhalation of site COCs is low. The potential for dermal contact with soils containing Site COCs during remedial operations is moderate. **Table 9.1** lists the primary contaminants that have been identified at the Site and the media in which they are present.

Table 9.1 – List of Primary Contaminants

Media: Soil		
Metals	**Maximum Concentration (mg/kg)**	**Applicable Monitoring Instrument**
Cadmium	2.84	Not Applicable
Copper	97.7	Not Applicable
Lead	523	Not Applicable
Mercury	2.24	Not Applicable
Nickel	62	Not Applicable
Zinc	278	Not Applicable
VOCs	**Maximum Concentration (mg/kg)**	**Applicable Monitoring Instrument**
Acetone	0.077	PID
Tetrachloroethene	17	PID
Trichloroethene	2.2	PID
SVOCs	**Maximum Concentration (mg/kg)**	**Applicable Monitoring Instrument**
Benzo(a)anthracene	11	Not Applicable
Benzo(a)pyrene	13	Not Applicable
Benzo(b)fluoranthene	15	Not Applicable
Benzo(k)fluoranthene	3.6	Not Applicable
Chrysene	9.8	Not Applicable
Dibenzo(a,h)anthracene	1.6	Not Applicable
Indeno(1,2,3-cd)pyrene	9	Not Applicable
Pesticides	**Maximum Concentration (mg/kg)**	**Applicable Monitoring Instrument**
4,4'-DDD	0.0075	Not Applicable
4,4'-DDE	0.0196	Not Applicable
4,4'-DDT	0.0361	Not Applicable
Dieldrin	0.0173	Not Applicable
PCBs	**Maximum**	**Applicable Monitoring**

	Concentration (mg/kg)	**Instrument**
PCBs (Total)	0.114	Not Applicable
PFAS	**Maximum Concentration (mg/kg)**	**Applicable Monitoring Instrument**
PFOS	0.928	Not Applicable

Media: Groundwater		
VOCs	**Maximum Concentration (ug/L)**	**Applicable Monitoring Instrument**
Tetrachloroethene	4,000	PID
Vinyl Chloride	600	PID
Trichloroethene	980	PID
Cis-1,2-dichloroethene	1500	PID
Naphthalene	12	PID
1,2,4,5-Tetramethylbenzene	16	PID
Acetone	290	PID

Media: Soil Vapor		
VOCs	**Maximum Concentration (ug/m^3)**	**Applicable Monitoring Instrument**
cis-1,2-Dichloroethene	527	PID
Tetrachloroethene	50,100	PID
Trichloroethene	10,100	PID
Vinyl chloride	22	PID

10.0 EMERGENCY PROCEDURES

10.1 GENERAL

Prior to the start of operations, the work area will be evaluated for the potential for fire, contaminant release, or other catastrophic event. Unusual conditions or events, activities, chemicals, and conditions will be reported to the FS/SSO immediately.

The FS/SSO will establish evacuation routes and assembly areas for the Site. All personnel entering the Site will be informed of this route and the assembly area.

All petroleum spills that occur within NYS must be reported to the NYS Spill Hotline (1-800-457-7362) within two (2) hours of discovery, except spills that meet **all the following criteria:**

1. The quantity is known to be less than five (5) gallons; and
2. The spill is contained and under the control of the spiller; and
3. The spill has not and will not reach the State's water or any land; and
4. The spill is cleaned up within two (2) hours of discovery.

A spill is considered to have not impacted land if it occurs on a paved surface such as asphalt or concrete. A spill in a dirt or gravel parking lot is considered to have impacted land and is reportable.

10.2 EMERGENCY RESPONSE

If an incident occurs, the following steps will be taken:

- The FS/SSO will evaluate the incident and assess the need for assistance and/or evacuation;
- The FS/SSO will call for outside assistance as needed;
- The FS/SSO will ensure the PM is notified promptly of the incident; and
- The FS/SSO will take appropriate measures to stabilize the incident scene.

10.2.1 FIRE

In the case of a fire at the Site, the FS/SSO will assess the situation and direct fire-fighting activities. The FS/SSO will ensure that the PM is immediately notified of any fires. Site personnel will attempt to extinguish the fire with available extinguishers, if safe to do so. In the event of a fire that Site personnel are unable to safely extinguish with one (1) fire extinguisher, the local fire department will be summoned.

10.2.2 CONTAMINANT RELEASE

In the event of a contaminant release, the following steps will be taken:

- Notify FS/SSO immediately;
- Evacuate immediate area of release;
- Conduct air monitoring to determine needed level of PPE; and
- Don required level of PPE and prepare to implement control procedures.

The FS/SSO has the authority to commit resources as needed to contain and control released material and to prevent its spread to off-Site areas.

10.3 MEDICAL EMERGENCY

All employee injuries must be promptly reported to the SSO/FS, who will:

- Ensure that the injured employee receives prompt first aid and medical attention;
- In emergency situations, the worker is to be transported by appropriate means to the nearest urgent care facility (normally a hospital emergency room); and
- If the injured person is a SESI employee, notify SESI at 973-808-9050.

10.3.1 EMERGENCY CARE STEPS

Survey the scene. Determine if it is safe to proceed. Try to determine if the conditions that caused the incident are still a threat. Protect yourself from exposure before attempting to rescue the victim.

- Do a primary survey of the victim. Check for airway obstruction, breathing, and pulse. Assess likely routes of chemical exposure by examining the eyes, mouth, nose, and skin of the victim for symptoms.
- Phone Emergency Medical Services (EMS). Give the location, telephone number used, caller's name, what happened, number of victims, victim's condition, and help being given.
- Maintain airway and perform rescue breathing as necessary.
- Perform CPR as necessary.
- Do a secondary survey of the victim. Check vital signs and do a head-to-toe exam.

Treat other conditions as necessary. If the victim can be moved, take him/her to a location away from the work area where EMS can gain access.

10.4 FIRST AID GENERAL

All persons must report any injury or illness to their immediate supervisor or the FS. Trained personnel will provide first aid. Injuries and illnesses requiring medical treatment must be documented. The FS and SSO must fill out an accident/incident report as soon as emergency conditions no longer exist and first aid and/or medical treatment has been

ensured. The report must be completed and submitted to the PM within 24 hours after the incident.

If first-aid treatment is required, first aid kits are kept at the CRZ. If treatment beyond first aid is required, the injured person(s) should be transported to the medical facility. If the injured person is not ambulatory or shows any sign of not being in a comfortable and stable condition for transport, then an ambulance/paramedics should be summoned. If there is any doubt as to the injured worker's condition, it is best to let the local paramedic or ambulance service examine and transport the worker.

10.4.1 FIRST AID—INHALATION

Any employee complaining of symptoms of chemical overexposure as described in Section 4, General Site Safety Procedures, will be removed from the work area and transported to the designated medical facility for examination and treatment.

10.4.2 FIRST AID—INGESTION

Call EMS and consult a poison control center for advice. If available, refer to the MSDS for treatment information. If the victim is unconscious, keep them on their side and clear the airway if vomiting occurs.

10.4.3 FIRST AID—SKIN CONTACT

Project personnel who have had skin contact with contaminants will, unless the contact is severe, proceed through the CRZ, to the wash area. Personnel will remove any contaminated clothing, and then flush the affected area with water for at least 15 minutes. The worker should be transported to the medical facility if he/she shows any sign of skin reddening, irritation, or if he/she requests a medical examination.

10.4.4 FIRST AID—EYE CONTACT

Project personnel who have had contaminants splashed in their eyes or who have experienced eye irritation while in the EZ, must immediately proceed to the eyewash station in the CRZ. Do not decontaminate prior to using the eyewash. Remove whatever protective clothing is necessary to use the eyewash. Flush the eye with clean running water for at least 15 minutes. Arrange prompt transport to the designated medical facility.

10.5 REPORTING INJURIES, ILLNESSES, AND SAFETY INCIDENTS

Injuries and illnesses, however minor, will be reported to the FS immediately. The FS will complete an injury report and submit it to the HSM, and the PM by end of shift.

10.6 EMERGENCY INFORMATION

The means to summon local public response agencies such as police, fire, and ambulance will be reviewed in the daily safety meeting. These agencies are identified in **Table 10.1** below.

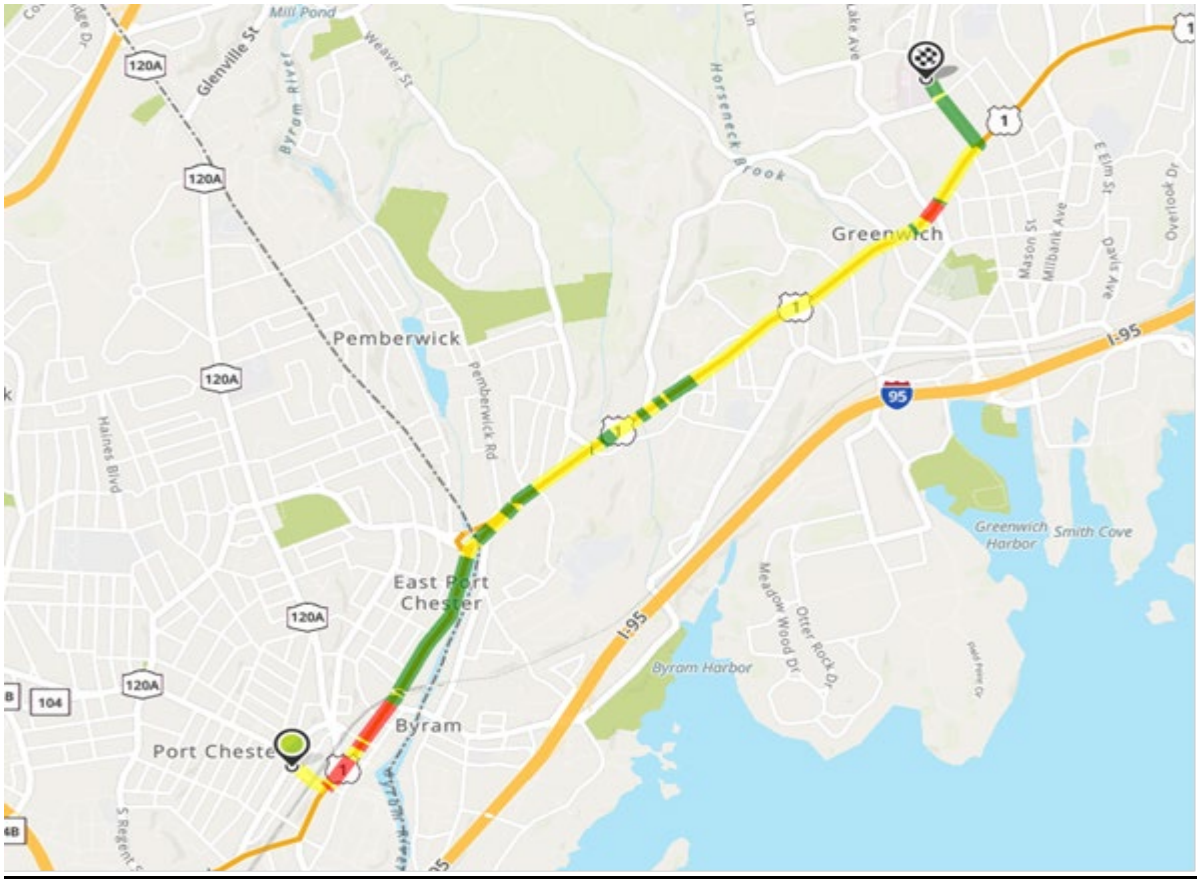
Table 10.1 – Emergency Contacts

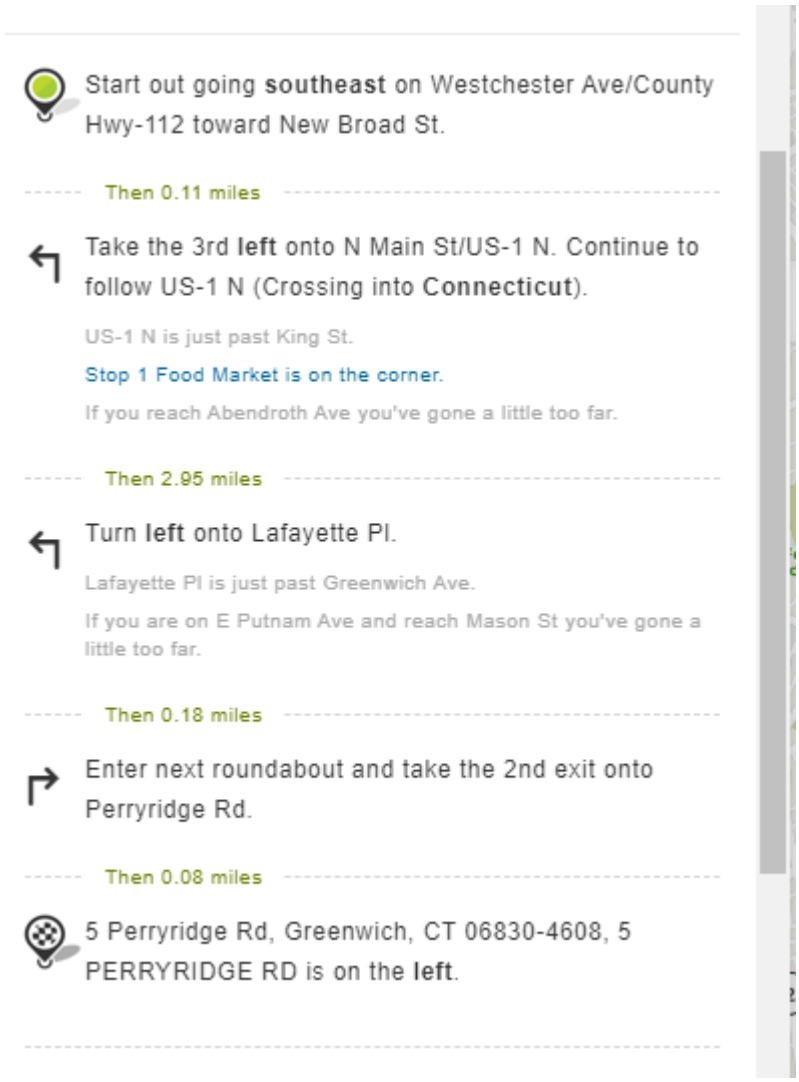
Local Emergency Contacts	**Telephone No.**
EMERGENCY	911
Greenwich Hospital	(203) 863-3000
Police Emergency	911
Fire Emergency	911
Rescue Squad	911
Ambulance	911
Miscellaneous Contacts	**Telephone No.**
N.Y. Poison Control Center	(800) 222-1222
National Response Center and Terrorist Hotline	(800) 424-8802
Center for Disease Control	(800) 311-3435
Utility Mark-Out	(800) 962-7962

10.6.1 DIRECTIONS TO HOSPITAL

Greenwich Hospital
5 Perryridge Road, Greenwich, CT
(203) 863-3000

Directions to Hospital:





Greenwich Hospital is depicted on **Figure 10.1**

11.0 LOGS, REPORTS, AND RECORD KEEPING

The following is a summary of required health and safety logs, reports, and record keeping for the operations at the subject Site.

11.1 HASP FIELD CHANGE REPORT

To be completed for initiating a change to the HASP. PM approval is required. The original will be kept in the project file (See Attachment 3).

11.2 MEDICAL AND TRAINING RECORDS

The HSM must obtain and keep a log of personnel meeting appropriate training and medical qualifications for the site work. The log will be kept in the project file. Each company's Human Resources Department will maintain medical records, in accordance with 29 CFR 1910.1020.

11.3 EXPOSURE RECORDS

Any personnel monitoring results, laboratory reports, calculations, and air sampling data sheets are part of an employee exposure record. These records will be kept in accordance with 29 CFR 1910.1020. For SESI employees, the originals will be sent to the Human Resources Manager. For subcontractor employees, the original file will be sent to the subcontractor employer with a copy maintained in the SESI project file.

11.4 ACCIDENT/INCIDENT REPORT

Any accident/incident reports must be completed following procedures given in Section 10.5 of this HASP. The originals will be sent to the HSM for maintenance. A copy of the forms will be kept in the project file. (See Attachment 4)

11.5 OSHA FORM 200

An OSHA Form 200 (Log of Occupational Injuries and Illnesses) will be kept at the project Site. All recordable injuries or illnesses will be recorded on this form. At the end of the project, the original will be sent to the Human Resources Manager for maintenance. Subcontractor employees must also meet the requirements of maintaining an OSHA 200 Form. The accident/incident report meets the requirements of OSHA Form 101 (Supplemental Record), which must be maintained with the OSHA Form 200 for all recordable injuries or illnesses.

11.6 ON-SITE HEALTH AND SAFETY FIELD LOGBOOKS

The HSM or designee will maintain an on-Site health and safety logbook in which daily Site conditions, activities, personnel, and significant events will be recorded. Calibration records and personnel monitoring results, if available, will also be recorded in the field logbook. The original logbook will be kept in the project file.

Whenever any personnel monitoring is conducted onsite, the monitoring results will be noted in the filed logbook. These will become part of the exposure records file and will be maintained by the HSM.

A signatory page is included (See Attachment 5) and is to be signed by those working on and/or visiting the Site.

11.7 MATERIAL SAFETY DATA SHEETS

Material Safety Data Sheets (MSDS) will be obtained and kept on file at the project site for each hazardous chemical brought to, use, or stored at the Site (See Attachment 6).

12.0 COVID-19 RESPONSE ACTION PLAN

SESI is concerned with the safety and well-being of its employees, vendors, subcontractors, and others with access to its offices and job sites, with particular emphasis on the unique challenges posed by COVID-19.

SESI has established the following protocols in keeping with the recommendations of the CDC and other sources including State Governor Executive Orders for work taking place on construction sites.

We request that all SESI employees, vendors, and subcontractors help with our prevention efforts while at work.

To minimize the spread of COVID-19, we must all cooperate in doing the following:

- Wash your hands regularly with soap and water or clean them with alcohol-based hand rub.
- Cover your mouth and nose with a mask when in public settings or around others.
- Maintain at least six (6) feet distance between you and people coughing or sneezing.
- Avoid touching your face.
- Cover your mouth and nose when coughing or sneezing.
- Stay home if you feel unwell.
- Refrain from smoking and other activities that weaken the lungs.
- Practice physical distancing by avoiding unnecessary travel and staying away from large groups of people.

The following are the specific jobsite protocols and response actions to be taken in the event someone on Site has been in contact with, or has themselves, the COVID-19 virus:

OFFICE/JOBSITE PROTOCOL

What To Do if Not Subject to Quarantine:

- Wear a well-fitting mask around others for 10 days from the date of last close contact with someone with COVID-19 (the date of last close contact is considered day 0)
- Get tested at least 5 days after the date of last close contact with someone with COVID-19. If test is positive or COVID-19 symptoms develop, isolate from other people and follow recommendations in the Isolation section of this guidance document.
- Anyone who had COVID-19 within the last 90 days and has since recovered and remained symptom free, does not need to get tested after close contact with someone with COVID-19.

- If an exposed person who does not have to quarantine cannot separate from one or more individuals with COVID-19 who are in isolation (e.g., because the exposed person lives in the same household with a sick individual who needs care), then the exposed person will have ongoing exposure until the infected person is no longer contagious. See detailed testing and mask recommendations in the "Ongoing COVID-19 Exposure FAQs" section of CDC's quarantine and isolation page.
- If an exposed person who does not have to quarantine travels during the 10 days after last close contact, the person should wear a well-fitting mask when around others for the entire duration of travel during the 10 days. Anyone unable to wear a mask should not travel during the ten (10) days. Travelers should get tested at least five (5) days after the date of the last close contact, receive a negative test result before travel or further travel, and be symptom free

RESPONSE ACTION TRIGGER EVENTS:

- an employee/worker at work has tested positive for COVID-19
- an employee/worker at work has suspected, but unconfirmed, case of COVID-19
- an employee/worker self-reported that they came in contact with someone who had a presumptive positive case of COVID-19
- an employee/worker has been exposed to the virus but only found out after they have interacted with others

RESPONSE ACTIONS:

- Upon occurrence of any of the Trigger Events above, employees/subcontractors shall notify SESI Management about the suspected employee/worker infected with, or exposed to, COVID-19.
- SESI Management will investigate the incident to confirm the report is valid.
- Employees/Subcontractors shall investigate their respective infected employee(s) and report the following to SESI Management and HR:
    - Identify all individuals who worked in proximity (six feet) of the infected employee/worker,
    - Employee(s)/Worker(s) infected with the COVID-19 virus, and employee(s)/worker(s) that came in contact with the infected employee/worker shall be sent home for a period of 10 days,
    - Do not identify the infected employee/worker by name to avoid violation of privacy/confidentiality laws, and,
    - Keep SESI Management informed of progress and updates.

- If an infected person was in the office, SESI will clean and disinfect common areas and surfaces, in accordance with CDC recommendations.
- SESI Management will notify affected employees/workers of the Trigger Event and instruct them to take the response actions above.

- **SESI Management policy requires written documentation from a health care professional, that confirmed infected employees can return to work.**

Except for circumstances in which SESI is legally required to report workplace occurrences of communicable disease, the confidentiality of all medical conditions will be maintained in accordance with applicable law and to the extent practical under the circumstances. When

required, the number of persons who will be informed of an employee's/worker's condition will be kept at the minimum needed to appropriately notify other potentially affected employees/workers of Trigger Events and to attempt to minimize the potential for transmission of the virus.

Attachment 1:
Air Monitor Log

Air Monitoring: Sample Collection and Analysis

Date & Time of Monitoring	Task / Operation Being	Substance(s)/ Hazard(s) Being	Monitoring Location	Type/Method of Monitoring	Monitoring Results	Exposure Limits	Required Action

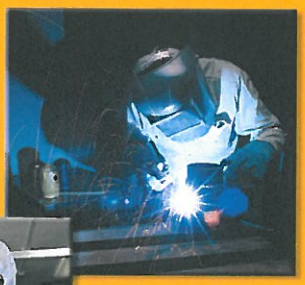
Attachment 2:
OSHA Poster

Job Safety and Health

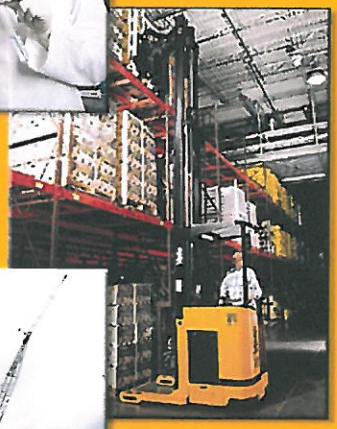
It's the law!

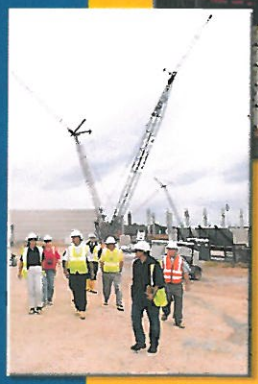
OSHA®

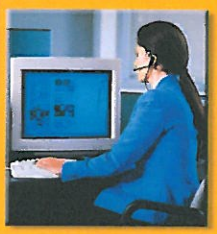
Occupational Safety and Health Administration
U.S. Department of Labor











EMPLOYEES:

- You have the right to notify your employer or OSHA about workplace hazards. You may ask OSHA to keep your name confidential.
- You have the right to request an OSHA inspection if you believe that there are unsafe and unhealthful conditions in your workplace. You or your representative may participate in that inspection.
- You can file a complaint with OSHA within 30 days of retaliation or discrimination by your employer for making safety and health complaints or for exercising your rights under the *OSH Act*.
- You have the right to see OSHA citations issued to your employer. Your employer must post the citations at or near the place of the alleged violations.
- Your employer must correct workplace hazards by the date indicated on the citation and must certify that these hazards have been reduced or eliminated.
- You have the right to copies of your medical records and records of your exposures to toxic and harmful substances or conditions.
- Your employer must post this notice in your workplace.
- You must comply with all occupational safety and health standards issued under the *OSH Act* that apply to your own actions and conduct on the job.

EMPLOYERS:

- You must furnish your employees a place of employment free from recognized hazards.
- You must comply with the occupational safety and health standards issued under the *OSH Act*.

This free poster available from OSHA –
The Best Resource for Safety and Health

Free assistance in identifying and correcting hazards or complying with standards is available to employers, without citation or penalty, through OSHA-supported consultation programs in each state.

1-800-321-OSHA (6742)
www.osha.gov

OSHA 3165-02 2012R

Attachment 3:
Field Change Request Form

HEALTH & SAFETY PLAN
CHANGE NOTICE

Pages _____ of _____

Project: H&S-CN

1) HASP VERSION: _____ SECTION: _____ PAGE (s): _____

RE: --- Change to existing HASP Anticipated Revision Date: _____
--- Addition to existing HASP
--- Other: _____
_____CONT._____

2) PROPOSED CHANGE: _____
_____
_____
_____

3) REASON FOR PROPOSED CHANGE(s):
--- Required by SPEC or Change Order --- Other: _____
--- Disposition of Deficiency _____CONT._____
--- Change in Regulatory or Other Requirements
--- Operational Experience

4) EXHIBITS ATTACHED ____ NO ____ YES (If YES, describe) _____
_____CONT._____

5) PMK APPROVALS PROJECT MANAGER: _____ Date: _____
SITE MANAGER: _____ Date: _____
H&S MANAGER: _____ Date: _____

Client Approval Required: ____ NO ____ YES (If YES, date submitted) _____

6) CLIENT APPROVAL _____ APPROVED _____ REMANDED _____ REJECTED

Comments: _____
_____
_____ CONT._____

Client Representative: _____Date: _____

7) DISTRIBUTION AFTER APPROVAL

X HASP UPDATE LIST --- OTHER: _____
X CLIENT _____
X PROJECT FILES _____

8) PREPARED BY: _____Date: _____
Title: _____

Attachment 4:
Injury Report Form

OSHA's Form 301
Injury and Illness Incident Report

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

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

Form approved OMB no. 1218-0176

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

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

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

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

Completed by _____

Title _____

Phone (_____)_____-_____ Date ___/___/___

Information about the employee

1) Full name _____

2) Street _____

City _____ State _____ ZIP _____

3) Date of birth ___/___/___

4) Date hired ___/___/___

5) ☐ Male
☐ Female

Information about the physician or other health care professional

6) Name of physician or other health care professional _____

_____

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

Facility _____

Street _____

City _____ State _____ ZIP _____

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

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

Information about the case

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

11) Date of injury or illness ___/___/___

12) Time employee began work _____ AM / PM

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

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

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

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

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

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

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

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

Log of Work-Related Injuries and Illnesses

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

Year 20__ __

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

Form approved OMB no. 1218-0176

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

Establishment name _____

City _____ State _____

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

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

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

Injury (1) Skin disorder (2) Respiratory condition (3) Poisoning (4) Hearing loss (5) All other illnesses (6)

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

Summary of Work-Related Injuries and Illnesses

Year 20__ __

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

Form approved OMB no. 1218-0176

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

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

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

Number of Cases

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

Number of Days

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

Injury and Illness Types

Total number of . . .	(M)		
(1) Injuries	_____	(4) Poisonings	_____
		(5) Hearing loss	_____
(2) Skin disorders	_____	(6) All other illnesses	_____
(3) Respiratory conditions	_____		

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

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

Establishment information

Your establishment name _____

Street _____

City _____ State _____ ZIP _____

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

_____

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

__ __ __ __

OR

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

__ __ __ __ __ __

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

Annual average number of employees _____

Total hours worked by all employees last year _____

Sign here

Knowingly falsifying this document may result in a fine.

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

_____ _____
Company executive Title

( ) - / /
Phone Date

Attachment 5:
Signatory Page

Attachment 5 – Site-Specific Health and Safety Orientation Signatory Page
HEALTH AND SAFETY PLAN

Title	Name	Signature
Project Manager:	TBD	
Health and Safety Manager:	TBD	

I have read the attached Health and Safety Plan (HASP) and have received site-specific information and orientation regarding the identified physical, chemical, and biological hazards anticipated at this site. My signature certifies that I understand the procedures, equipment, and restrictions applicable to this project site and agree to abide by them.

Signature	Printed Name	Company	Date

Attachment 5– Health and Safety Orientation Signatory Page (continued)

Signature	Printed Name	Company	Date

Attachment 6:

Material Safety Data Sheets

SAFETY DATA SHEET

Version 4.10
Revision Date 08/10/2016
Print Date 11/10/2018

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Cadmium

Product Number : 265330
Brand : Aldrich
Index-No. : 048-002-00-0

CAS-No. : 7440-43-9

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Inhalation (Category 2), H330
Germ cell mutagenicity (Category 2), H341
Carcinogenicity (Category 1B), H350
Reproductive toxicity (Category 2), H361
Specific target organ toxicity - repeated exposure (Category 1), H372
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word Danger

Hazard statement(s)
H330 Fatal if inhaled.
H341 Suspected of causing genetic defects.
H350 May cause cancer.
H361 Suspected of damaging fertility or the unborn child.
H372 Causes damage to organs through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P284	Wear respiratory protection.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/doctor.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Cd
Molecular weight	:	112.41 g/mol
CAS-No.	:	7440-43-9
EC-No.	:	231-152-8
Index-No.	:	048-002-00-0

Hazardous components

Component	Classification	Concentration
Cadmium Included in the Candidate List of Substances of Very High Concern (SVHC) according to Regulation (EC) No. 1907/2006 (REACH)		
	Acute Tox. 2; Muta. 2; Carc. 1B; Repr. 2; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H330, H341, H350, H361, H372, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Move out of dangerous area.Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Air sensitive.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
	Remarks	Substance listed; for more information see OSHA document 1910.1027		
Cadmium	7440-43-9	TWA	0.1 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the		

		Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		TWA	0.2 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.3 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		CEIL	0.6 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect.		
		Potential Occupational Carcinogen See Appendix A		
		TWA	0.01 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen varies		
		TWA	0.002 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen varies		
		PEL	0.005 mg/m3	OSHA Specifically Regulated Chemicals/Carcinogens
		1910.1027 This standard applies to all occupational exposures to cadmium and cadmium compounds, in all forms, and in all industries covered by the Occupational Safety and Health Act, except the construction-related industries, which are covered under 29 CFR 1926.63. OSHA specifically regulated carcinogen		
		PEL	0.005 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		see Sections 1532 & 5207		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Cadmium	7440-43-9	cadmium	5 µg/l	In blood	ACGIH - Biological Exposure Indices (BEI)
	Remarks	Not critical			
		cadmium	5µg/g creatinine	Urine	ACGIH - Biological Exposure Indices (BEI)
		Not critical			

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: granular Colour: light grey
b)	Odour	odourless
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 320.9 °C (609.6 °F) - lit.
f)	Initial boiling point and boiling range	765 °C (1,409 °F) - lit.
g)	Flash point	Not applicable

h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	8.65 g/cm3 at 25 °C (77 °F)
n)	Water solubility	0.0023 g/l at 20 °C (68 °F)
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Oxidizing agents, acids

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Cadmium/cadmium oxides
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 2,330 mg/kg

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC: 1 - Group 1: Carcinogenic to humans (Cadmium)

NTP: Known to be human carcinogenThe reference note has been added by TD based on the background information of the NTP. (Cadmium)

OSHA: OSHA specifically regulated carcinogen (Cadmium)

Reproductive toxicity

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: EU9800000

Damage to the lungs., Kidney injury may occur., prolonged or repeated exposure can cause:, Vomiting, Diarrhoea, Lung irritation

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 0.001 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.024 mg/l - 48 h
Toxicity to algae	static test EC50 - Selenastrum capricornutum (green algae) - 0.023 mg/l - 72 h (OECD Test Guideline 201)

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
Bioaccumulation: Oncorhynchus mykiss (rainbow trout) - 72 d - 1.27 µg/l

Bioconcentration factor (BCF): 55

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
Very toxic to aquatic life with long lasting effects.
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3288 Class: 6.1 Packing group: II
Proper shipping name: Toxic solid, inorganic, n.o.s. (Cadmium)
Reportable Quantity (RQ): 10 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3288 Class: 6.1 Packing group: II EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, INORGANIC, N.O.S. (Cadmium)
Marine pollutant:yes

IATA
UN number: 3288 Class: 6.1 Packing group: II
Proper shipping name: Toxic solid, inorganic, n.o.s. (Cadmium)

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Cadmium	7440-43-9	2007-07-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. Cadmium	7440-43-9	2009-02-01
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Cadmium	7440-43-9	2009-02-01

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H330	Fatal if inhaled.
H341	Suspected of causing genetic defects.
H350	May cause cancer.
H361	Suspected of damaging fertility or the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	4
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	4
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.10 Revision Date: 08/10/2016 Print Date: 11/10/2018

SAFETY DATA SHEET

Version 4.8
Revision Date 09/03/2017
Print Date 11/10/2018

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Copper

Product Number : 31284
Brand : Aldrich

CAS-No. : 7440-50-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Not a hazardous substance or mixture.

2.2 GHS Label elements, including precautionary statements

Not a hazardous substance or mixture.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula : Cu
Molecular weight : 63.55 g/mol
CAS-No. : 7440-50-8
EC-No. : 231-159-6

Hazardous components

Component	Classification	Concentration
Copper		
		90 - 100 %

4. FIRST AID MEASURES

4.1 Description of first aid measures

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration.

In case of skin contact
Wash off with soap and plenty of water.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Avoid dust formation. Avoid breathing vapours, mist or gas.
For personal protection see section 8.

6.2 Environmental precautions
No special environmental precautions required.

6.3 Methods and materials for containment and cleaning up
Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Store under inert gas. Air sensitive.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Copper	7440-50-8	TWA	1.000000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Irritation Gastrointestinal metal fume fever		
		TWA	0.200000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Irritation Gastrointestinal metal fume fever		
		TWA	1.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	1.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	1.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	1.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.100000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	1 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Irritation Gastrointestinal metal fume fever		
		TWA	0.2 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Irritation Gastrointestinal metal fume fever		
		TWA	1 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	1 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	1 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.1 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		PEL	0.1 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)

8.2 Exposure controls

Appropriate engineering controls
General industrial hygiene practice.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
No special environmental precautions required.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: Wire Colour: light red
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 1,083.4 °C (1,982.1 °F)
f)	Initial boiling point and boiling range	2,567 °C (4,653 °F)
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available

k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	8.940 g/cm3
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong acids, Strong oxidizing agents, Acid chlorides, Halogens

10.6 Hazardous decomposition products
Other decomposition products - No data available
Hazardous decomposition products formed under fire conditions. - Copper oxides
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

LD50 Intraperitoneal - Mouse - 3.5 mg/kg

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: GL5325000

Symptoms of systemic copper poisoning may include: capillary damage, headache, cold sweat, weak pulse, and kidney and liver damage, central nervous system excitation followed by depression, jaundice, convulsions, paralysis, and coma. Death may occur from shock or renal failure. Chronic copper poisoning is typified by hepatic cirrhosis, brain damage and demyelination, kidney defects, and copper deposition in the cornea as exemplified by humans with Wilson's disease. It has also been reported that copper poisoning has lead to hemolytic anemia and accelerates arteriosclerosis.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods

IMDG
Not dangerous goods

IATA
Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
No SARA Hazards

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Copper	7440-50-8	1989-08-11

	CAS-No.	Revision Date
Copper	7440-50-8	1989-08-11

New Jersey Right To Know Components

	CAS-No.	Revision Date
Copper	7440-50-8	1989-08-11

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.8 Revision Date: 09/03/2017 Print Date: 11/10/2018

SAFETY DATA SHEET

Version 4.11
Revision Date 10/12/2018
Print Date 06/28/2019

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Lead

Product Number : 391352
Brand : Aldrich

CAS-No. : 7439-92-1

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Carcinogenicity (Category 2), H351
Reproductive toxicity (Category 2), H361
Specific target organ toxicity - repeated exposure (Category 2), H373
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word Warning

Hazard statement(s)

H302	Harmful if swallowed.
H351	Suspected of causing cancer.
H361	Suspected of damaging fertility or the unborn child.
H373	May cause damage to organs through prolonged or repeated exposure.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.

P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell. Rinse mouth.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Pb
Molecular weight	:	207.20 g/mol
CAS-No.	:	7439-92-1
EC-No.	:	231-100-4

Hazardous components

Component	Classification	Concentration
Lead		
	Acute Tox. 4; Carc. 2; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H302, H351, H372, H410	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place.
Storage class (TRGS 510): 6.1D: Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
	Remarks	See 1910.1025		
Lead	7439-92-1	TWA	0.05 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Confirmed animal carcinogen with unknown relevance to humans		
		TWA	0.05 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Hematologic effects Peripheral Nervous System impairment Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed animal carcinogen with unknown relevance to humans		

		TWA	0.05 mg/m3	USA. NIOSH Recommended Exposure Limits
		See Appendix C		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
	-	Lead	200 µg/l	In blood	ACGIH - Biological Exposure Indices (BEI)
	Remarks	Not critical			

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance — Form: powder

b) Odour — No data available

c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 327.4 °C (621.3 °F) - lit.
f)	Initial boiling point and boiling range	1,740 °C (3,164 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong acids

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Lead oxides
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity

Rat
Cytogenetic analysis

Carcinogenicity

Limited evidence of carcinogenicity in animal studies

IARC:	2B - Group 2B: Possibly carcinogenic to humans (Lead)
NTP:	RAHC - Reasonably anticipated to be a human carcinogenThe reference note has been added by TD based on the background information of the NTP. (Lead)
OSHA:	OSHA specifically regulated carcinogen (Lead)

Reproductive toxicity

Reproductive toxicity - Rat - Inhalation
Effects on Newborn: Biochemical and metabolic.

Reproductive toxicity - Rat - Oral
Effects on Newborn: Behavioral.

Reproductive toxicity - Mouse - Oral
Effects on Fertility: Female fertility index (e.g., # females pregnant per females mated). Effects on Fertility: Pre-implantation mortality (e.g., reduction in numbe corpora lutea).

May damage fertility. May damage the unborn child.

Developmental Toxicity - Rat - Inhalation
Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow).

Developmental Toxicity - Rat - Oral
Specific Developmental Abnormalities: Blood and lymphatic system (including spleen and marrow). Effects on Newborn: Growth statistics (e.g., reduced weight gain).

Developmental Toxicity - Rat - Oral
Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.

Developmental Toxicity - Mouse - Oral
Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Effects on Embryo or Fetus: Fetal death.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

Additional Information
RTECS: OF7525000

anemia

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	mortality LOEC - Oncorhynchus mykiss (rainbow trout) - 1.19 mg/l - 96.0 h
	LC50 - Micropterus dolomieui - 2.2 mg/l - 96.0 h
	mortality NOEC - Salvelinus fontinalis - 1.7 mg/l - 10.0 d
Toxicity to daphnia and other aquatic invertebrates	mortality LOEC - Daphnia (water flea) - 0.17 mg/l - 24 h
	mortality NOEC - Daphnia (water flea) - 0.099 mg/l - 24 h
Toxicity to algae	mortality EC50 - Skeletonema costatum - 7.94 mg/l - 10 d

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential

Bioaccumulation	Oncorhynchus kisutch - 2 Weeks - 150 µg/l
	Bioconcentration factor (BCF): 12

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Lead)
Reportable Quantity (RQ): 10 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Lead)
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Lead)

Further information

EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Lead	7439-92-1	2015-11-23

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Lead	7439-92-1	2015-11-23

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Lead	7439-92-1	2015-11-23

	CAS-No.	Revision Date
Lead	7439-92-1	2015-11-23

New Jersey Right To Know Components

	CAS-No.	Revision Date
Lead	7439-92-1	2015-11-23

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. Lead	7439-92-1	2009-02-01
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Lead	7439-92-1	2009-02-01

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H302	Harmful if swallowed.
H351	Suspected of causing cancer.
H361	Suspected of damaging fertility or the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure.
H373	May cause damage to organs through prolonged or repeated exposure.

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.11 Revision Date: 10/12/2018 Print Date: 06/28/2019

SAFETY DATA SHEET

Version 3.15
Revision Date 03/05/2018
Print Date 11/10/2018

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Mercury

Product Number : 215457
Brand : Sigma-Aldrich
Index-No. : 080-001-00-0

CAS-No. : 7439-97-6

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Inhalation (Category 2), H330
Reproductive toxicity (Category 1B), H360
Specific target organ toxicity - repeated exposure (Category 1), H372
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word Danger

Hazard statement(s)
H330 Fatal if inhaled.
H360 May damage fertility or the unborn child.
H372 Causes damage to organs through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.
P260 Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.

P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P284	Wear respiratory protection.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/doctor.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Hg
Molecular weight	:	200.59 g/mol
CAS-No.	:	7439-97-6
EC-No.	:	231-106-7
Index-No.	:	080-001-00-0

Hazardous components

Component	Classification	Concentration
Mercury		
	Acute Tox. 2; Repr. 1B; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H330, H360, H372, H410	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Wear respiratory protection. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal. In some instances, a mercury spill kit may be used. Please consult with your site EHS representative to determine the most appropriate clean up method.Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Store under inert gas.
Storage class (TRGS 510): 6.1B: Non-combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Mercury	7439-97-6	C	0.1 mg/m3	USA. NIOSH Recommended Exposure Limits
	Remarks	Potential for dermal absorption		
		CEIL	1.0mg/10m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		TWA	0.05 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		Skin notation		

		TWA	0.025 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen Danger of cutaneous absorption		
		TWA	0.05 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential for dermal absorption		

8.2 Exposure controls

Appropriate engineering controls
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: silver, white

b)	Odour	odourless
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: -38.87 °C (-37.97 °F) - lit.
f)	Initial boiling point and boiling range	356.6 °C (673.9 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	< 0.01 hPa (< 0.01 mmHg) at 20 °C (68 °F) 1 hPa (1 mmHg) at 126 °C (259 °F)
l)	Vapour density	6.93 - (Air = 1.0)
m)	Relative density	13.55 g/cm3 at 25 °C (77 °F)
n)	Water solubility	0.00006 g/l at 25 °C (77 °F)
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

Relative vapour density	6.93 - (Air = 1.0)

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents, Ammonia, Azides, Nitrates, Chlorates, Copper

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Mercury/mercury oxides.
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

LC50 Inhalation - Rat - male - 2 h - < 27 mg/m3

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
Presumed human reproductive toxicant

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

Additional Information
RTECS: OV4550000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	mortality LC50 - Cyprinus carpio (Carp) - 0.160 mg/l - 96 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential

Bioaccumulation	Carassius auratus (goldfish) - 1,789 d - 0.25 µg/l

Bioconcentration factor (BCF): 155,986

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 2809 Class: 8 (6.1) Packing group: III
Proper shipping name: A. W. Mercury
Reportable Quantity (RQ): 1 lbs
Poison Inhalation Hazard: No

IMDG

IATA
UN number: 2809 Class: 8 (6.1) Packing group: III
Proper shipping name: Mercury

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Mercury	7439-97-6	2015-11-23

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Mercury	7439-97-6	2015-11-23

	CAS-No.	Revision Date
Mercury	7439-97-6	2015-11-23

New Jersey Right To Know Components

	CAS-No.	Revision Date
Mercury	7439-97-6	2015-11-23

California Prop. 65 Components

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Mercury	CAS-No. 7439-97-6	Revision Date 2013-12-20

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H330	Fatal if inhaled.
H360	May damage fertility or the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
Repr.	Reproductive toxicity

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 3.15 Revision Date: 03/05/2018 Print Date: 11/10/2018

SAFETY DATA SHEET

Version 4.9
Revision Date 04/24/2018
Print Date 10/19/2018

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Nickel

Product Number : 577995
Brand : Aldrich
Index-No. : 028-002-01-4

CAS-No. : 7440-02-0

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Skin sensitisation (Category 1), H317
Carcinogenicity (Category 2), H351
Specific target organ toxicity - repeated exposure, Inhalation (Category 1), H372
Acute aquatic toxicity (Category 3), H402
Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word Danger

Hazard statement(s)

H317	May cause an allergic skin reaction.
H351	Suspected of causing cancer.
H372	Causes damage to organs through prolonged or repeated exposure if inhaled.
H412	Harmful to aquatic life with long lasting effects.

Precautionary statement(s)

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.

P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P272	Contaminated work clothing should not be allowed out of the workplace.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P333 + P313	If skin irritation or rash occurs: Get medical advice/ attention.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Ni
Molecular weight	:	58.69 g/mol
CAS-No.	:	7440-02-0
EC-No.	:	231-111-4
Index-No.	:	028-002-01-4

Hazardous components

Component	Classification	Concentration
Nickel, powder [particle diameter < 1 mm]		
	Skin Sens. 1; Carc. 2; STOT RE 1; Aquatic Acute 3; Aquatic Chronic 3; H317, H351, H372, H412	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Handle and store under inert gas. Keep in a dry place.
Storage class (TRGS 510): 4.1B: Flammable solid hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Nickel, powder [particle diameter < 1 mm]	7440-02-0	TWA	1.5 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Dermatitis Pneumoconiosis Not suspected as a human carcinogen		

		PEL	0.5 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		TWA	1 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.015 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder Colour: grey

b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point: 1,455 °C (2,651 °F)
f)	Initial boiling point and boiling range	2,730 °C (4,946 °F)
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	1 hPa (1 mmHg) at 1,810 °C (3,290 °F)
l)	Vapour density	No data available
m)	Relative density	8.9 g/cm3 at 25 °C (77 °F)
n)	Water solubility	insoluble
o)	Partition coefficient: n-octanol/water	Not applicable for inorganic substances
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
acids, Oxidizing agents, Sulphur compounds, Hydrogen gas, Oxygen, Methanol, organic solvents, Aluminium, Fluorine, Ammonia

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Nickel/nickel oxides
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - male and female - > 9,000 mg/kg
(OECD Test Guideline 401)

Dermal: No data available

No data available

Skin corrosion/irritation

Skin - Rabbit
Result: No skin irritation - 4 h
(OECD Test Guideline 404)

Serious eye damage/eye irritation

Eyes - Rabbit
Result: No eye irritation
(OECD Test Guideline 405)

Respiratory or skin sensitisation

Germ cell mutagenicity

No data available

Carcinogenicity

Limited evidence of carcinogenicity in animal studies

IARC:	1 - Group 1: Carcinogenic to humans (Nickel, powder [particle diameter < 1 mm])
	2B - Group 2B: Possibly carcinogenic to humans (Nickel, powder [particle diameter < 1 mm])
IARC:	1 - Group 1: Carcinogenic to humans (Nickel, powder [particle diameter < 1 mm])
	2B - Group 2B: Possibly carcinogenic to humans (Nickel, powder [particle diameter < 1 mm])
NTP:	RAHC - Reasonably anticipated to be a human carcinogen (Nickel, powder [particle diameter < 1 mm])
OSHA:	No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure

No data available

Specific target organ toxicity - repeated exposure

Inhalation - Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard

No data available

Additional Information

Repeated dose toxicity	Rat - male and female - Inhalation - LOAEL : 0.0001 mg/l - OECD Test Guideline 451

RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Stomach - Irregularities - Based on Human Evidence
Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	semi-static test LC50 - Oncorhynchus mykiss (rainbow trout) - 15.3 mg/l - 96 h

12.2 Persistence and degradability

The methods for determining biodegradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential

12.4 Mobility in soil

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3089 Class: 4.1 Packing group: II
Proper shipping name: Metal powders, flammable, n.o.s.
Reportable Quantity (RQ): 100 lbs
Poison Inhalation Hazard: No

IMDG

IATA

UN number: 3089 Class: 4.1 Packing group: II
Proper shipping name: Metal powder, flammable, n.o.s.

15. REGULATORY INFORMATION

SARA 302 Components

This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Nickel, powder [particle diameter < 1 mm]	7440-02-0	2007-07-01

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Nickel, powder [particle diameter < 1 mm]	7440-02-0	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Nickel, powder [particle diameter < 1 mm]	7440-02-0	2007-07-01

California Prop. 65 Components

, which is/are known to the State of California to cause cancer.	CAS-No.	Revision Date
For more information go to www.P65Warnings.ca.gov.	7440-02-0	2007-09-28
Nickel, powder [particle diameter < 1 mm]		

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H317	May cause an allergic skin reaction.
H351	Suspected of causing cancer.
H372	Causes damage to organs through prolonged or repeated exposure if inhaled.
H402	Harmful to aquatic life.
H412	Harmful to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	*
Flammability:	1
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	1
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.9 Revision Date: 04/24/2018 Print Date: 10/19/2018

SAFETY DATA SHEET

Version 5.8
Revision Date 10/12/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Zinc

Product Number : 96454
Brand : Sigma-Aldrich

CAS-No. : 7440-66-6

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Combustible dust,
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word Warning

Hazard statement(s)

May form combustible dust concentrations in air
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P273 Avoid release to the environment.
P391 Collect spillage.
P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

Combustible dust

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2 Mixtures

Formula : Zn
Molecular weight : 65.39 g/mol

Hazardous components

Component		Classification	Concentration
Zinc powder (stabilized)			
CAS-No. EC-No. Index-No.	7440-66-6 231-175-3 030-001-01-9	Aquatic Acute 1; Aquatic Chronic 1; H410	<= 100 %
Zinc oxide			
CAS-No. EC-No. Index-No.	1314-13-2 215-222-5 030-013-00-7	Aquatic Acute 1; Aquatic Chronic 1; H410	>= 5 - < 10 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Special powder against metal fire Dry sandUse water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable extinguishing media
Water

5.2 Special hazards arising from the substance or mixture

Zinc/zinc oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation.
For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place.
Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Zinc oxide	1314-13-2	TWA	2.000000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	metal fume fever		
		STEL	10.000000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		metal fume fever		

		TWA	5.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	5.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	10.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		C	15.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	5.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	15.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	5.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	5.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder Colour: grey
b)	Odour	odourless
c)	Odour Threshold	No data available
d)	pH	Not applicable
e)	Melting point/freezing point	Melting point/range: 420 °C (788 °F) - lit.
f)	Initial boiling point and boiling range	907 °C (1,665 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	May form combustible dust concentrations in air
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	Not applicable
l)	Vapour density	No data available
m)	Relative density	7.133 g/mL at 25 °C (77 °F)
n)	Water solubility	insoluble
o)	Partition coefficient: n-octanol/water	Not applicable
p)	Auto-ignition temperature	does not ignite
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	During processing, dust may form explosive mixture in air.
t)	Oxidizing properties	No data available

9.2 Other safety information

Bulk density	1.8 - 3.2 kg/m3

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Dust may form explosive mixture in air.

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents, Acids and bases

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available (Zinc powder (stabilized))

Inhalation: No data available (Zinc powder (stabilized))

Dermal: No data available (Zinc powder (stabilized))

No data available (Zinc powder (stabilized))

Skin corrosion/irritation
No data available (Zinc powder (stabilized))

Serious eye damage/eye irritation
No data available (Zinc powder (stabilized))

Respiratory or skin sensitisation
Did not cause sensitisation on laboratory animals. (Zinc powder (stabilized))

Germ cell mutagenicity
No data available (Zinc powder (stabilized))

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available (Zinc powder (stabilized))

No data available (Zinc powder (stabilized))

Specific target organ toxicity - single exposure
No data available (Zinc powder (stabilized))

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available (Zinc powder (stabilized))

Additional Information
RTECS: ZG8600000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Effects due to ingestion may include:, chills, dry throat, sweet taste, Fever, Cough, Nausea, Vomiting, Weakness, Contact with eyes or skin may cause:, Irritation (Zinc powder (stabilized))

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Cyprinus carpio (Carp) - 450 µg/l - 96 h (Zinc powder (stabilized))
Toxicity to daphnia and other aquatic invertebrates	LC50 - Daphnia magna (Water flea) - 0.068 mg/l - 48 h (Zinc powder (stabilized))
	mortality NOEC - Daphnia (water flea) - 0.101 - 0.14 mg/l - 7 d (Zinc powder (stabilized))

12.2 Persistence and degradability

The methods for determining the biological degradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential

Bioaccumulation	Algae - 7 d at 16 °C - 5 µg/l (Zinc powder (stabilized))
	Bioconcentration factor (BCF): 466

12.4 Mobility in soil

No data available (Zinc powder (stabilized))

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Zinc powder (stabilized))
Reportable Quantity (RQ): 1020 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Zinc powder (stabilized))
Marine pollutant:yes

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Zinc powder (stabilized))

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Zinc oxide	1314-13-2	2007-03-01
Zinc powder (stabilized)	7440-66-6	1993-04-24

SARA 311/312 Hazards
No SARA Hazards

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Zinc powder (stabilized)	7440-66-6	1993-04-24
Zinc oxide	1314-13-2	2007-03-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Zinc powder (stabilized)	7440-66-6	1993-04-24
Zinc oxide	1314-13-2	2007-03-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Zinc powder (stabilized)	7440-66-6	1993-04-24
Zinc oxide	1314-13-2	2007-03-01

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

	May form combustible dust concentrations in air
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.8 Revision Date: 10/12/2015 Print Date: 05/01/2016

SAFETY DATA SHEET

Version 6.1
Revision Date 05/28/2017
Print Date 06/29/2019

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Acetone

Product Number : 650501
Brand : SIGALD
Index-No. : 606-001-00-8

CAS-No. : 67-64-1

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 Spruce Street
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 2), H225
Eye irritation (Category 2A), H319
Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word Danger

Hazard statement(s)
H225 Highly flammable liquid and vapour.
H319 Causes serious eye irritation.
H336 May cause drowsiness or dizziness.

Precautionary statement(s)
P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233 Keep container tightly closed.

P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/ eye protection/ face protection.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor if you feel unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

Repeated exposure may cause skin dryness or cracking.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	C_3H_6O
Molecular weight	:	58.08 g/mol
CAS-No.	:	67-64-1
EC-No.	:	200-662-2
Index-No.	:	606-001-00-8

Hazardous components

Component	Classification	Concentration
Acetone		
	Flam. Liq. 2; Eye Irrit. 2A; STOT SE 3; H225, H319, H336	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters
Components with workplace control parameters
Derived No Effect Level (DNEL)

Application Area	Exposure routes	Health effect	Value
Workers	Skin contact	Long-term systemic effects	186mg/kg BW/d
Consumers	Ingestion	Long-term systemic effects	62mg/kg BW/d
Consumers	Skin contact	Long-term systemic effects	62mg/kg BW/d
Workers	Inhalation	Acute systemic effects	2420 mg/m3
Workers	Inhalation	Long-term systemic effects	1210 mg/m3

Consumers	Inhalation	Long-term systemic effects	200 mg/m3

Predicted No Effect Concentration (PNEC)

Compartment	Value
Soil	33.3 mg/kg
Marine water	1.06 mg/l
Fresh water	10.6 mg/l
Marine sediment	3.04 mg/kg
Fresh water sediment	30.4 mg/kg
Onsite sewage treatment plant	100 mg/l

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: butyl-rubber
Minimum layer thickness: 0.3 mm
Break through time: 480 min
Material tested:Butoject® (KCL 897 / Aldrich Z677647, Size M)

Splash contact
Material: butyl-rubber
Minimum layer thickness: 0.3 mm
Break through time: 480 min
Material tested:Butoject® (KCL 897 / Aldrich Z677647, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industria situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Impervious clothing, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engine protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid, clear Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available

d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: -94 °C (-137 °F)
f)	Initial boiling point and boiling range	56 °C (133 °F) at 1013 hPa
g)	Flash point	-17.0 °C (1.4 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 13 %(V) Lower explosion limit: 2 %(V)
k)	Vapour pressure	533.3 hPa at 39.5 °C (103.1 °F) 245.3 hPa at 20.0 °C(68.0 °F)
l)	Vapour density	No data available
m)	Relative density	0.791 g/mL at 25 °C (77 °F)
n)	Water solubility	completely miscible
o)	Partition coefficient: n-octanol/water	log Pow: -0.24
p)	Auto-ignition temperature	465.0 °C (869.0 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

Surface tension	23.2 mN/m at 20.0 °C (68.0 °F)

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Vapours may form explosive mixture with air.

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Bases, Oxidizing agents, Reducing agents, Acetone reacts violently with phosphorous oxychloride.

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 5,800 mg/kg(Acetone)
Remarks: Behavioral:Altered sleep time (including change in righting reflex). Behavioral:Tremor. Behavioral:Headache. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhoea.
LC50 Inhalation - Rat - 8 h - 50,100 mg/m3(Acetone)
Remarks: Drowsiness Dizziness Unconsciousness
LD50 Dermal - Guinea pig - 7,426 mg/kg(Acetone)
No data available(Acetone)

Skin corrosion/irritation
Skin - Rabbit(Acetone)
Result: Mild skin irritation - 24 h

Serious eye damage/eye irritation
Eyes - Rabbit(Acetone)
Result: Eye irritation - 24 h

Respiratory or skin sensitisation
- Guinea pig(Acetone)
Result: Does not cause skin sensitisation.

Germ cell mutagenicity

No data available(Acetone)

Carcinogenicity
This product is or contains a component that is not classifiable as to its classification.(Acetone)
(Acetone)
(Acetone)

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available(Acetone)

No data available(Acetone)

Specific target organ toxicity - single exposure
May cause drowsiness or dizziness.(Acetone)

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available(Acetone)

Additional Information
RTECS: AL3150000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.(Acetone)

Kidney - Irregularities - Based on Human Evidence
Skin - Dermatitis - Based on Human Evidence

Kidney - Irregularities - Based on Human Evidence(Acetone)
Skin - Dermatitis - Based on Human Evidence(Acetone)

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 5,540 mg/l - 96 h(Acetone)
Toxicity to daphnia and other aquatic invertebrates	LC50 - Daphnia magna (Water flea) - 8,800 mg/l - 48 h(Acetone)
Toxicity to algae	Remarks: No data available

12.2 Persistence and degradability

Biodegradability: Result: 91 % - Readily biodegradable.
(OECD Test Guideline 301B)

12.3 Bioaccumulative potential

Does not bioaccumulate.

12.4 Mobility in soil

No data available(Acetone)

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber b highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1090 Class: 3 Packing group: II
Proper shipping name: Acetone
Reportable Quantity (RQ) : 5000 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 1090 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: ACETONE

IATA
UN number: 1090 Class: 3 Packing group: II
Proper shipping name: Acetone

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Acetone	67-64-1	

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Acetone	67-64-1	

New Jersey Right To Know Components

	CAS-No.	Revision Date
Acetone	67-64-1	

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

H225	Highly flammable liquid and vapour.
H319	Causes serious eye irritation.
H336	May cause drowsiness or dizziness.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956
Version: 6.1 Revision Date: 05/28/2017 Print Date: 06/29/2019

SAFETY DATA SHEET

Version 4.11
Revision Date 06/28/2017
Print Date 06/22/2019

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Tetrachloroethylene

Product Number : 371696
Brand : Sigma-Aldrich
Index-No. : 602-028-00-4

CAS-No. : 127-18-4

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Skin sensitisation (Category 1), H317
Carcinogenicity (Category 2), H351
Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336
Acute aquatic toxicity (Category 2), H401
Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word Warning

Hazard statement(s)

H315	Causes skin irritation.
H317	May cause an allergic skin reaction.
H319	Causes serious eye irritation.
H336	May cause drowsiness or dizziness.
H351	Suspected of causing cancer.
H411	Toxic to aquatic life with long lasting effects.

Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P272	Contaminated work clothing should not be allowed out of the workplace.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor if you feel unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P333 + P313	If skin irritation or rash occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	:	Perchloroethylene PCE
Formula	:	C_2Cl_4
Molecular weight	:	165.83 g/mol
CAS-No.	:	127-18-4
EC-No.	:	204-825-9
Index-No.	:	602-028-00-4

Hazardous components

Component	Classification	Concentration
Tetrachloroethylene		
	Skin Irrit. 2; Eye Irrit. 2A; Skin Sens. 1; Carc. 2; STOT SE 3; Aquatic Acute 2; Aquatic Chronic 2; H315, H317, H319, H336, H351, H411	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Tetrachloroethylene	127-18-4	TWA	25.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nervous System impairment Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed animal carcinogen with unknown relevance to humans		
		STEL	100.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed animal carcinogen with unknown relevance to humans		
		Potential Occupational Carcinogen Minimize workplace exposure concentrations. See Appendix A		
		See Table Z-2		
		TWA	100.000000 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		CEIL	200.000000 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Peak	300.000000 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		TWA	25 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed animal carcinogen with unknown relevance to humans		
		STEL	100 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed animal carcinogen with unknown relevance to humans		
		Potential Occupational Carcinogen Minimize workplace exposure concentrations. See Appendix A		
		See Table Z-2		

		TWA	100 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		CEIL	200 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Peak	300 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		TWA	25 ppm 170 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		STEL	100 ppm 685 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		C	300 ppm	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		PEL	25 ppm 170 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Tetrachloroethylene	127-18-4	Tetrachloroethylene	3ppm	In end-exhaled air	ACGIH - Biological Exposure Indices (BEI)
	Remarks	Prior to shift (16 hours after exposure ceases)			
		Tetrachloroethylene	0.5000 mg/l	In blood	ACGIH - Biological Exposure Indices (BEI)
		Prior to shift (16 hours after exposure ceases)			
		Tetrachloroethylene	3ppm	In end-exhaled air	ACGIH - Biological Exposure Indices (BEI)
		Prior to shift (16 hours after exposure ceases)			
		Tetrachloroethylene	0.5 mg/l	In blood	ACGIH - Biological Exposure Indices (BEI)
		Prior to shift (16 hours after exposure ceases)			

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.2 mm

Break through time: 49 min
Material tested:Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid, clear Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: -22 °C (-8 °F) - lit.
f)	Initial boiling point and boiling range	121 °C (250 °F) - lit.
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	25.3 hPa (19.0 mmHg) at 25.0 °C (77.0 °F) 17.3 hPa (13.0 mmHg) at 20.0 °C (68.0 °F)
l)	Vapour density	No data available
m)	Relative density	1.623 g/cm3 at 25 °C (77 °F)
n)	Water solubility	0.15 g/l at 25 °C (77 °F)
o)	Partition coefficient: n-octanol/water	log Pow: 2.53 at 23 °C (73 °F)
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available

t) Oxidizing properties No data available

9.2 Other safety information

Surface tension 32.1 mN/m at 20 °C (68 °F)

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Strong oxidizing agents, Strong bases

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - female - 3,385 mg/kg
(OECD Test Guideline 401)

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation
Skin - Rabbit
Result: Skin irritation - 4 h
(OECD Test Guideline 404)

Serious eye damage/eye irritation
Eyes - Rabbit
Result: Mild eye irritation - 24 h

Respiratory or skin sensitisation
- Mouse
Result: May cause sensitisation by skin contact.
(OECD Test Guideline 429)

Germ cell mutagenicity
Hamster
ovary
Result: negative

OECD Test Guideline 474
Mouse - male
Result: negative

Carcinogenicity

Limited evidence of carcinogenicity in animal studies

IARC: 2A - Group 2A: Probably carcinogenic to humans (Tetrachloroethylene)

NTP: RAHC - Reasonably anticipated to be a human carcinogen (Tetrachloroethylene)

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
May cause drowsiness or dizziness.

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information

Repeated dose toxicity	Mouse - female - Oral - LOAEL : 390 mg/kg

RTECS: KX3850000

narcosis, Liver injury may occur., Kidney injury may occur.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	flow-through test LC50 - Oncorhynchus mykiss (rainbow trout) - 5 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 7.50 mg/l - 48 h
Toxicity to algae	static test EC50 - Skeletonema costatum - > 16 mg/l - 7 h

12.2 Persistence and degradability

Biodegradability	aerobic - Exposure time 28 d Result: 11 % - Not readily biodegradable. (OECD Test Guideline 301C)

12.3 Bioaccumulative potential

Bioaccumulation	Lepomis macrochirus (Bluegill) - 21 d - 0.00343 mg/l Bioconcentration factor (BCF): 49

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1897 Class: 6.1 Packing group: III
Proper shipping name: Tetrachloroethylene
Reportable Quantity (RQ): 100 lbsReportable Quantity (RQ): 100 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 1897 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TETRACHLOROETHYLENE
Marine pollutant: yes

IATA
UN number: 1897 Class: 6.1 Packing group: III
Proper shipping name: Tetrachloroethylene

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Tetrachloroethylene	127-18-4	2007-07-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Reportable Quantity D039 lbs

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Tetrachloroethylene	127-18-4	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Tetrachloroethylene	127-18-4	2007-07-01

	CAS-No.	Revision Date
Tetrachloroethylene	127-18-4	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Tetrachloroethylene	127-18-4	2007-07-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. Tetrachloroethylene	127-18-4	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity

Eye Irrit.	Eye irritation
H315	Causes skin irritation.
H317	May cause an allergic skin reaction.
H319	Causes serious eye irritation.
H336	May cause drowsiness or dizziness.
H351	Suspected of causing cancer.
H401	Toxic to aquatic life.
H411	Toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	3
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.11 Revision Date: 06/28/2017 Print Date: 06/22/2019

SAFETY DATA SHEET

Version 4.10
Revision Date 01/04/2018
Print Date 06/28/2019

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Trichloroethylene

Product Number : 251402
Brand : Sigma-Aldrich
Index-No. : 602-027-00-9

CAS-No. : 79-01-6

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Germ cell mutagenicity (Category 2), H341
Carcinogenicity (Category 1B), H350
Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336
Acute aquatic toxicity (Category 3), H402
Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word Danger

Hazard statement(s)

H315	Causes skin irritation.
H319	Causes serious eye irritation.
H336	May cause drowsiness or dizziness.
H341	Suspected of causing genetic defects.
H350	May cause cancer.
H412	Harmful to aquatic life with long lasting effects.

Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear eye protection/ face protection.
P280	Wear protective gloves.
P281	Use personal protective equipment as required.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P312	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	:	TCE Trichloroethene
Formula	:	C_2HCl_3
Molecular weight	:	131.39 g/mol
CAS-No.	:	79-01-6
EC-No.	:	201-167-4
Index-No.	:	602-027-00-9

Hazardous components

Component	Classification	Concentration
Trichloroethylene		
	Skin Irrit. 2; Eye Irrit. 2A; Muta. 2; Carc. 1B; STOT SE 3; Aquatic Acute 3; Aquatic Chronic 3; H315, H319, H336, H341, H350, H412	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Light sensitive. Handle and store under inert gas.
Storage class (TRGS 510): 6.1D: Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Trichloroethylene	79-01-6	TWA	10.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nervous System impairment cognitive decrement Renal toxicity Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen		
		STEL	25.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment cognitive decrement Renal toxicity Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen		
		Potential Occupational Carcinogen See Appendix C See Appendix A		
		See Table Z-2		
		TWA	100.000000 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.19-1967		
		CEIL	200.000000 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.19-1967		
		Peak	300.000000 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.19-1967		
		TWA	100 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.19-1967		
		CEIL	200 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.19-1967		
		Peak	300 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z37.19-1967		

		STEL	100 ppm 537 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		C	300 ppm	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		PEL	25 ppm 135 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
	-	Trichloroacetic acid	15.0000 mg/l	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			
		Trichloroethanol	0.5000 mg/l	In blood	ACGIH - Biological Exposure Indices (BEI)
		End of shift at end of workweek			
		Trichloroethylene		In blood	ACGIH - Biological Exposure Indices (BEI)
		End of shift at end of workweek			
		Trichloroethylene		In end-exhaled air	ACGIH - Biological Exposure Indices (BEI)
		End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 480 min
Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid, clear Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: -84.8 °C (-120.6 °F) - lit.
f)	Initial boiling point and boiling range	86.7 °C (188.1 °F) - lit.
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 10.5 %(V) Lower explosion limit: 8 %(V)
k)	Vapour pressure	81.3 hPa (61.0 mmHg) at 20.0 °C (68.0 °F)
l)	Vapour density	No data available
m)	Relative density	1.463 g/mL at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 2.29log Pow: 5
p)	Auto-ignition temperature	410.0 °C (770.0 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Oxidizing agents, Strong bases, Magnesium

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 4,920 mg/kg

LC50 Inhalation - Mouse - 4 h - 8450 ppm

LD50 Dermal - Rabbit - > 20,000 mg/kg

No data available

Skin corrosion/irritation
Skin - Rabbit
Result: Severe skin irritation - 24 h

Serious eye damage/eye irritation
Eyes - Rabbit
Result: Eye irritation - 24 h

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
Laboratory experiments have shown mutagenic effects.
In vitro tests showed mutagenic effects

Carcinogenicity

This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Possible human carcinogen

IARC:	1 - Group 1: Carcinogenic to humans (Trichloroethylene)
NTP:	RAHC - Reasonably anticipated to be a human carcinogen (Trichloroethylene)
OSHA:	No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: KX4550000

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting, Exposure to and/or consumption of alcohol may increase toxic effects., Gastrointestinal disturbance, Kidney injury may occur., narcosis
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 41 mg/l - 96.0 h
	LOEC - other fish - 11 mg/l - 10.0 d
	NOEC - Oryzias latipes - 40 mg/l - 10.0 d
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 18.00 mg/l - 48 h
Toxicity to algae	IC50 - Pseudokirchneriella subcapitata (green algae) - 175.00 mg/l - 96 h

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
Does not bioaccumulate.

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life with long lasting effects.

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1710 Class: 6.1 Packing group: III
Proper shipping name: Trichloroethylene
Reportable Quantity (RQ): 100 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 1710 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TRICHLOROETHYLENE

IATA
UN number: 1710 Class: 6.1 Packing group: III

Proper shipping name: Trichloroethylene

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Trichloroethylene	79-01-6	2007-07-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Trichloroethylene	79-01-6	2007-07-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Trichloroethylene	79-01-6	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Trichloroethylene	79-01-6	2007-07-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. Trichloroethylene	79-01-6	2011-09-01
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Trichloroethylene	79-01-6	2011-09-01

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
Eye Irrit.	Eye irritation
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H336	May cause drowsiness or dizziness.
H341	Suspected of causing genetic defects.
H350	May cause cancer.
H402	Harmful to aquatic life.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.10 Revision Date: 01/04/2018 Print Date: 06/28/2019

SAFETY DATA SHEET

Version 4.4
Revision Date 12/01/2015
Print Date 06/28/2019

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : cis-Dichloroethylene

Product Number : 48597
Brand : Supelco
Index-No. : 602-026-00-3

CAS-No. : 156-59-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable liquids (Category 2), H225
Acute toxicity, Inhalation (Category 4), H332
Acute aquatic toxicity (Category 3), H402
Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word Danger

Hazard statement(s)
H225 Highly flammable liquid and vapour.
H332 Harmful if inhaled.
H412 Harmful to aquatic life with long lasting effects.

Precautionary statement(s)
P210 Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233 Keep container tightly closed.
P240 Ground/bond container and receiving equipment.
P241 Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242 Use only non-sparking tools.

P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P312	Call a POISON CENTER or doctor/ physician if you feel unwell.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P403 + P235	Store in a well-ventilated place. Keep cool.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	C2H2Cl2
Molecular weight	:	96.94 g/mol
CAS-No.	:	156-59-2
EC-No.	:	205-859-7
Index-No.	:	602-026-00-3

Hazardous components

Component	Classification	Concentration
cis-Dichloroethylene		
	Flam. Liq. 2; Acute Tox. 4; Aquatic Acute 3; Aquatic Chronic 3; H225, H332, H412	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Recommended storage temperature 2 - 8 °C

Handle and store under inert gas. Air and moisture sensitive. Light sensitive.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
cis-Dichloroethylene	156-59-2	TWA	200 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nervous System impairment Eye irritation		

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: light yellow
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	-80.0 °C (-112.0 °F)
f)	Initial boiling point and boiling range	60.0 - 61.0 °C (140.0 - 141.8 °F)
g)	Flash point	6.0 °C (42.8 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	1.28 g/cm3
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available

p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
Vapours may form explosive mixture with air.

10.4 Conditions to avoid
Heat, flames and sparks. Extremes of temperature and direct sunlight.

10.5 Incompatible materials
Oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LC50 Inhalation - Rat - 13700 ppm
Remarks: Behavioral:Somnolence (general depressed activity). Liver:Fatty liver degeneration.

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC:	No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
NTP:	No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
No data available

No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: KV9420000

narcosis, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1150 Class: 3 Packing group: II
Proper shipping name: 1,2-Dichloroethylene

Poison Inhalation Hazard: No

IMDG
UN number: 1150 Class: 3 Packing group: II EMS-No: F-E, S-D
Proper shipping name: 1,2-DICHLOROETHYLENE

IATA
UN number: 1150 Class: 3 Packing group: II
Proper shipping name: 1,2-Dichloroethylene

15. REGULATORY INFORMATION

SARA 302 Components
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Fire Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
cis-Dichloroethylene	156-59-2	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
cis-Dichloroethylene	156-59-2	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
cis-Dichloroethylene	156-59-2	1993-04-24

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H332	Harmful if inhaled.
H402	Harmful to aquatic life.

HMIS Rating

Health hazard:	1
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	1

NFPA Rating

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information
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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information
Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.4 Revision Date: 12/01/2015 Print Date: 06/28/2019

SAFETY DATA SHEET

Version 3.16
Revision Date 03/05/2018
Print Date 06/28/2019

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Vinyl chloride

Product Number : 387622
Brand : Aldrich
Index-No. : 602-023-00-7

CAS-No. : 75-01-4

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Flammable gases (Category 1), H220
Gases under pressure (Liquefied gas), H280
Carcinogenicity (Category 1A), H350
Simple Asphyxiant,

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word Danger

Hazard statement(s)

H220	Extremely flammable gas.
H280	Contains gas under pressure; may explode if heated.
H350	May cause cancer. May displace oxygen and cause rapid suffocation.

Precautionary statement(s)

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P280	Wear protective gloves/ protective clothing/ eye protection/ face

	protection.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P377	Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381	Eliminate all ignition sources if safe to do so.
P405	Store locked up.
P410 + P403	Protect from sunlight. Store in a well-ventilated place.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

May form explosive peroxides.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	:	Chloroethylene
Formula	:	C_2H_3Cl
Molecular weight	:	62.50 g/mol
CAS-No.	:	75-01-4
EC-No.	:	200-831-0
Index-No.	:	602-023-00-7

Hazardous components

Component	Classification	Concentration
Vinyl chloride		
	Flam. Gas 1; Press. Gas Liquefied gas; Carc. 1A; SA ; H220, H280, H350,	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
No data available

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Clean up promptly by sweeping or vacuum.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid inhalation of vapour or mist.
Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

Contents under pressure. Light sensitive.
Storage class (TRGS 510): 2A: Gases

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Vinyl chloride	75-01-4	TWA	1 ppm	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	1 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Liver damage Lung cancer Confirmed human carcinogen		
		STEL	5 ppm	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	1 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		STEL	5 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		See 1910.1017		

		Potential Occupational Carcinogen See Appendix A

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Splash contact
Material: Fluorinated rubber
Minimum layer thickness: 0.7 mm
Break through time: 120 min
Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: Liquefied gas
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: -153.8 °C (-244.8 °F) - lit.
f)	Initial boiling point and boiling range	-13.4 °C (7.9 °F) - lit.
g)	Flash point	-61.0 °C (-77.8 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available

j)	Upper/lower flammability or explosive limits	Upper explosion limit: 33 %(V) Lower explosion limit: 3.6 %(V)
k)	Vapour pressure	No data available
l)	Vapour density	No data available
m)	Relative density	0.911 g/cm3 at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
No data available

10.2 Chemical stability
Stable under recommended storage conditions.
Contains the following stabiliser(s):
Hydroquinone (>=0 - <=0.0001 %)
Phenol (>=0 - <=0.01 %)

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
Heat, flames and sparks. Extremes of temperature and direct sunlight.

10.5 Incompatible materials
Chemically active metals, Copper

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas
Other decomposition products - No data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

LC50 Inhalation - Rat - 0.3 h - 180000 ppm
Remarks: Behavioral:Tremor. Behavioral:Convulsions or effect on seizure threshold. Respiratory disorder

Dermal: No data available

No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

This is or contains a component that has been reported to be carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Human carcinogen.

IARC:	1 - Group 1: Carcinogenic to humans (Vinyl chloride)
NTP:	Known - Known to be human carcinogen (Vinyl chloride)
OSHA:	OSHA specifically regulated carcinogen (Vinyl chloride)

Reproductive toxicity
No data available

Overexposure may cause reproductive disorder(s) based on tests with laboratory animals.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: KU9625000

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Central nervous system -
Stomach - Irregularities - Based on Human Evidence (Phenol)
Liver - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 1086 Class: 2.1
Proper shipping name: Vinyl chloride, stabilized
Reportable Quantity (RQ): 1 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 1086 Class: 2.1 EMS-No: F-D, S-U
Proper shipping name: VINYL CHLORIDE, STABILIZED

IATA
UN number: 1086 Class: 2.1
Proper shipping name: Vinyl chloride, stabilized
IATA Passenger: Not permitted for transport

15. REGULATORY INFORMATION

SARA 302 Components
The following components are subject to reporting levels established by SARA Title III, Section 302:

	CAS-No.	Revision Date
Phenol	108-95-2	2007-07-01
Hydroquinone	123-31-9	2007-03-01

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Vinyl chloride	75-01-4	2007-07-01

SARA 311/312 Hazards
Fire Hazard, Sudden Release of Pressure Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Vinyl chloride	75-01-4	2007-07-01
Phenol	108-95-2	2007-07-01
Hydroquinone	123-31-9	2007-03-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Vinyl chloride	75-01-4	2007-07-01
Phenol	108-95-2	2007-07-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Vinyl chloride	75-01-4	2007-07-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Vinyl chloride	75-01-4	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

	May displace oxygen and cause rapid suffocation.
Carc.	Carcinogenicity
Flam. Gas	Flammable gases
H220	Extremely flammable gas.
H280	Contains gas under pressure; may explode if heated.
H350	May cause cancer.
Press. Gas	Gases under pressure
SA	Simple Asphyxiant

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	4
Physical Hazard	3

NFPA Rating

Health hazard:	2
Fire Hazard:	4
Reactivity Hazard:	0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 3.16 Revision Date: 03/05/2018 Print Date: 06/28/2019

SAFETY DATA SHEET

Version 6.16
Revision Date 04/07/2025
Print Date 04/08/2025

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Naphthalene

Product Number : 147141
Brand : Aldrich
Index-No. : 601-052-00-2
CAS-No. : 91-20-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable solids (Category 2), H228
Carcinogenicity (Category 2), H351

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Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Warning

Hazard Statements

H228	Flammable solid.
H351	Suspected of causing cancer.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary Statements

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.
P240	Ground and bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P280	Wear protective gloves, protective clothing, eye protection and face protection.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Formula	:	C10H8
Molecular weight	:	128.17 g/mol
CAS-No.	:	91-20-3
EC-No.	:	202-049-5
Index-No.	:	601-052-00-2

Component	Classification	Concentration
Naphthalene		
	Flam. Sol. 2; Carc. 2; Aquatic Acute 1; Aquatic	>= 80 - <= 100 %

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	Chronic 1; H228, H351, H400, H410	

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Combustible.
Vapors are heavier than air and may spread along floors.
Forms explosive mixtures with air on intense heating.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

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5.4 Further information

Remove container from danger zone and cool with water. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid inhalation of dusts. Avoid substance contact. Ensure adequate ventilation. Keep away from heat and sources of ignition. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains. Risk of explosion.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up dry. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture.

Advice on protection against fire and explosion
Keep away from open flames, hot surfaces and sources of ignition.Take precautionary measures against static discharge.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Keep away from heat and sources of ignition.

Storage class
Storage class (TRGS 510): 4.1B: Flammable solid hazardous materials

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

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SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Naphthalene	91-20-3	TWA	10 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption		
		TWA	10 ppm 50 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	15 ppm 75 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	10 ppm 50 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		PEL	0.1 ppm 0.5 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		Skin		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Naphthalene	91-20-3	1-Naphthol + 2-Naphthol			ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift (As soon as possible after exposure ceases)			

8.2 Exposure controls

Appropriate engineering controls

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).
Full contact
Material: Nitrile rubber

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Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).
Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection
Flame retardant antistatic protective clothing.

Respiratory protection
Recommended Filter type: Filter A-(P3)
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated. Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains. Risk of explosion.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: flakes, granules Color: white
b)	Odor	aromatic
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/ range: 80 - 82 °C (176 - 180 °F) - lit.
f)	Initial boiling point and boiling range	218 °C 424 °F - lit.
g)	Flash point	78.5 °C (173.3 °F) - closed cup - ISO 2719
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	The substance or mixture is a flammable solid with the category 2. - Flammability (solids)
j)	Upper/lower flammability or	Upper explosion limit: 5.9 %(V) Lower explosion limit: 0.9 %(V)

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	explosive limits	
k)	Vapor pressure	0.072 hPa at 20 °C (68 °F) - OECD Test Guideline 104
l)	Vapor density	No data available
m)	Density	1.08 g/cm3 at 24.7 °C (76.5 °F) - OECD Test Guideline 109
	Relative density	No data available
n)	Water solubility	0.0308 g/l at 25 °C (77 °F) - OECD Test Guideline 105 - slightly soluble
o)	Partition coefficient: n-octanol/water	log Pow: 3.4 at 25 °C (77 °F) - OECD Test Guideline 107 - Bioaccumulation is not expected.
p)	Autoignition temperature	526 - 587 °C (979 - 1089 °F) at 1,013 hPa - DIN 51794
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	Not classified as explosive.
t)	Oxidizing properties	none

9.2 Other safety information

Surface tension	31.8 mN/m at 100.0 °C (212.0 °F)

SECTION 10: Stability and reactivity

10.1 Reactivity

Forms explosive mixtures with air on intense heating.
A range from approx. 15 Kelvin below the flash point is to be rated as critical.
The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions

Violent reactions possible with:
Oxidizing agents
chromium(VI) oxide
benzoyl chloride
aluminium chloride
Risk of explosion with:
nitrogen oxides

10.4 Conditions to avoid

Heat, flames and sparks.
Strong heating.

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10.5 Incompatible materials
No data available

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Oral: No data available
LC50 Inhalation - Rat - male and female - 4 h - > 0.4 mg/l - vapor

(OECD Test Guideline 403)
LD50 Dermal - Rabbit - 20,000 mg/kg
Remarks: (RTECS)

Skin corrosion/irritation
Skin - Rabbit
Result: No skin irritation - 24 h
Remarks: (ECHA)

Serious eye damage/eye irritation
Eyes - Rabbit
Result: No eye irritation - 24 h
Remarks: (ECHA)

Respiratory or skin sensitization
Maximization Test - Guinea pig
Result: negative
(OECD Test Guideline 406)

Germ cell mutagenicity
Test Type: Mutagenicity (mammal cell test): chromosome aberration.
Test system: Chinese hamster ovary cells
Metabolic activation: Metabolic activation
Method: OECD Test Guideline 473
Result: positive
Test Type: Ames test
Test system: Salmonella typhimurium
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 471
Result: negative

Test Type: unscheduled DNA synthesis assay
Species: Rat
Cell type: Liver cells
Application Route: Oral
Method: OECD Test Guideline 486
Result: negative

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Test Type: Micronucleus test
Species: Mouse
Cell type: Bone marrow
Application Route: Intraperitoneal
Method: US-EPA
Result: negative
Remarks: (ECHA)

Carcinogenicity
Suspected of causing cancer.

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Naphthalene)

No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC. (Naphthalene)

NTP: RAHC - Reasonably anticipated to be a human carcinogen (Naphthalene)

No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP. (Naphthalene)

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

Repeated dose toxicity - Rat - male and female - Oral - 91 Days - NOAEL (No observed adverse effect level) - 200 mg/kg - LOAEL (Lowest observed adverse effect level) - 400 mg/kg

Repeated dose toxicity - Mouse - male and female - Oral - 90 Days - NOAEL (No observed adverse effect level) - 100 mg/kg

Repeated dose toxicity - Rat - male and female - Dermal - 90 Days - NOAEL (No observed adverse effect level) - 1,000 mg/kg

Repeated dose toxicity - Rat - male and female - inhalation (vapor) - 90 Days - NOAEL (No observed adverse effect level) - 300 mg/kg

RTECS: QJ0525000
After absorption:

Headache

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Stomach/intestinal disorders
Tremors
Convulsions
Changes in the blood count

Other dangerous properties can not be excluded.

This substance should be handled with particular care.

Heart -

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	flow-through test LC50 - Oncorhynchus mykiss (rainbow trout) - 1.6 mg/l - 96 h (OECD Test Guideline 203)
Toxicity to daphnia and other aquatic invertebrates	static test EC50 - Daphnia magna (Water flea) - 2.16 mg/l - 48 h (OECD Test Guideline 202)
Toxicity to algae	static test EC50 - Pseudokirchneriella subcapitata (green algae) - 2.96 mg/l - 4 h (US-EPA) Remarks: (ECHA)
Toxicity to fish(Chronic toxicity)	flow-through test LC50 - Oncorhynchus kisutch (coho salmon) - 2.1 mg/l - 96 h Remarks: (ECHA)
	flow-through test NOEC - Oncorhynchus kisutch (coho salmon) - 0.37 mg/l - 40 Days Remarks: (ECHA)
Toxicity to daphnia and other aquatic invertebrates(Chronic toxicity)	static test NOEC - Daphnia pulex (Water flea) - 0.59 mg/l - 125 d Remarks: (ECHA)

12.2 Persistence and degradability

Biodegradability	aerobic - Exposure time 28 d Result: 2 % - Not readily biodegradable. (OECD Test Guideline 302C)

12.3 Bioaccumulative potential

Bioaccumulation	Cyprinus carpio (Carp) - 56 d at 25 °C(Naphthalene)
	Bioconcentration factor (BCF): 36.5 - 168

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(OECD Test Guideline 305)

Remarks: Bioaccumulation is unlikely.

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)
UN number: 1334 Class: 4.1 Packing group: III
Proper shipping name: Naphthalene, refined
Reportable Quantity (RQ): 100 lbs
Marine pollutant: yes Poison Inhalation Hazard: No

IMDG
UN number: 1334 Class: 4.1 Packing group: III EMS-No: F-A, S-G
Proper shipping name: NAPHTHALENE, REFINED
Marine pollutant : yes

IATA
UN number: 1334 Class: 4.1 Packing group: III
Proper shipping name: Naphthalene, refined

SECTION 15: Regulatory information

CERCLA Reportable Quantity

The life science business of Merck KGaA, Darmstadt, Germany
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Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
Naphthalene	91-20-3	100	100

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Fire Hazard
Acute Health Hazard
Chronic Health Hazard

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Clean Air Act

This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).
The following chemical(s) are listed as HAP under the U.S. Clean Air Act, Section 112 (40 CFR 61):

Naphthalene 91-20-3 >= 90 - <= 100 %

This product does not contain any chemicals listed under the U.S. Clean Air Act Section 112(r) for Accidental Release Prevention (40 CFR 68.130, Subpart F).
This product does not contain any chemicals listed under the U.S. Clean Air Act Section 111 SOCMI Intermediate or Final VOC's (40 CFR 60.489).

Clean Water Act

The following Hazardous Substances are listed under the U.S. CleanWater Act, Section 311, Table 116.4A:

Naphthalene 91-20-3 >= 90 - <= 100 %

The following Hazardous Chemicals are listed under the U.S. CleanWater Act, Section 311, Table 117.3:

Naphthalene 91-20-3 >= 90 - <= 100 %

This product contains the following toxic pollutants listed under the U.S. Clean Water Act Section 307

Naphthalene 91-20-3 >= 90 - <= 100 %

This product contains the following priority pollutants related to the U.S. Clean Water Act:

Naphthalene 91-20-3 >= 90 - <= 100 %

US State Regulations

Massachusetts Right To Know

Naphthalene 91-20-3

Maine Chemicals of High Concern

Product does not contain any listed chemicals

Vermont Chemicals of High Concern

Product does not contain any listed chemicals

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Washington Chemicals of High Concern

Product does not contain any listed chemicals

The ingredients of this product are reported in the following inventories:

TSCA : All substances listed as active on the TSCA inventory

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.16 Revision Date: 04/07/2025 Print Date: 04/08/2025

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SAFETY DATA SHEET

Version 6.7
Revision Date 08/05/2024
Print Date 08/06/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : 1,2,4,5-Tetramethylbenzene

Product Number : T19607
Brand : Aldrich
CAS-No. : 95-93-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable solids (Category 1), H228
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

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2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Danger

Hazard Statements

H228	Flammable solid.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary Statements

P210	Keep away from heat/ sparks/ open flames/ hot surfaces. No smoking.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P391	Collect spillage.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms : Durene
1,2,4,5-Tetramethylbenzene

Formula : $C_{10}H_{14}$
Molecular weight : 134.22 g/mol
CAS-No. : 95-93-2
EC-No. : 202-465-7

Component	Classification	Concentration
1,2,4,5-tetramethylbenzene		
	Flam. Sol. 1; Aquatic Acute 1; Aquatic Chronic 1; H228, H400, H410 M-Factor - Aquatic Acute: 1 - Aquatic Chronic: 1	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

The life science business of Merck KGaA, Darmstadt, Germany
operates as MilliporeSigma in the US and Canada

SECTION 4: First aid measures

4.1 Description of first-aid measures
No data available

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media
No data available

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Combustible.

5.3 Advice for firefighters
No data available

5.4 Further information
No data available

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
For personal protection see section 8.

6.2 Environmental precautions
No data available

6.3 Methods and materials for containment and cleaning up
No data available

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
No data available

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

The life science business of Merck KGaA, Darmstadt, Germany
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SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Skin protection
Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Control of environmental exposure
Prevent product from entering drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystals
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/ range: 76 - 80 °C (169 - 176 °F) - lit.
f)	Initial boiling point and boiling range	191 - 193 °C 376 - 379 °F
g)	Flash point	74 °C (165 °F) - closed cup - c.c.
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	The substance or mixture is a flammable solid with the category 1.
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
l)	Vapor density	No data available

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m)	Density	0.838 g/mL at 25 °C (77 °F) - lit.
	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	Not classified as explosive.
t)	Oxidizing properties	none

9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
No data available

10.2 Chemical stability
No data available

10.3 Possibility of hazardous reactions
Violent reactions possible with:
Oxidizing agents

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
No data available

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 6,700 mg/kg
Remarks: (RTECS)
Inhalation: No data available
Dermal: No data available

The life science business of Merck KGaA, Darmstadt, Germany
operates as MilliporeSigma in the US and Canada

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

RTECS: DC0500000
The data available to us do not suffice to permit any industrial-toxicological assessment.

Further toxicological data:

Risk of absorption.

Other dangerous properties can not be excluded.

Further data:

Handle in accordance with good industrial hygiene and safety practice.

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	LC0 - Leuciscus idus (Golden orfe) - 10 mg/l - 48 h Remarks: (ECOTOX Database)

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LC50 - Leuciscus idus (Golden orfe) - 30 mg/l - 48 h
Remarks: (ECOTOX Database)

LC100 - Leuciscus idus (Golden orfe) - 50 mg/l - 48 h
Remarks: (ECOTOX Database)

Toxicity to daphnia and other aquatic invertebrates: EC50 - Daphnia magna (Water flea) - 0.47 mg/l - 48 h
Remarks: (External MSDS)

12.2 Persistence and degradability
Not readily biodegradable.

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
Discharge into the environment must be avoided.

SECTION 13: Disposal considerations

13.1 Waste treatment methods
No data available

SECTION 14: Transport information

DOT (US)
UN number: 1325 Class: 4.1 Packing group: II
Proper shipping name: Flammable solids, organic, n.o.s. (1,2,4,5-tetramethylbenzene)
Reportable Quantity (RQ):
Poison Inhalation Hazard: No

IMDG
UN number: 1325 Class: 4.1 Packing group: II EMS-No: F-A, S-G

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Proper shipping name: FLAMMABLE SOLID, ORGANIC, N.O.S. (1,2,4,5-tetramethylbenzene)
Marine pollutant : yes

IATA
UN number: 1325 Class: 4.1 Packing group: II
Proper shipping name: Flammable solid, organic, n.o.s. (1,2,4,5-tetramethylbenzene)

SECTION 15: Regulatory information

CERCLA Reportable Quantity

This material does not contain any components with a CERCLA RQ.

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Fire Hazard

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

US State Regulations

Massachusetts Right To Know

No components are subject to the Massachusetts Right to Know Act.

Maine Chemicals of High Concern

Product does not contain any listed chemicals

Vermont Chemicals of High Concern

Product does not contain any listed chemicals

Washington Chemicals of High Concern

Product does not contain any listed chemicals

The ingredients of this product are reported in the following inventories:

TSCA : All substances listed as active on the TSCA inventory

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

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SECTION 16: Other information

The branding on the header and/or footer of this document may temporarily not visually match the product purchased as we transition our branding. However, all of the information in the document regarding the product remains unchanged and matches the product ordered. For further information please contact mlsbranding@sial.com.

Version: 6.7 Revision Date: 08/05/2024 Print Date: 08/06/2024

The life science business of Merck KGaA, Darmstadt, Germany
operates as MilliporeSigma in the US and Canada

SAFETY DATA SHEET

Version 6.13
Revision Date 04/07/2025
Print Date 04/08/2025

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Benz[*a*]anthracene

Product Number : 48563
Brand : Supelco
Index-No. : 601-033-00-9
CAS-No. : 56-55-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Carcinogenicity (Category 1B), H350
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

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For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Danger

Hazard Statements

H350	May cause cancer.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary Statements

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P273	Avoid release to the environment.
P280	Wear protective gloves, protective clothing, eye protection and face protection.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms	:	1,2-Benzanthracene Tetraphene
Formula	:	$C_{18}H_{12}$
Molecular weight	:	228.29 g/mol
CAS-No.	:	56-55-3
EC-No.	:	200-280-6
Index-No.	:	601-033-00-9

Component	Classification	Concentration
Benz[a]anthracene		
	Carc. 1B; Aquatic Acute 1; Aquatic Chronic 1; H350, H400, H410 M-Factor - Aquatic Acute: 10 - Aquatic Chronic: 10	>= 80 - <= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

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SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Combustible.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Prevent fire extinguishing water from contaminating surface water or the ground water system.

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SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class
Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

	Remarks	Suspected human carcinogen

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Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Benz[a]anthracene	56-55-3	1-Hydroxypyrene	2.5 µg/l	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			
		3-hydroxybenzo(a)pyrene		Urine	ACGIH - Biological Exposure Indices (BEI)
		End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
Handle with impervious gloves.

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection
protective clothing

Respiratory protection
Recommended Filter type: Filter type P3
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated.

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Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/ range: 157 - 159 °C (315 - 318 °F)
f)	Initial boiling point and boiling range	437.6 °C 819.7 °F
g)	Flash point	()Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
l)	Vapor density	No data available
m)	Density	No data available
	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	Not classified as explosive.
t)	Oxidizing properties	none

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9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
Violent reactions possible with:
Strong oxidizing agents

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
No data available

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Oral: No data available
Inhalation: No data available
Dermal: No data available
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.
Possible human carcinogen

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IARC: 2B - Group 2B: Possibly carcinogenic to humans (Benz[a]anthracene)

NTP: RAHC - Reasonably anticipated to be a human carcinogen (Benz[a]anthracene)

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
Discharge into the environment must be avoided.

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SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Benz[a]anthracene)
Reportable Quantity (RQ): 10 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Benz[a]anthracene)
Marine pollutant : yes
Marine pollutant : no

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Benz[a]anthracene)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

SECTION 15: Regulatory information

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
Benz[a]anthracene	56-55-3	10	10

SARA 304 Extremely Hazardous Substances Reportable Quantity
This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity
This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Chronic Health Hazard

The life science business of Merck KGaA, Darmstadt, Germany
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SARA 313 : The following components are subject to reporting levels established by SARA Title III, Section 313:

Benz[a]anthrac ene	56-55-3	>= 90 - <= 100 %

Clean Air Act

This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).
The following chemical(s) are listed as HAP under the U.S. Clean Air Act, Section 112 (40 CFR 61):

Benz[a]anthracene	56-55-3	>= 90 - <= 100 %

This product does not contain any chemicals listed under the U.S. Clean Air Act Section 112(r) for Accidental Release Prevention (40 CFR 68.130, Subpart F).
This product does not contain any chemicals listed under the U.S. Clean Air Act Section 111 SOCMI Intermediate or Final VOC's (40 CFR 60.489).

Clean Water Act

This product does not contain any Hazardous Substances listed under the U.S. CleanWater Act, Section 311, Table 116.4A.
This product does not contain any Hazardous Chemicals listed under the U.S. CleanWater Act, Section 311, Table 117.3.
This product contains the following toxic pollutants listed under the U.S. Clean Water Act Section 307

Benz[a]anthracene	56-55-3	>= 90 - <= 100 %

This product contains the following priority pollutants related to the U.S. Clean Water Act:

Benz[a]anthracene	56-55-3	>= 90 - <= 100 %

US State Regulations

Massachusetts Right To Know

Benz[a]anthracene	56-55-3

Pennsylvania Right To Know

Benz[a]anthracene	56-55-3

Maine Chemicals of High Concern

Product does not contain any listed chemicals

Vermont Chemicals of High Concern

Product does not contain any listed chemicals

Washington Chemicals of High Concern

Product does not contain any listed chemicals

California Prop. 65

WARNING: This product can expose you to chemicals including Benz[a]anthracene, which is/are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

The ingredients of this product are reported in the following inventories:

TSCA : All substances listed as active on the TSCA inventory

The life science business of Merck KGaA, Darmstadt, Germany
operates as MilliporeSigma in the US and Canada

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.13 Revision Date: 04/07/2025 Print Date: 04/08/2025

The life science business of Merck KGaA, Darmstadt, Germany
operates as MilliporeSigma in the US and Canada

SAFETY DATA SHEET

Version 6.15
Revision Date 09/05/2024
Print Date 09/06/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Benzo[a]pyrene

Product Number : B1760
Brand : Sigma
Index-No. : 601-032-00-3
CAS-No. : 50-32-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Skin sensitization (Category 1), H317
Germ cell mutagenicity (Category 1B), H340
Carcinogenicity (Category 1B), H350

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Reproductive toxicity (Category 1B), H360
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Danger

Hazard Statements

H317	May cause an allergic skin reaction.
H340	May cause genetic defects.
H350	May cause cancer.
H360	May damage fertility or the unborn child.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary Statements

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P261	Avoid breathing dust.
P272	Contaminated work clothing must not be allowed out of the workplace.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P333 + P313	If skin irritation or rash occurs: Get medical advice/ attention.
P363	Wash contaminated clothing before reuse.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms	:	3,4-Benzpyrene 3,4-Benzopyrene Benzo[def]chrysene
Formula	:	$C_{20}H_{12}$
Molecular weight	:	252.31 g/mol
CAS-No.	:	50-32-8
EC-No.	:	200-028-5
Index-No.	:	601-032-00-3

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Component	Classification	Concentration
benzo[a]pyrene		
	Skin Sens. 1; Muta. 1B; Carc. 1B; Repr. 1B; Aquatic Acute 1; Aquatic Chronic 1; H317, H340, H350, H360, H400, H410 Concentration limits: >= 0.01 %: Carc. 1B, H350;	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

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5.2 Special hazards arising from the substance or mixture

Carbon oxides
Combustible.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information

Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class
Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

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7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
	Remarks	Suspected human carcinogen		
benzo[a]pyrene	50-32-8	TWA	0.2 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		OSHA specifically regulated carcinogen		
		TWA	0.1 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen		
		PEL	0.2 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		PEL	0.2 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
benzo[a]pyrene	50-32-8	1-Hydroxypyrene	2.5 µg/l	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			
		3-hydroxybenzo(a)pyrene		Urine	ACGIH - Biological Exposure Indices (BEI)
		End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

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Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
Handle with impervious gloves.

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection
protective clothing

Respiratory protection
Recommended Filter type: Filter type P3
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid Color: yellow
b)	Odor	weakly aromatic
c)	Odor Threshold	No data available
d)	pH	No data available

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e)	Melting point/freezing point	Melting point/ range: 177 - 180 °C (351 - 356 °F) - lit.
f)	Initial boiling point and boiling range	495 °C 923 °F - lit.
g)	Flash point	()Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
l)	Vapor density	No data available
m)	Density	1.35 g/cm3 - (HSDB)
	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	none

9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
Violent reactions possible with:
Strong oxidizing agents

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10.4 Conditions to avoid
no information available

10.5 Incompatible materials
No data available

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Oral: No data available
Inhalation: No data available
Dermal: No data available

Skin corrosion/irritation
Skin - Mouse
Result: Mild skin irritation
Remarks: (RTECS)

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
May cause allergic skin reaction. Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)

Germ cell mutagenicity
May cause genetic defects.
Test Type: Ames test
Test system: Salmonella typhimurium
Metabolic activation: with and without metabolic activation
Result: positive
Remarks: (Lit.)
Test Type: Mutagenicity (mammal cell test): chromosome aberration.
Test system: Chinese hamster ovary cells
Metabolic activation: with and without metabolic activation
Result: positive
Remarks: (National Toxicology Program)
Test Type: sister chromatid exchange assay
Test system: Chinese hamster ovary cells
Metabolic activation: with and without metabolic activation
Result: positive
Remarks: (National Toxicology Program)

Test Type: Chromosome aberration test
Species: Mouse
Cell type: Bone marrow
Application Route: Intraperitoneal injection

Result: positive

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Remarks: (National Toxicology Program)

Carcinogenicity
Presumed to have carcinogenic potential for humans

IARC: 1 - Group 1: Carcinogenic to humans (benzo[a]pyrene)

NTP: RAHC - Reasonably anticipated to be a human carcinogen (benzo[a]pyrene)

OSHA: OSHA specifically regulated carcinogen (benzo[a]pyrene)

Reproductive toxicity
May damage the unborn child.
May damage fertility.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

RTECS: DJ3675000
burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.25 mg/l - 48 h Remarks: (above the solubility limit in the test medium) (ECOTOX Database)
Toxicity to algae	static test ErC50 - Scenedesmus acutus - 0.005 mg/l - 72 h Remarks: (ECOTOX Database)

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential

Bioaccumulation	Lepomis macrochirus (Bluegill) - 48 h - 0.0005 mg/l(benzo[a]pyrene)
	Bioconcentration factor (BCF): 3,208

12.4 Mobility in soil
No data available

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12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties

No data available

12.7 Other adverse effects

No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)

UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (benzo[a]pyrene)
Reportable Quantity (RQ): 1 lbs
Poison Inhalation Hazard: No

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (benzo[a]pyrene)
Marine pollutant : yes
Marine pollutant : no

IATA

UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (benzo[a]pyrene)

Further information

EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

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SECTION 15: Regulatory information

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
benzo[a]pyrene	50-32-8	1	1

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Acute Health Hazard
Chronic Health Hazard

SARA 313 : The following components are subject to reporting levels established by SARA Title III, Section 313:

benzo[a]pyrene 50-32-8 >= 90 - <= 100 %

US State Regulations

Massachusetts Right To Know

benzo[a]pyrene 50-32-8

Pennsylvania Right To Know

benzo[a]pyrene 50-32-8

Maine Chemicals of High Concern

Product does not contain any listed chemicals

Vermont Chemicals of High Concern

Product does not contain any listed chemicals

Washington Chemicals of High Concern

Product does not contain any listed chemicals

California Prop. 65

WARNING: This product can expose you to chemicals including benzo[a]pyrene, which is/are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

The ingredients of this product are reported in the following inventories:

TSCA : All substances listed as active on the TSCA inventory

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

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SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.15 Revision Date: 09/05/2024 Print Date: 09/06/2024

The life science business of Merck KGaA, Darmstadt, Germany
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SAFETY DATA SHEET

Version 6.13
Revision Date 09/07/2024
Print Date 09/08/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Benzo[b]fluoranthene

Product Number : 275336
Brand : Aldrich
Index-No. : 601-034-00-4
CAS-No. : 205-99-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Carcinogenicity (Category 1B), H350
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

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For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Danger

Hazard Statements

H350	May cause cancer.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary Statements

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms : 3,4-Benzofluoranthene
Benz[e]acephenanthrylene
2,3-Benzfluoranthene
3,4-Benz[e]acephenanthrylene
Benzo[b]fluoranthene
Benzo[e]fluoranthene
NSC 89265

Formula : $C_{20}H_{12}$
Molecular weight : 252.31 g/mol
CAS-No. : 205-99-2
EC-No. : 205-911-9
Index-No. : 601-034-00-4

Component	Classification	Concentration
Benzo[b]fluoranthene		
	Carc. 1B; Aquatic Acute 1; Aquatic Chronic 1; H350, H400, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

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SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Combustible.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Prevent fire extinguishing water from contaminating surface water or the ground water system.

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SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class
Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
	Remarks	Suspected human carcinogen		

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Benzo[b]fluoranthene	205-99-2	PEL	0.2 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Benzo[b]fluoranthene	205-99-2	1-Hydroxypyrene	2.5 µg/l	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			
		3-hydroxybenzo(a)pyrene		Urine	ACGIH - Biological Exposure Indices (BEI)
		End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
Handle with impervious gloves.

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection
protective clothing

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Respiratory protection
Recommended Filter type: Filter type P3
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/ range: 163 - 165 °C (325 - 329 °F) - lit.
f)	Initial boiling point and boiling range	No data available
g)	Flash point	()Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
l)	Vapor density	No data available
m)	Density	No data available
	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available

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r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	none

9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
Violent reactions possible with:
Strong oxidizing agents

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
No data available

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Oral: No data available
Inhalation: No data available
Dermal: No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

The life science business of Merck KGaA, Darmstadt, Germany
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Presumed to have carcinogenic potential for humans

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Benzo[b]fluoranthene)

NTP: RAHC - Reasonably anticipated to be a human carcinogen (Benzo[b]fluoranthene)

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
No data available

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operates as MilliporeSigma in the US and Canada

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)
Not dangerous goods

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Benzo[b]fluoranthene)
Marine pollutant : yes
Marine pollutant : no

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Benzo[b]fluoranthene)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.Packages smaller than or equal to 5 kg / L , not dangerous goods of Class 9

SECTION 15: Regulatory information

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
Benzo[b]fluoranthene	205-99-2	1	1

SARA 304 Extremely Hazardous Substances Reportable Quantity
This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity
This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Chronic Health Hazard

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SARA 313 : The following components are subject to reporting levels established by SARA Title III, Section 313:

Benzo[b]fluoranthene	205-99-2	>= 90 - <= 100 %

US State Regulations

Massachusetts Right To Know

Benzo[b]fluoranthene	205-99-2

Pennsylvania Right To Know

Benzo[b]fluoranthene	205-99-2

Maine Chemicals of High Concern

Product does not contain any listed chemicals

Vermont Chemicals of High Concern

Product does not contain any listed chemicals

Washington Chemicals of High Concern

Product does not contain any listed chemicals

California Prop. 65

WARNING: This product can expose you to chemicals including Benzo[b]fluoranthene, which is/are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

The ingredients of this product are reported in the following inventories:

TSCA : Product contains substance(s) not listed on TSCA inventory.

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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SAFETY DATA SHEET

Version 6.11
Revision Date 09/08/2024
Print Date 09/09/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Benzo[k]fluoranthene

Product Number : 392251
Brand : Aldrich
Index-No. : 601-036-00-5
CAS-No. : 207-08-9

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Carcinogenicity (Category 1B), H350
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

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For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Danger

Hazard Statements

H350	May cause cancer.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary Statements

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Formula	:	$C_{20}H_{12}$
Molecular weight	:	252.31 g/mol
CAS-No.	:	207-08-9
EC-No.	:	205-916-6
Index-No.	:	601-036-00-5

Component	Classification	Concentration
Benzo[k]fluoranthene		
	Carc. 1B; Aquatic Acute 1; Aquatic Chronic 1; H350, H400, H410 M-Factor - Aquatic Acute: 10 M-Factor - Aquatic Chronic: 10	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

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SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Combustible.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Prevent fire extinguishing water from contaminating surface water or the ground water system.

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SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class
Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

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Component	CAS-No.	Value	Control parameters	Basis
Benzo[k]fluoranthene	207-08-9	PEL	0.2 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Benzo[k]fluoranthene	207-08-9	1-Hydroxypyrene	2.5 µg/l	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			
		3-hydroxybenzo(a)pyrene		Urine	ACGIH - Biological Exposure Indices (BEI)
		End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
Handle with impervious gloves.

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection
protective clothing

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Respiratory protection
Recommended Filter type: Filter type P3
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystalline Color: yellow
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/ range: 215 - 217 °C (419 - 423 °F) - lit.
f)	Initial boiling point and boiling range	480 °C 896 °F
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
l)	Vapor density	No data available
m)	Density	1.286 g/cm3 at 20 °C (68 °F)
	Relative density	No data available
n)	Water solubility	insoluble
o)	Partition coefficient: n-octanol/water	log Pow: 6.188 at 25 °C (77 °F) - Potential bioaccumulation
p)	Autoignition temperature	No data available
q)	Decomposition	No data available

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temperature

r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	none

9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Oral: No data available
Inhalation: Irritating to respiratory system.
Dermal: No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

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Presumed to have carcinogenic potential for humans

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Benzo[k]fluoranthene)

NTP: RAHC - Reasonably anticipated to be a human carcinogen (Benzo[k]fluoranthene)

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

RTECS: DF6350000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
No data available

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SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Benzo[k]fluoranthene)
Reportable Quantity (RQ): 5000 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Benzo[k]fluoranthene)
Marine pollutant : yes
Marine pollutant : no

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Benzo[k]fluoranthene)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

SECTION 15: Regulatory information

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
Benzo[k]fluoranthene	207-08-9	5000	5000

SARA 304 Extremely Hazardous Substances Reportable Quantity
This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity
This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Acute Health Hazard
Chronic Health Hazard

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SARA 313 : The following components are subject to reporting levels established by SARA Title III, Section 313:

Benzo[k]fluoranthene	207-08-9	>= 90 - <= 100 %

US State Regulations

Massachusetts Right To Know

Benzo[k]fluoranthene	207-08-9

Pennsylvania Right To Know

Benzo[k]fluoranthene	207-08-9

Maine Chemicals of High Concern

Product does not contain any listed chemicals

Vermont Chemicals of High Concern

Product does not contain any listed chemicals

Washington Chemicals of High Concern

Product does not contain any listed chemicals

California Prop. 65

WARNING: This product can expose you to chemicals including Benzo[k]fluoranthene, which is/are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

The ingredients of this product are reported in the following inventories:

TSCA : Product contains substance(s) not listed on TSCA inventory.

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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SAFETY DATA SHEET

Version 6.7
Revision Date 09/06/2024
Print Date 09/07/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Chrysene

Product Number : 35754
Brand : Sigma-Aldrich
Index-No. : 601-048-00-0
CAS-No. : 218-01-9

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Germ cell mutagenicity (Category 2), H341
Carcinogenicity (Category 1B), H350
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

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For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Danger

Hazard Statements

H341	Suspected of causing genetic defects.
H350	May cause cancer.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary Statements

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P273	Avoid release to the environment.
P281	Use personal protective equipment as required.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Formula	:	$C_{18}H_{12}$
Molecular weight	:	228.29 g/mol
CAS-No.	:	218-01-9
EC-No.	:	205-923-4
Index-No.	:	601-048-00-0

Component	Classification	Concentration
chrysene		
	Muta. 2; Carc. 1B; Aquatic Acute 1; Aquatic Chronic 1; H341, H350, H400, H410 M-Factor - Aquatic Acute: 10 M-Factor - Aquatic Chronic: 10	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

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SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

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6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class
Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
	Remarks	Confirmed animal carcinogen with unknown relevance to humans		
chrysene	218-01-9	TWA	0.2 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		OSHA specifically regulated carcinogen		

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		TWA	0.1 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen		
		PEL	0.2 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
chrysene	218-01-9	1-Hydroxypyrene	2.5 µg/l	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			
		3-hydroxybenzo(a)pyrene		Urine	ACGIH - Biological Exposure Indices (BEI)
		End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

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If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the EC approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
protective clothing

Respiratory protection
Recommended Filter type: Filter type P3
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/ range: 252 - 254 °C (486 - 489 °F) - lit.
f)	Initial boiling point and boiling range	448 °C 838 °F - lit.
g)	Flash point	()No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
l)	Vapor density	No data available
m)	Density	No data available
	Relative density	No data available

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n)	Water solubility	insoluble
o)	Partition coefficient: n-octanol/water	log Pow: 5.73
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
No data available

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Oral: No data available
Inhalation: No data available
Dermal: No data available
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

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Respiratory or skin sensitization
No data available

Germ cell mutagenicity
In vitro tests showed mutagenic effects
Test Type: Ames test
Test system: Salmonella typhimurium
Result: positive
Remarks: (Lit.)

Carcinogenicity
Possible human carcinogen

IARC: 2B - Group 2B: Possibly carcinogenic to humans (chrysene)

NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: OSHA specifically regulated carcinogen (chrysene)

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

RTECS: GC0700000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Property that cannot be excluded on the basis of structure- effect considerations:

Nausea
Vomiting
Risk of methaemoglobin formation with headache, cardiac dysrhythmia, drop in blood pressure, dyspnoea and spasms, principal symptom: cyanosis (blue discolouration of the blood).

This substance should be handled with particular care.

SECTION 12: Ecological information

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

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12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
Discharge into the environment must be avoided.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (chrysene) (chrysene)
Reportable Quantity (RQ): 100 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (chrysene) (chrysene)
Marine pollutant : yes
Marine pollutant : no

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (chrysene) (chrysene)

Further information

The life science business of Merck KGaA, Darmstadt, Germany
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EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

SECTION 15: Regulatory information

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
chrysene	218-01-9	100	100

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

Components	CAS-No.	Component TPQ (lbs)

SARA 311/312 Hazards : Chronic Health Hazard

SARA 313 : The following components are subject to reporting levels established by SARA Title III, Section 313:

chrysene 218-01-9 100 %

US State Regulations

Massachusetts Right To Know

chrysene 218-01-9

Pennsylvania Right To Know

chrysene 218-01-9

Pennsylvania Right To Know

chrysene 218-01-9

New Jersey Right To Know

chrysene 218-01-9

California Prop. 65

WARNING! This product contains a chemical known in the State of California to cause cancer.

The ingredients of this product are reported in the following inventories:

TSCA : All substances listed as active on the TSCA inventory

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

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SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.7 Revision Date: 09/06/2024 Print Date: 09/07/2024

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SAFETY DATA SHEET

Version 6.10
Revision Date 10/16/2024
Print Date 10/17/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Dibenz[*a*,*h*]anthracene

Product Number : 91861
Brand : Sigma-Aldrich
Index-No. : 601-041-00-2
CAS-No. : 53-70-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Carcinogenicity (Category 1B), H350
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

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For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Danger

Hazard Statements

H350	May cause cancer.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary Statements

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Formula	:	$C_{22}H_{14}$
Molecular weight	:	278.35 g/mol
CAS-No.	:	53-70-3
EC-No.	:	200-181-8
Index-No.	:	601-041-00-2

Component	Classification	Concentration
Dibenz[a,h]anthracene		
	Carc. 1B; Aquatic Acute 1; Aquatic Chronic 1; H350, H400, H410 Concentration limits: >= 0.01 %: Carc. 1B, H350; M-Factor - Aquatic Acute: 100 - Aquatic Chronic: 100	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

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SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Combustible.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Prevent fire extinguishing water from contaminating surface water or the ground water system.

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SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.
Storage stability Recommended storage temperature
15 - 25 °C
Moisture sensitive.

Storage class
Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

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Component	CAS-No.	Value	Control parameters	Basis
Dibenz[a,h]anthracene	53-70-3	PEL	0.2 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Dibenz[a,h]anthracene	53-70-3	1-Hydroxypyrene	2.5 µg/l	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at end of workweek			
		3-hydroxybenzo(a)pyrene		Urine	ACGIH - Biological Exposure Indices (BEI)
		End of shift at end of workweek			

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
Handle with impervious gloves.

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection
protective clothing

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Respiratory protection
Recommended Filter type: Filter type P3
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/ range: 262 - 265 °C (504 - 509 °F) - lit.
f)	Initial boiling point and boiling range	524 °C 975 °F - lit.
g)	Flash point	()Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
l)	Vapor density	No data available
m)	Density	No data available
	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available

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r)	Viscosity	No data available
s)	Explosive properties	Not classified as explosive.
t)	Oxidizing properties	none

9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
Violent reactions possible with:
strong oxidising agents

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
No data available

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Oral: No data available
Inhalation: No data available
Dermal: No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

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Presumed to have carcinogenic potential for humans

IARC: 2A - Group 2A: Probably carcinogenic to humans (Dibenz[a,h]anthracene)

NTP: RAHC - Reasonably anticipated to be a human carcinogen (Dibenz[a,h]anthracene)

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

RTECS: HN2625000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Lungs -

SECTION 12: Ecological information

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
Discharge into the environment must be avoided.

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SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Dibenz[a,h]anthracene)
Reportable Quantity (RQ): 1 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Dibenz[a,h]anthracene)
Marine pollutant : yes
Marine pollutant : no

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Dibenz[a,h]anthracene)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

SECTION 15: Regulatory information

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
Dibenz[a,h]anthracene	53-70-3	1	1

SARA 304 Extremely Hazardous Substances Reportable Quantity
This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity
This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Chronic Health Hazard

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SARA 313 : The following components are subject to reporting levels established by SARA Title III, Section 313:

Dibenz[a,h]anthracene	53-70-3	>= 90 - <= 100 %

Clean Air Act

This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).
The following chemical(s) are listed as HAP under the U.S. Clean Air Act, Section 112 (40 CFR 61):

Dibenz[a,h]anthracene	53-70-3	>= 90 - <= 100 %

This product does not contain any chemicals listed under the U.S. Clean Air Act Section 112(r) for Accidental Release Prevention (40 CFR 68.130, Subpart F).
This product does not contain any chemicals listed under the U.S. Clean Air Act Section 111 SOCMI Intermediate or Final VOC's (40 CFR 60.489).

Clean Water Act

This product does not contain any Hazardous Substances listed under the U.S. CleanWater Act, Section 311, Table 116.4A.
This product does not contain any Hazardous Chemicals listed under the U.S. CleanWater Act, Section 311, Table 117.3.
This product contains the following toxic pollutants listed under the U.S. Clean Water Act Section 307

Dibenz[a,h]anthracene	53-70-3	>= 90 - <= 100 %

This product contains the following priority pollutants related to the U.S. Clean Water Act:

Dibenz[a,h]anthracene	53-70-3	>= 90 - <= 100 %

US State Regulations

Massachusetts Right To Know

Dibenz[a,h]anthracene	53-70-3

Pennsylvania Right To Know

Dibenz[a,h]anthracene	53-70-3

Maine Chemicals of High Concern

Product does not contain any listed chemicals

Vermont Chemicals of High Concern

Product does not contain any listed chemicals

Washington Chemicals of High Concern

Product does not contain any listed chemicals

California Prop. 65

WARNING: This product can expose you to chemicals including Dibenz[a,h]anthracene, which is/are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

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The ingredients of this product are reported in the following inventories:

TSCA : All substances listed as active on the TSCA inventory

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.10 Revision Date: 10/16/2024 Print Date: 10/17/2024

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SAFETY DATA SHEET

Version 6.11
Revision Date 04/07/2025
Print Date 04/08/2025

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Indeno[1,2,3-*cd*]pyrene

Product Number : 48499
Brand : Supelco
CAS-No. : 193-39-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Carcinogenicity (Category 2), H351

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

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Pictogram	
Signal Word	Warning

Hazard Statements

H351	Suspected of causing cancer.

Precautionary Statements

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P280	Wear protective gloves, protective clothing, eye protection and face protection.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Formula	:	$C_{22}H_{12}$
Molecular weight	:	276.33 g/mol
CAS-No.	:	193-39-5
EC-No.	:	205-893-2

Component	Classification	Concentration
Indeno[1,2,3-cd]pyrene		
	Carc. 2; H351	>= 80 - <= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

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In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Combustible.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Avoid inhalation of dusts. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up dry. Dispose of properly. Clean up affected area. Avoid generation of dusts.

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6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class
Storage class (TRGS 510): 11: Combustible Solids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
Handle with impervious gloves.

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

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Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection
protective clothing

Respiratory protection
Recommended Filter type: Filter type P3
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	163.6 °C (326.5 °F)
f)	Initial boiling point and boiling range	No data available
g)	Flash point	()Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available

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k)	Vapor pressure	No data available
l)	Vapor density	No data available
m)	Density	No data available
	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Oral: No data available

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Inhalation: No data available
Dermal: No data available

Skin corrosion/irritation
Remarks: No data available

Serious eye damage/eye irritation
Remarks: No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Indeno[1,2,3-cd]pyrene)

NTP: RAHC - Reasonably anticipated to be a human carcinogen (Indeno[1,2,3-cd]pyrene)

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

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12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties

No data available

12.7 Other adverse effects

No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)

UN number: 3077 Class: 9 Packing group: III

Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Indeno[1,2,3-cd]pyrene)

Reportable Quantity (RQ): 100 lbs

Poison Inhalation Hazard: No

IMDG

Not dangerous goods

IATA

Not dangerous goods

Further information

Not classified as dangerous in the meaning of transport regulations.

SECTION 15: Regulatory information

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
Indeno[1,2,3-cd]pyrene	193-39-5	100	100

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SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Chronic Health Hazard

SARA 313 : The following components are subject to reporting levels established by SARA Title III, Section 313:

Indeno[1,2,3-cd]pyrene	193-39-5	>= 90 - <= 100 %

Clean Air Act

This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).
The following chemical(s) are listed as HAP under the U.S. Clean Air Act, Section 112 (40 CFR 61):

Indeno[1,2,3-cd]pyrene	193-39-5	>= 90 - <= 100 %

This product does not contain any chemicals listed under the U.S. Clean Air Act Section 112(r) for Accidental Release Prevention (40 CFR 68.130, Subpart F).
This product does not contain any chemicals listed under the U.S. Clean Air Act Section 111 SOCMI Intermediate or Final VOC's (40 CFR 60.489).

Clean Water Act

This product does not contain any Hazardous Substances listed under the U.S. CleanWater Act, Section 311, Table 116.4A.
This product does not contain any Hazardous Chemicals listed under the U.S. CleanWater Act, Section 311, Table 117.3.
This product contains the following toxic pollutants listed under the U.S. Clean Water Act Section 307

Indeno[1,2,3-cd]pyrene	193-39-5	>= 90 - <= 100 %

This product contains the following priority pollutants related to the U.S. Clean Water Act:

Indeno[1,2,3-cd]pyrene	193-39-5	>= 90 - <= 100 %

US State Regulations

Massachusetts Right To Know

Indeno[1,2,3-cd]pyrene	193-39-5

Pennsylvania Right To Know

Indeno[1,2,3-cd]pyrene	193-39-5

Maine Chemicals of High Concern

Product does not contain any listed chemicals

Vermont Chemicals of High Concern

Product does not contain any listed chemicals

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Washington Chemicals of High Concern

Product does not contain any listed chemicals

California Prop. 65

WARNING: This product can expose you to chemicals including Indeno[1,2,3-cd]pyrene, which is/are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

The ingredients of this product are reported in the following inventories:

TSCA : All substances listed as active on the TSCA inventory

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.11 Revision Date: 04/07/2025 Print Date: 04/08/2025

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SAFETY DATA SHEET

Version 6.6
Revision Date 09/09/2024
Print Date 09/10/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : 4,4'-DDD

Product Number : 35486
Brand : Sigma-Aldrich
CAS-No. : 72-54-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 3), H301
Acute toxicity, Dermal (Category 4), H312
Carcinogenicity (Category 2), H351
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

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For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Danger

Hazard Statements

H301	Toxic if swallowed.
H312	Harmful in contact with skin.
H351	Suspected of causing cancer.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary Statements

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER/ doctor.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P322	Specific measures (see supplemental first aid instructions on this label).
P330	Rinse mouth.
P363	Wash contaminated clothing before reuse.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms : 1,1-Dichloro-2,2-bis(4-chlorophenyl)ethane
TDE

Formula : $C_{14}H_{10}Cl_4$
Molecular weight : 320.04 g/mol
CAS-No. : 72-54-8
EC-No. : 200-783-0

Component	Classification	Concentration
2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane		
	Acute Tox. 3; Acute Tox. 4; Carc. 2; Aquatic Acute	<= 100 %

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	1; Aquatic Chronic 1; H301, H312, H351, H400, H410 M-Factor - Aquatic Acute: 100 - Aquatic Chronic: 100	

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
If swallowed: give water to drink (two glasses at most). Seek medical advice immediately. In exceptional cases only, if medical care is not available within one hour, induce vomiting (only in persons who are wide awake and fully conscious), administer activated charcoal (20 - 40 g in a 10% slurry) and consult a doctor as quickly as possible.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

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5.2 Special hazards arising from the substance or mixture

Carbon oxides
Hydrogen chloride gas
Nature of decomposition products not known.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information

Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid inhalation of dusts. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class
Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

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7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the EC approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
protective clothing

Respiratory protection
Recommended Filter type: Filter type P3

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The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	94.0 - 96.0 °C (201.2 - 204.8 °F)
f)	Initial boiling point and boiling range	193.0 °C 379.4 °F at 1.3 hPa
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	< 0.000 hPa at 25.0 °C (77.0 °F)
l)	Vapor density	No data available
m)	Density	1.38 g/cm3
	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 6.02
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available

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s) Explosive properties No data available

t) Oxidizing properties No data available

9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
No data available

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
Acute toxicity estimate Oral - 113 mg/kg
(Calculation method)
LD50 Oral - Rat - 113.0 mg/kg
Remarks: (RTECS)
Inhalation: No data available
Acute toxicity estimate Dermal - 1,200 mg/kg
(Calculation method)
LD50 Dermal - Rabbit - 1,200 mg/kg
Remarks: Behavioral:Excitement.
Behavioral:Convulsions or effect on seizure threshold.
Skin irritation
(RTECS)

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

The life science business of Merck KGaA, Darmstadt, Germany
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Germ cell mutagenicity
No data available

Carcinogenicity
Suspected of causing cancer.

IARC: 2A - Group 2A: Probably carcinogenic to humans (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane)

IARC: 2A - Group 2A: Probably carcinogenic to humans (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane)

ACGIH: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

11.2 Additional Information

RTECS: KI0700000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.06 - 0.09 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia pulex (Water flea) - 0.01 mg/l - 48 h

12.2 Persistence and degradability
No data available

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12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)
UN number: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solids, organic, n.o.s. (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane)
Reportable Quantity (RQ): 1 lbs
Poison Inhalation Hazard: No

IMDG
UN number: 2811 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane)
Marine pollutant : yes

IATA
UN number: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solid, organic, n.o.s. (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane)

The life science business of Merck KGaA, Darmstadt, Germany
operates as MilliporeSigma in the US and Canada

SECTION 15: Regulatory information

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane	72-54-8	1	1

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

Components	CAS-No.	Component TPQ (lbs)

SARA 311/312 Hazards : Acute Health Hazard

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

US State Regulations

Massachusetts Right To Know

No components are subject to the Massachusetts Right to Know Act.

Massachusetts Right To Know

2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane 72-54-8

Pennsylvania Right To Know

2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane 72-54-8

Pennsylvania Right To Know

2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane 72-54-8

Maine Chemicals of High Concern

Product does not contain any listed chemicals

Vermont Chemicals of High Concern

Product does not contain any listed chemicals

Washington Chemicals of High Concern

Product does not contain any listed chemicals

New Jersey Right To Know

2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane 72-54-8

California Prop. 65

WARNING! This product contains a chemical known in the State of California to cause cancer. WARNING: This product can expose you to chemicals including 2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane, which is/are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

The ingredients of this product are reported in the following inventories:

TSCA : Product contains substance(s) not listed on TSCA

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inventory.

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.6 Revision Date: 09/09/2024 Print Date: 09/10/2024

The life science business of Merck KGaA, Darmstadt, Germany
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SAFETY DATA SHEET

Version 6.6
Revision Date 09/06/2024
Print Date 09/07/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : 4,4'-DDE

Product Number : 35487
Brand : Sigma-Aldrich
CAS-No. : 72-55-9

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 3), H301
Carcinogenicity (Category 2), H351
Specific target organ toxicity - repeated exposure, Oral (Category 1), H372
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

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For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Danger

Hazard Statements

H301	Toxic if swallowed.
H351	Suspected of causing cancer.
H372	Causes damage to organs through prolonged or repeated exposure if swallowed.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary Statements

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapors/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310 + P330	IF SWALLOWED: Immediately call a POISON CENTER/ doctor. Rinse mouth.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms : 1,1-Dichloro-2,2-bis(4-chlorophenyl)ethene

Formula : $C_{14}H_8Cl_4$
Molecular weight : 318.03 g/mol
CAS-No. : 72-55-9
EC-No. : 200-784-6

Component	Classification	Concentration
2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene		
	Acute Tox. 3; Carc. 2; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H301, H351, H372, H400,	<= 100 %

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	H410 M-Factor - Aquatic Acute: 100	

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
If swallowed: give water to drink (two glasses at most). Seek medical advice immediately. In exceptional cases only, if medical care is not available within one hour, induce vomiting (only in persons who are wide awake and fully conscious), administer activated charcoal (20 - 40 g in a 10% slurry) and consult a doctor as quickly as possible.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Hydrogen chloride gas
Combustible.
Development of hazardous combustion gases or vapours possible in the event of fire.

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5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class
Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

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SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
Handle with impervious gloves.

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection
protective clothing

Respiratory protection
Recommended Filter type: Filter type P3
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

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SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/ range: 88.0 - 90.0 °C (190.4 - 194.0 °F)
f)	Initial boiling point and boiling range	No data available
g)	Flash point	()No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	< 0.000 hPa
l)	Vapor density	No data available
m)	Density	No data available
	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	log Pow: 6.51
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

No data available

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SECTION 10: Stability and reactivity

10.1 Reactivity
The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
Strong oxidizing agents, Strong bases

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 87.0 mg/kg
Remarks: The value is given in analogy to the following substances: 1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane
Inhalation: No data available
Dermal: No data available
No data available

Skin corrosion/irritation
Remarks: No data available

Serious eye damage/eye irritation
Remarks: No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.
Limited evidence of carcinogenicity in animal studies

IARC: 2A - Group 2A: Probably carcinogenic to humans (2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene)

NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

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OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Remarks: No data available
The value is given in analogy to the following substances: 1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane
Ingestion - Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

11.2 Additional Information

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 0.01 mg/l - 96 h Remarks: The value is given in analogy to the following substances: 1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane LC50 - Lepomis macrochirus (Bluegill sunfish) - 0.01 mg/l - 96 h Remarks: The value is given in analogy to the following substances: 1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane LC50 - Oncorhynchus mykiss (rainbow trout) - 0.003400 mg/l - 96 h Remarks: The value is given in analogy to the following substances: 1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane
Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - 0.00108 mg/l - 48 h Remarks: The value is given in analogy to the following substances: 1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane
Toxicity to fish(Chronic toxicity)	NOEC - Oncorhynchus mykiss (rainbow trout) - 113 mg/l - 3.0 d Remarks: The value is given in analogy to the following substances: 1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane

12.2 Persistence and degradability
No data available

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12.3 Bioaccumulative potential

Bioaccumulation Gambusia affinis (Mosquito fish) - 33 d
- 3.84 µg/l(2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene)

Bioconcentration factor (BCF): 12,037

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties

No data available

12.7 Other adverse effects

No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)

UN number: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solids, organic, n.o.s. (2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene)
Reportable Quantity (RQ): 1 lbs
Marine pollutant: yes Poison Inhalation Hazard: No

IMDG

UN number: 2811 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene)
Marine pollutant : yes

IATA

UN number: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solid, organic, n.o.s. (2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene)

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SECTION 15: Regulatory information

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene	72-55-9	1	1

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

Components	CAS-No.	Component TPQ (lbs)

SARA 311/312 Hazards : Acute Health Hazard
Chronic Health Hazard

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

US State Regulations

Massachusetts Right To Know

No components are subject to the Massachusetts Right to Know Act.

Massachusetts Right To Know

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know

2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene 72-55-9

Pennsylvania Right To Know

2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene 72-55-9

Maine Chemicals of High Concern

Product does not contain any listed chemicals

Vermont Chemicals of High Concern

Product does not contain any listed chemicals

Washington Chemicals of High Concern

Product does not contain any listed chemicals

New Jersey Right To Know

2,2-bis(p-Chlorophenyl)-1,1-dichloroethylene 72-55-9

The ingredients of this product are reported in the following inventories:

TSCA : Product contains substance(s) not listed on TSCA inventory.

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TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.6 Revision Date: 09/06/2024 Print Date: 09/07/2024

The life science business of Merck KGaA, Darmstadt, Germany
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SAFETY DATA SHEET

Version 6.10
Revision Date 09/06/2024
Print Date 09/07/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : 4,4'-DDT

Product Number : 31041
Brand : Sigma-Aldrich
Index-No. : 602-045-00-7
CAS-No. : 50-29-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 3), H301
Acute toxicity, Dermal (Category 3), H311
Carcinogenicity (Category 2), H351
Specific target organ toxicity - repeated exposure, Oral (Category 1), H372

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Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Danger

Hazard Statements

H301 + H311	Toxic if swallowed or in contact with skin.
H351	Suspected of causing cancer.
H372	Causes damage to organs through prolonged or repeated exposure if swallowed.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary Statements

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310 + P330	IF SWALLOWED: Immediately call a POISON CENTER/ doctor. Rinse mouth.
P302 + P352 + P312	IF ON SKIN: Wash with plenty of water.Call a POISON CENTER/ doctor if you feel unwell.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms	:	1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane 1,1-Bis(4-chlorophenyl)-2,2,2-trichloroethane
Formula	:	$C_{14}H_9Cl_5$
Molecular weight	:	354.49 g/mol
CAS-No.	:	50-29-3
EC-No.	:	200-024-3
Index-No.	:	602-045-00-7

The life science business of Merck KGaA, Darmstadt, Germany
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Component	Classification	Concentration
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane		
	Acute Tox. 3; Carc. 2; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H301, H311, H351, H372, H400, H410 M-Factor - Aquatic Acute: 100 - Aquatic Chronic: 100	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
First aiders need to protect themselves. Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Call a physician immediately.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
If swallowed: give water to drink (two glasses at most). Seek medical advice immediately. In exceptional cases only, if medical care is not available within one hour, induce vomiting (only in persons who are wide awake and fully conscious), administer activated charcoal (20 - 40 g in a 10% slurry) and consult a doctor as quickly as possible.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

The life science business of Merck KGaA, Darmstadt, Germany
operates as MilliporeSigma in the US and Canada

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Hydrogen chloride gas
Combustible.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

The life science business of Merck KGaA, Darmstadt, Germany
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Storage class
Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane	50-29-3	TWA	1 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Confirmed animal carcinogen with unknown relevance to humans		
		TWA	0.5 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen		
		TWA	1 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Skin designation		
		PEL	1 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		Skin		

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
Handle with impervious gloves.

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please

The life science business of Merck KGaA, Darmstadt, Germany
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contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection
protective clothing

Respiratory protection
Recommended Filter type: Filter type P3
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/ range: 107 - 110 °C (225 - 230 °F) - lit.
f)	Initial boiling point and boiling range	260.0 °C 500.0 °F
g)	Flash point	()Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower	No data available

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	flammability or explosive limits	
k)	Vapor pressure	0.000002 hPa at 20.0 °C (68.0 °F)
l)	Vapor density	No data available
m)	Density	0.99 g/cm3
	Relative density	No data available
n)	Water solubility	slightly soluble
o)	Partition coefficient: n-octanol/water	log Pow: 6.91 - Potential bioaccumulation
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	none

9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
Violent reactions possible with:
Oxidizing agents
iron/iron-containing compounds

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
No data available

10.6 Hazardous decomposition products
In the event of fire: see section 5

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operates as MilliporeSigma in the US and Canada

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 87.0 mg/kg
Remarks: (RTECS)
Inhalation: No data available
LD50 Dermal - Rabbit - 300.0 mg/kg
Remarks: Behavioral:Tremor.
Behavioral:Muscle weakness.
Behavioral:Ataxia.
(RTECS)

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
Suspected of causing cancer.

IARC:	2A - Group 2A: Probably carcinogenic to humans (1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane)
NTP:	RAHC - Reasonably anticipated to be a human carcinogen (1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane)
OSHA:	No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Ingestion - Causes damage to organs through prolonged or repeated exposure.
Remarks: Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)

Aspiration hazard
No data available

11.2 Additional Information

RTECS: KJ3325000
CNS stimulation., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Pancreas. -

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SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.003400 mg/l - 96.0 h Remarks: (ECOTOX Database) (Regulation (EC) No 1272/2008, Annex VI)
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.00108 mg/l - 48 h Remarks: (ECOTOX Database) (Regulation (EC) No 1272/2008, Annex VI)

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential

Bioaccumulation	Oncorhynchus mykiss (rainbow trout) - 20 d - 0.001 mg/l(1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane) Bioconcentration factor (BCF): 46,670

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties

No data available

12.7 Other adverse effects

No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

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SECTION 14: Transport information

DOT (US)
UN number: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solids, organic, n.o.s. (1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane)
Reportable Quantity (RQ): 1 lbs
Marine pollutant: yes Poison Inhalation Hazard: No

IMDG
UN number: 2811 Class: 6.1 Packing group: III EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane)
Marine pollutant : yes

IATA
UN number: 2811 Class: 6.1 Packing group: III
Proper shipping name: Toxic solid, organic, n.o.s. (1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane)

SECTION 15: Regulatory information

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane	50-29-3	1	1

SARA 304 Extremely Hazardous Substances Reportable Quantity
This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity
This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Acute Health Hazard
Chronic Health Hazard

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

US State Regulations

Massachusetts Right To Know
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane 50-29-3

Pennsylvania Right To Know
1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane 50-29-3

Maine Chemicals of High Concern

The life science business of Merck KGaA, Darmstadt, Germany
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Product does not contain any listed chemicals

Vermont Chemicals of High Concern

Product does not contain any listed chemicals

Washington Chemicals of High Concern

Product does not contain any listed chemicals

California Prop. 65

WARNING: This product can expose you to chemicals including 1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane, which is/are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

International Regulations

Rotterdam Convention (Prior Informed Consent)	:	1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane
Stockholm Convention (Persistent Organic Pollutants)	:	1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane

The ingredients of this product are reported in the following inventories:

TSCA	:	All substances listed as active on the TSCA inventory

TSCA list

The following substance(s) is/are subject to a Significant New Use Rule:

1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane	50-29-3	See 40 CFR § 721.2287; Final Rule

The following substance(s) is/are subject to TSCA 12(b) export notification requirements:

1,1,1-Trichloro-2,2-bis(4-chlorophenyl)ethane	50-29-3

SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.10 Revision Date: 09/06/2024 Print Date: 09/07/2024

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SAFETY DATA SHEET

Version 6.9
Revision Date 09/08/2024
Print Date 09/09/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Dieldrin

Product Number : 33491
Brand : Sigma-Aldrich
Index-No. : 602-049-00-9
CAS-No. : 60-57-1

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 2), H300
Acute toxicity, Dermal (Category 1), H310
Carcinogenicity (Category 2), H351
Specific target organ toxicity - repeated exposure, Oral (Category 1), H372

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Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Danger

Hazard Statements

H300 + H310	Fatal if swallowed or in contact with skin.
H351	Suspected of causing cancer.
H372	Causes damage to organs through prolonged or repeated exposure if swallowed.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary Statements

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust.
P262	Do not get in eyes, on skin, or on clothing.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310 + P330	IF SWALLOWED: Immediately call a POISON CENTER/ doctor. Rinse mouth.
P302 + P350 + P310	IF ON SKIN: Gently wash with plenty of soap and water. Immediately call a POISON CENTER or doctor/ physician.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms	:	1,2,3,4,10,10-Hexachloro-1,4,4a,5,6,7,8,8a-octahydro-6,7-epoxy-1,4:5,8-dimethanonaphthalene
Formula	:	$C_{12}H_8Cl_6O$
Molecular weight	:	380.91 g/mol
CAS-No.	:	60-57-1
EC-No.	:	200-484-5

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Index-No. : 602-049-00-9

Component	Classification	Concentration
Dieldrin		
	Acute Tox. 2; Acute Tox. 1; Carc. 2; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H300, H310, H351, H372, H400, H410 M-Factor - Aquatic Acute: 100 M-Factor - Aquatic Chronic: 10	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
First aiders need to protect themselves. Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Call a physician immediately.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
If swallowed: give water to drink (two glasses at most). Seek medical advice immediately. In exceptional cases only, if medical care is not available within one hour, induce vomiting (only in persons who are wide awake and fully conscious), administer activated charcoal (20 - 40 g in a 10% slurry) and consult a doctor as quickly as possible.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

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SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Carbon oxides
Hydrogen chloride gas
Combustible.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information

Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

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For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class
Storage class (TRGS 510): 6.1A: Combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Dieldrin	60-57-1	TWA	0.1 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption		
		TWA	0.25 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen Potential for dermal absorption		
		TWA	0.25 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Skin designation		
		PEL	0.25 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		Skin		

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

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Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374
If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the EC approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection
protective clothing

Respiratory protection
Recommended Filter type: Filter type P3
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available

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e)	Melting point/freezing point	Melting point/ range: 143 - 144 °C (289 - 291 °F) - lit.
f)	Initial boiling point and boiling range	No data available
g)	Flash point	()Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
l)	Vapor density	No data available
m)	Density	No data available
	Relative density	No data available
n)	Water solubility	slightly soluble
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	none

9.2 Other safety information
No data available

SECTION 10: Stability and reactivity

10.1 Reactivity
The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
Violent reactions possible with:
Strong oxidizing agents

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10.4 Conditions to avoid
no information available

10.5 Incompatible materials
No data available

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - 38.3 mg/kg
Remarks: (RTECS)
Inhalation: No data available
Acute toxicity estimate Dermal - 5.1 mg/kg
(Expert judgment)
Remarks: Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
Suspected of causing cancer.

IARC:	2A - Group 2A: Probably carcinogenic to humans (Dieldrin)
NTP:	No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
OSHA:	No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Ingestion - Causes damage to organs through prolonged or repeated exposure.
Remarks: Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)

Aspiration hazard
No data available

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11.2 Additional Information

RTECS: IO1750000
Discomfort, Headache, Nausea, Vomiting, Dizziness, Tremors, tonic convulsions, clonic spasms, Coma., respiratory failure
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Blood - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	static test LC50 - Lepomis cyanellus - 0.011 mg/l - 96 h Remarks: (ECOTOX Database)

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties

No data available

12.7 Other adverse effects

Discharge into the environment must be avoided.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

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SECTION 14: Transport information

DOT (US)
UN number: 2811 Class: 6.1 Packing group: I
Proper shipping name: Toxic solids, organic, n.o.s. (Dieldrin)
Reportable Quantity (RQ): 1 lbs
Marine pollutant: yes Poison Inhalation Hazard: No

IMDG
UN number: 2811 Class: 6.1 Packing group: I EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (Dieldrin)
Marine pollutant : yes

IATA
UN number: 2811 Class: 6.1 Packing group: I
Proper shipping name: Toxic solid, organic, n.o.s. (Dieldrin)
IATA Passenger: Not permitted for transport

SECTION 15: Regulatory information

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
Dieldrin	60-57-1	1	1

SARA 304 Extremely Hazardous Substances Reportable Quantity
This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity
This material does not contain any components with a section 302 EHS TPQ.

SARA 311/312 Hazards : Acute Health Hazard
Chronic Health Hazard

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

US State Regulations

Massachusetts Right To Know
Dieldrin 60-57-1

Pennsylvania Right To Know
Dieldrin 60-57-1

Maine Chemicals of High Concern
Product does not contain any listed chemicals

Vermont Chemicals of High Concern
Product does not contain any listed chemicals

The life science business of Merck KGaA, Darmstadt, Germany
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Washington Chemicals of High Concern

Product does not contain any listed chemicals

California Prop. 65

WARNING: This product can expose you to chemicals including Dieldrin, which is/are known to the State of California to cause cancer. For more information go to www.P65Warnings.ca.gov.

International Regulations

Rotterdam Convention (Prior Informed Consent)	:	Dieldrin
Stockholm Convention (Persistent Organic Pollutants)	:	Dieldrin

The ingredients of this product are reported in the following inventories:

TSCA	:	Product contains substance(s) not listed on TSCA inventory.

TSCA list

No substances are subject to a Significant New Use Rule.

No substances are subject to TSCA 12(b) export notification requirements.

SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.9 Revision Date: 09/08/2024 Print Date: 09/09/2024

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SAFETY DATA SHEET

Version 8.6
Revision Date 03/13/2024
Print Date 07/13/2024

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Aroclor 1254 solution

Product Number : 48734
Brand : Supelco

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Specific target organ toxicity - repeated exposure (Category 2), H373
Short-term (acute) aquatic hazard (Category 1), H400
Long-term (chronic) aquatic hazard (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Warning

The life science business of Merck KGaA, Darmstadt, Germany
operates as MilliporeSigma in the US and Canada

Hazard Statements

H373	May cause damage to organs through prolonged or repeated exposure.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary Statements

P260	Do not breathe mist or vapors.
P273	Avoid release to the environment.
P314	Get medical advice/ attention if you feel unwell.
P391	Collect spillage.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.2 Mixtures

Component		Classification	Concentration
butyl hydroxytoluene (BHT)			
CAS-No. EC-No. Registration number	128-37-0 204-881-4 01-2119565113-46-XXXX	Aquatic Acute 1; Aquatic Chronic 1; H400, H410 M-Factor - Aquatic Acute: 1 - Aquatic Chronic: 1	>= 90 - <= 100 %
Aroclor 1254			
CAS-No. EC-No. Index-No.	11097-69-1 601-021-3 602-039-00-4	Acute Tox. 4; STOT RE 2; Aquatic Acute 1; Aquatic Chronic 1; H302, H373, H400, H410 Concentration limits: >= 0.005 %: STOT RE 2, H373; >= 0.005 %: STOT RE 2, H373; M-Factor - Aquatic Acute: 1,000 M-Factor - Aquatic Chronic: 1,000	>= 0.005 - < 0.1 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice

Show this material safety data sheet to the doctor in attendance.

The life science business of Merck KGaA, Darmstadt, Germany
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If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Combustible.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Do not breathe vapors, aerosols. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

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6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up with liquid-absorbent material (e.g. Chemizorb®). Dispose of properly. Clean up affected area.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture. Avoid generation of vapours/aerosols.

Hygiene measures
Change contaminated clothing. Preventive skin protection recommended. Wash hands after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed.

Storage class
Storage class (TRGS 510): 10: Combustible liquids

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
butyl hydroxytoluene (BHT)	128-37-0	TWA	2 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Not classifiable as a human carcinogen		

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		TWA	10 mg/m3	USA. NIOSH Recommended Exposure Limits
		PEL	10 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
Aroclor 1254	11097-69-1	TWA	0.5 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Skin designation		
		TWA	0.5 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption		
		TWA	0.5 mg/m3	USA. Table Z-1-A Limits for Air Contaminants (1989 vacated values)
		Skin notation		
		TWA	0.001 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen		
		PEL	0.5 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		Skin		

8.2 Exposure controls

Appropriate engineering controls
Change contaminated clothing. Preventive skin protection recommended. Wash hands after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection
required

Body Protection
protective clothing

Respiratory protection
Recommended Filter type: Filter type ABEK
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when vapours/aerosols are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

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Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	No data available
f)	Initial boiling point and boiling range	No data available
g)	Flash point	()No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
l)	Vapor density	No data available
m)	Density	No data available
	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	Not classified as explosive.
t)	Oxidizing properties	none

9.2 Other safety information

No data available

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SECTION 10: Stability and reactivity

10.1 Reactivity
No data available

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
Bases, Oxidizing agents, Copper, Acid chlorides, Acid anhydrides, Brass

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Mixture

Acute toxicity
Oral: No data available
Inhalation: No data available
Acute toxicity estimate Dermal - 2,500 mg/kg
(Calculation method)

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity

IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

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Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Mixture may cause damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

11.2 Additional Information

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
Hazardous properties cannot be excluded but are unlikely when the product is handled appropriately.

Components

butyl hydroxytoluene (BHT)

Acute toxicity
LD50 Oral - Rat - male and female - > 6,000 mg/kg
(OECD Test Guideline 401)
Inhalation: No data available
LD50 Dermal - Rat - male and female - > 2,000 mg/kg
(OECD Test Guideline 402)

Skin corrosion/irritation
Skin - Rabbit
Result: No skin irritation - 4 h
(OECD Test Guideline 404)

Serious eye damage/eye irritation
Eyes - Rabbit
Result: No eye irritation
(OECD Test Guideline 405)

Respiratory or skin sensitization
Patch test: - In vitro study
Result: negative
Remarks: (ECHA)

Germ cell mutagenicity
Test Type: Ames test
Test system: Salmonella typhimurium
Result: negative
Remarks: (ECHA)
Test Type: In vitro mammalian cell gene mutation test
Test system: rat hepatocytes
Result: negative
Remarks: (ECHA)
Test Type: Mutagenicity (mammal cell test): chromosome aberration.
Test system: Chinese hamster ovary cells
Result: negative
Remarks: (ECHA)
Species: Mouse - male and female - Bone marrow

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Result: negative
Remarks: (ECHA)
Species: Rat - male - Bone marrow
Result: negative
Remarks: (ECHA)

Carcinogenicity
This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Aroclor 1254

Acute toxicity
LD50 Oral - Rat - 1,010 mg/kg
Remarks: (RTECS)
Inhalation: No data available
Dermal: No data available
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available

Carcinogenicity
No data available

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Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard
No data available

SECTION 12: Ecological information

12.1 Toxicity

Mixture
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
No data available

Components

butyl hydroxytoluene (BHT)

Toxicity to fish	semi-static test LC50 - Danio rerio (zebra fish) - > 0.57 mg/l - 96 h (Directive 67/548/EEC, Annex V, C.1.)
Toxicity to daphnia and other aquatic invertebrates	static test EC50 - Daphnia magna (Water flea) - 0.48 mg/l - 48 h (OECD Test Guideline 202)
Toxicity to algae	static test ErC50 - Desmodesmus subspicatus (green algae) - > 0.4 mg/l - 72 h (Regulation (EC) No. 440/2008, Annex, C.3)
Toxicity to bacteria	static test EC50 - activated sludge - > 10,000 mg/l - 3 h (OECD Test Guideline 209)
Toxicity to fish(Chronic toxicity)	NOEC - Oryzias latipes - 0.053 mg/l - 30 d (OECD Test Guideline 210)

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Toxicity to daphnia and other aquatic invertebrates(Chronic toxicity)	EC50 - Daphnia magna (Water flea) - 0.096 mg/l - 21 d (OECD Test Guideline 211)

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Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.22 µg/l - 96.0 h
Toxicity to algae	LC50 - Algae - 0.015 mg/l - 28 h
Toxicity to daphnia and other aquatic invertebrates(Chronic toxicity)	LC50 - Daphnia magna (Water flea) - 0.001 mg/l - 21 d

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)
Not dangerous goods

IMDG
UN number: 3082 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (butyl hydroxytoluene (BHT)) (butyl hydroxytoluene (BHT))
Marine pollutant : yes
Marine pollutant : no

IATA
UN number: 3082 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, liquid, n.o.s. (butyl hydroxytoluene (BHT)) (butyl hydroxytoluene (BHT))

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.Packages smaller than or equal to 5 kg / L , not dangerous goods of Class 9

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SECTION 15: Regulatory information

SARA 302 Components
This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
No SARA Hazards

Massachusetts Right To Know Components

	CAS-No.	Revision Date
butyl hydroxytoluene (BHT)	128-37-0	
Aroclor 1254	11097-69-1	1993-02-16

California Prop. 65 Components

	CAS-No.	Revision Date
, which is/are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.Aroclor 1254	11097-69-1	2008-08-01

SECTION 16: Other information

Further information
The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.
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The branding on the header and/or footer of this document may temporarily not visually match the product purchased as we transition our branding. However, all of the information in the document regarding the product remains unchanged and matches the product ordered. For further information please contact mlsbranding@sial.com.
Version: 8.6 Revision Date: 03/13/2024 Print Date: 07/13/2024

The life science business of Merck KGaA, Darmstadt, Germany
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SAFETY DATA SHEET

Version 8.6
Revision Date 03/22/2025
Print Date 03/23/2025

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : 1H,1H,2H,2H-Perfluorooctanesulfonic acid

Product Number : 93497
Brand : Supelco
CAS-No. : 27619-97-2

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

Uses advised against : The product is being supplied under the TSCA R&D Exemption (40 CFR Section 720.36). It is the recipient's responsibility to comply with the requirements of the R&D exemption. The product may not be used for a non-exempt commercial purpose under TSCA unless appropriate consent is granted in writing by MilliporeSigma.

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302
Skin corrosion (Sub-category 1B), H314
Serious eye damage (Category 1), H318, EUH071
Specific target organ toxicity - repeated exposure (Category 2), Kidney, H373

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For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal Word Danger

Hazard Statements

H302	Harmful if swallowed.
H314	Causes severe skin burns and eye damage.
H373	May cause damage to organs (Kidney) through prolonged or repeated exposure.

Precautionary Statements

P260	Do not breathe dust.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P280	Wear eye protection/ face protection.
P280	Wear protective gloves, protective clothing, eye protection and face protection.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.
P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/ doctor.
P305 + P351 + P338 + P310	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/ doctor.
P314	Get medical advice/ attention if you feel unwell.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms	:	3,3,4,4,5,5,6,6,7,7,8,8,8-Tridecafluorooctane-1-sulfonic acid
Formula	:	C8H5F13O3S
Molecular weight	:	428.17 g/mol
CAS-No.	:	27619-97-2
EC-No.	:	248-580-6

Component	Classification	Concentration

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1H,1H,2H,2H-Tridecafluorooctane-1-sulphonic acid		
	Acute Tox. 4; Skin Corr. 1B; Eye Dam. 1; STOT RE 2; H302, H314, H318, EUH071, H373	>= 80 - <= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
First aiders need to protect themselves. Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Call a physician immediately.

In case of eye contact
After eye contact: rinse out with plenty of water. Immediately call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: make victim drink water (two glasses at most), avoid vomiting (risk of perforation). Call a physician immediately. Do not attempt to neutralise.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture
Carbon oxides
Sulfur oxides
Hydrogen fluoride
Combustible.

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Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters
Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information
Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures
Advice for non-emergency personnel: Avoid inhalation of dusts. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up
Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up dry. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling
Work under hood. Do not inhale substance/mixture.

Hygiene measures
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions
Tightly closed. Dry.
Storage stability Recommended storage temperature
2 - 8 °C
Store under argon.

Storage class
Storage class (TRGS 510): 8A: Combustible, corrosive hazardous materials

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

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SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection
Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Tightly fitting safety goggles

Skin protection
Handle with impervious gloves.

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN 16523-1 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection
protective clothing

Respiratory protection
Recommended Filter type: Filter type P2
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are carried out according to the instructions of the producer. These measures have to be properly documented.
required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

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Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid Color: light brown
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/ range: 81.5 - 87 °C (178.7 - 189 °F) at ca.1,013 hPa - OECD Test Guideline 102
f)	Initial boiling point and boiling range	No data available
g)	Flash point	()Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
l)	Vapor density	No data available
m)	Density	1.953 g/cm3 at 20 °C (68 °F) - OECD Test Guideline 109
	Relative density	1.95320 °C - OECD Test Guideline 109
n)	Water solubility	658 g/l at 20 °C (68 °F) - OECD Test Guideline 105
o)	Partition coefficient: n-octanol/water	log Pow: 0.95 at 20 °C (68 °F) - Bioaccumulation is not expected.
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	Not classified as explosive.
t)	Oxidizing properties	none

9.2 Other safety information

Surface tension	34.9 mN/m at 20 °C (68 °F) - OECD Test Guideline 115

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SECTION 10: Stability and reactivity

10.1 Reactivity
The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions
Violent reactions possible with:
Strong oxidizing agents

10.4 Conditions to avoid
no information available

10.5 Incompatible materials
No data available

10.6 Hazardous decomposition products
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - Rat - male and female - > 300 - < 2,000 mg/kg
(OECD Test Guideline 420)
Inhalation: No data available
LD50 Dermal - Rat - male and female - > 2,000 mg/kg
(OECD Test Guideline 402)

Skin corrosion/irritation
Skin - in vitro test
Result: Corrosive
(OECD Test Guideline 435)

Serious eye damage/eye irritation
Remarks: Causes serious eye damage.

Respiratory or skin sensitization
Local lymph node assay (LLNA) - Mouse
Result: negative
(OECD Test Guideline 429)

Germ cell mutagenicity
Test Type: Ames test
Test system: S. typhimurium
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 471
Result: negative

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Test Type: Chromosome aberration test in vitro
Test system: Chinese hamster ovary cells
Metabolic activation: with and without metabolic activation
Method: OECD Test Guideline 473
Result: negative

Test Type: unscheduled DNA synthesis assay
Species: Rat
Cell type: Liver cells
Application Route: Oral
Method: OECD Test Guideline 486
Result: negative

Test Type: Micronucleus test
Species: Mouse
Cell type: Bone marrow
Application Route: Oral
Method: OECD Test Guideline 474
Result: negative

Carcinogenicity

IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
May cause damage to organs through prolonged or repeated exposure.
- Kidney

Aspiration hazard
No data available

11.2 Additional Information

Repeated dose toxicity - Rat - male and female - Oral - 90 d - NOAEL (No observed adverse effect level) - 15 mg/kg

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

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operates as MilliporeSigma in the US and Canada

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	static test LC50 - Oncorhynchus mykiss (rainbow trout) - > 108 mg/l - 96 h (OECD Test Guideline 203)
Toxicity to daphnia and other aquatic invertebrates	static test EC50 - Daphnia magna (Water flea) - > 112 mg/l - 48 h (OECD Test Guideline 202)
Toxicity to algae	static test ErC50 - Pseudokirchneriella subcapitata (green algae) - > 125 mg/l - 72 h (OECD Test Guideline 201)
Toxicity to bacteria	static test EC50 - activated sludge - > 100 mg/l - 3 h (OECD Test Guideline 209)
Toxicity to fish(Chronic toxicity)	NOEC - Oncorhynchus mykiss (rainbow trout) - 2.62 mg/l - 90 d (OECD Test Guideline 210)

12.2 Persistence and degradability

Biodegradability: aerobic - Exposure time 28 d
Result: 41.5 % - Not readily biodegradable.
(OECD Test Guideline 301B)

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties

No data available

12.7 Other adverse effects

No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

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SECTION 14: Transport information

DOT (US)

UN number: 3261 Class: 8 Packing group: II
Proper shipping name: Corrosive solid, acidic, organic, n.o.s. (1H,1H,2H,2H-Tridecafluorooctane-1-sulphonic acid)
Reportable Quantity (RQ): 1 lbs
Poison Inhalation Hazard: No

IMDG

UN number: 3261 Class: 8 Packing group: II EMS-No: F-A, S-B
Proper shipping name: CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S. (1H,1H,2H,2H-Tridecafluorooctane-1-sulphonic acid)

IATA

UN number: 3261 Class: 8 Packing group: II
Proper shipping name: Corrosive solid, acidic, organic, n.o.s. (1H,1H,2H,2H-Tridecafluorooctane-1-sulphonic acid)

SECTION 15: Regulatory information

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)
1H,1H,2H,2H-Tridecafluorooctane-1-sulphonic acid	27619-97-2	1	1

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 302 Extremely Hazardous Substances Threshold Planning Quantity

This material does not contain any components with a section 302 EHS TPQ.

SARA 313 : This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Clean Air Act

This product neither contains, nor was manufactured with a Class I or Class II ODS as defined by the U.S. Clean Air Act Section 602 (40 CFR 82, Subpt. A, App.A + B).
This product does not contain any hazardous air pollutants (HAP), as defined by the U.S. Clean Air Act Section 112 (40 CFR 61).
This product does not contain any chemicals listed under the U.S. Clean Air Act Section 112(r) for Accidental Release Prevention (40 CFR 68.130, Subpart F).
This product does not contain any chemicals listed under the U.S. Clean Air Act Section 111 SOCMI Intermediate or Final VOC's (40 CFR 60.489).

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Clean Water Act

This product does not contain any Hazardous Substances listed under the U.S. CleanWater Act, Section 311, Table 116.4A.
This product does not contain any Hazardous Chemicals listed under the U.S. CleanWater Act, Section 311, Table 117.3.
This product does not contain any toxic pollutants listed under the U.S. Clean Water Act Section 307
This product does not contain any priority pollutants related to the U.S. Clean Water Act

US State Regulations

Massachusetts Right To Know

No components are subject to the Massachusetts Right to Know Act.

Maine Chemicals of High Concern

1H,1H,2H,2H-Tridecafluorooctane-1-sulphonic acid	27619-97-2

Vermont Chemicals of High Concern

1H,1H,2H,2H-Tridecafluorooctane-1-sulphonic acid	27619-97-2

Washington Chemicals of High Concern

1H,1H,2H,2H-Tridecafluorooctane-1-sulphonic acid	27619-97-2

International Regulations

Stockholm Convention (Persistent Organic Pollutants)	:	1H,1H,2H,2H-Tridecafluorooctane-1-sulphonic acid

The ingredients of this product are reported in the following inventories:

TSCA	:	All substances listed as active on the TSCA inventory

TSCA list

The following substance(s) is/are subject to a Significant New Use Rule:

1H,1H,2H,2H-Tridecafluorooctane-1-sulphonic acid	27619-97-2	See 40 CFR § 721.10536; Proposed Rule

The following substance(s) is/are subject to TSCA 12(b) export notification requirements:

1H,1H,2H,2H-Tridecafluorooctane-1-sulphonic acid	27619-97-2

SECTION 16: Other information

Further information

The information is believed to be correct but is not exhaustive and will be used solely as a guideline, which is based on current knowledge of the chemical substance or mixture and is applicable to appropriate safety precautions for the product. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact

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with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.
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Version: 8.6 Revision Date: 03/22/2025 Print Date: 03/23/2025

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SAFETY DATA SHEET

Version 3.4
Revision Date 06/27/2014
Print Date 06/28/2019

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Heptadecafluorooctanesulfonic acid solution

Product Number : 77283
Brand : Aldrich

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : +1-703-527-3887 (CHEMTREC)

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)
Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 3), H331
Skin corrosion (Category 1B), H314
Serious eye damage (Category 1), H318
Carcinogenicity (Category 2), H351
Reproductive toxicity (Category 1B), H360
Effects on or via lactation, H362
Specific target organ toxicity - repeated exposure (Category 1), H372
Acute aquatic toxicity (Category 2), H401
Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word Danger

Hazard statement(s)
H302 Harmful if swallowed.
H314 Causes severe skin burns and eye damage.
H331 Toxic if inhaled.
H351 Suspected of causing cancer.
H360 May damage fertility or the unborn child.
H362 May cause harm to breast-fed children.
H372 Causes damage to organs through prolonged or repeated exposure.

H411	Toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P263	Avoid contact during pregnancy/ while nursing.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P330 + P331	IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER or doctor/ physician.
P321	Specific treatment (see supplemental first aid instructions on this label).
P363	Wash contaminated clothing before reuse.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2 Mixtures

Formula : $C_8HF_{17}O_3S$

Molecular Weight : 500.13 g/mol

Hazardous components

Component		Classification	Concentration
Heptadecafluorooctane-1-sulphonic acid			
CAS-No. EC-No. Index-No.	1763-23-1 217-179-8 607-624-00-8	Acute Tox. 4; Skin Corr. 1B; Eye Dam. 1; Carc. 2; Repr. 1B; Lact. ; STOT RE 1; Aquatic Acute 2; Aquatic Chronic 2; H302 + H332, H314, H351, H360, H362, H372, H411	30 - 60 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.Continue rinsing eyes during transport to hospital.

If swallowed
Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed
no data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture
Carbon oxides, Sulphur oxides, Hydrogen fluoride

5.3 Advice for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information
no data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
For personal protection see section 8.

6.2 Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up
Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections
For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling
Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection
Tightly fitting safety goggles. Faceshield (8-inch minimum). Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: clear, liquid Colour: light red
b)	Odour	no data available
c)	Odour Threshold	no data available
d)	pH	no data available
e)	Melting point/freezing point	no data available
f)	Initial boiling point and boiling range	no data available
g)	Flash point	no data available
h)	Evapouration rate	no data available
i)	Flammability (solid, gas)	no data available
j)	Upper/lower flammability or explosive limits	no data available
k)	Vapour pressure	no data available
l)	Vapour density	no data available
m)	Relative density	1.250 g/cm3
n)	Water solubility	no data available
o)	Partition coefficient: n-octanol/water	no data available
p)	Auto-ignition temperature	no data available

q)	Decomposition temperature	no data available
r)	Viscosity	no data available
s)	Explosive properties	no data available
t)	Oxidizing properties	no data available

9.2 Other safety information
no data available

10. STABILITY AND REACTIVITY

10.1 Reactivity
no data available

10.2 Chemical stability
Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
no data available

10.4 Conditions to avoid
no data available

10.5 Incompatible materials
Strong oxidizing agents

10.6 Hazardous decomposition products
Other decomposition products - no data available
In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
no data available

Inhalation: no data available

Dermal: no data available

no data available

Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
no data available

Respiratory or skin sensitisation
no data available

Germ cell mutagenicity

no data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a

carcinogen or potential carcinogen by OSHA.

Reproductive toxicity
no data available
no data available

Specific target organ toxicity - single exposure
no data available

Specific target organ toxicity - repeated exposure
no data available

Aspiration hazard
no data available

Additional Information
RTECS: Not available

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin.

12. ECOLOGICAL INFORMATION

12.1 Toxicity
no data available

12.2 Persistence and degradability
no data available

12.3 Bioaccumulative potential
no data available

12.4 Mobility in soil
no data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3265 Class: 8 Packing group: II
Proper shipping name: Corrosive liquid, acidic, organic, n.o.s. (Heptadecafluorooctane-1-sulphonic acid)
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG
UN number: 3265 Class: 8 Packing group: II EMS-No: F-A, S-B
Proper shipping name: CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S. (Heptadecafluorooctane-1-sulphonic acid)
Marine pollutant: No

IATA
UN number: 3265 Class: 8 Packing group: II
Proper shipping name: Corrosive liquid, acidic, organic, n.o.s. (Heptadecafluorooctane-1-sulphonic acid)

15. REGULATORY INFORMATION

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
Acute Health Hazard

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Water	7732-18-5	
Heptadecafluorooctane-1-sulphonic acid	1763-23-1	2009-07-17

New Jersey Right To Know Components

	CAS-No.	Revision Date
Water	7732-18-5	
Heptadecafluorooctane-1-sulphonic acid	1763-23-1	2009-07-17

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
Eye Dam.	Serious eye damage
H302	Harmful if swallowed.
H302 + H332	Harmful if swallowed or if inhaled
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H331	Toxic if inhaled.
H351	Suspected of causing cancer.
H360	May damage fertility or the unborn child.
H362	May cause harm to breast-fed children.
H372	Causes damage to organs through prolonged or repeated exposure.
H401	Toxic to aquatic life.
H411	Toxic to aquatic life with long lasting effects.
Lact.	Effects on or via lactation

HMIS Rating

Health hazard:	3
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	3
Fire Hazard:	0

Reactivity Hazard: 0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 3.4 Revision Date: 06/27/2014 Print Date: 06/28/2019

Appendix E:

Quality Assurance Project Plan

SESI
CONSULTING ENGINEERS

QUALITY ASSURANCE PROJECT PLAN

Grand Union Hotel Bowling Alley Site
140 and 148-150 Westchester Ave.
Port Chester, New York 10573

NYSDEC BCP Site # C360222

Prepared For:

Port Chester OZ Fund III QOZB, LLC
181 Westchester Ave. Suite 301a
Port Chester, New York 10573

Prepared By:

SESI CONSULTING ENGINEERS
959 Route 46E, 3rd Floor
Parsippany, New Jersey 07054

Project No.: 11895A

April 2025
Revised June 2026

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1.0 PROJECT DESCRIPTION

This document presents the Quality Assurance Project Plan (QAPP) for the Remedial Investigation Work Plan (RIWP) for the property known as the Grand Union Hotel Bowling Alley Site (BCP# C360222), located at 146 Westchester Avenue, Port Chester, New York, and identified under Tax Map ID 143.30-2-70. The Site consists of .4486 acres of land and was previously identified on the Westchester County Assessors map as Block 2, Lots 17 and 65. The former Block 2, Lot 17 is improved by three (3) buildings and a parking lot. The former Block 2, Lot 65 is improved with an asphalt parking lot.

The Site is bound to the east by New Broad Street and commercial/residential properties. The Site is bound to the south by JP Upholstery Shop, to the west by Pearl Street and a parking lot and to the north by Westchester Avenue, restaurants, a local theater, and apartments.

2.0 PROJECT ORGANIZATION

The RAWP activities will be conducted by SESI and their qualified subcontractors, on behalf of Port Chester OZ Fund III QOZB, LLC and Port Chester Oz Fund III PropCo, LLC, (PropCo). The organization of SESI's key project management and field staff, and respective areas of responsibility, is presented below **(Table 2.1)** along with the names of subcontractors. Resumes of the project management team are included in **Attachment A.**

Table 2.1—SESI Personnel and Subcontractors

Role	Name	Telephone No.
Project Principal	Fuad Dahan, P.E., PhD	973-808-9050
Principal Engineer	Andrew Schweitzer, P.E.	973-808-9050
Project Manager (PM)	Andrew Schweitzer, P.E.	973-808-9050
Remedial Action Work Plan Project Manager	Andrew Schweitzer, P.E.	973-808-9050
Field Team Leader	Sheng Long	973-808-9050
Quality Assurance Officer	Sheng Long	973-808-9050
Field Personnel	TBD	
Analytical Laboratory	Alpha Analytical	201-972-6356
Data Validator	Laboratory Data Consultants	760-827-1100
Driller	Aquifer Drilling and Testing, Inc.	516-616-6026

2.1 PROJECT PRINCIPAL

The project principal provides technical and administrative oversight and guidance throughout the project, assists in securing company resources, participates in technical review of deliverables, and will attend key meetings, as needed.

2.2 PRINCIPAL ENGINEER

The principal engineer provides technical guidance and review of reports, analytical data and will have key involvement in screening and development of remedial alternatives.

2.3 PROJECT MANAGER

The project manager is responsible for maintaining the day-to-day schedule for completing the fieldwork and deliverables according to BCP program requirements and client expectations.

2.4 REMEDIAL INVESTIGATION WORK PLAN PROJECT MANAGER

The remedial investigation work plan project manager is responsible for coordinating and directing field efforts of SESI staff and subcontractors, and for maintaining that work is done according to QAPP specifications.

2.5 FIELD TEAM LEADER

The field team leader is responsible for overseeing field work during the implementation of the RIWP, including observing subcontractors, maintaining field notes, and collecting samples of various environmental media.

2.6 QUALITY ASSURANCE OFFICER

The quality assurance officer is responsible for reviewing sampling procedures and to certify that the data was collected and analyzed using the appropriate procedures.

3.0 QA/QC OBJECTIVES FOR MEASUREMENT OF DATA

In cases where NYSDOH ELAP Certification exists for a specific group or category of parameters, the laboratory performing analysis in connection with this project will have appropriate New York State Department of Health (NYSDOH) ELAP Certification. Alpha Analytical Laboratories of Westborough, MA, an ELAP-certified lab, will be performing the sample analyses for the project. Analytical Service Protocol (ASP, June 2000) Category B deliverables are required for all samples. All data will be sent to a third party, Laboratory Data Consultants of Carlsbad, CA, for validation in accordance with NYSDEC BCP requirements. Resumes and Qualifications from LDC are included in Appendix C of the RIWP.

Detection limits set by NYSDEC-ASP will be used for all sample analyses unless otherwise noted. If NYSDEC-ASP-dictated detection limits prove insufficient to assess project goals (i.e., comparison to drinking water standards or attainment of Applicable or Relevant and Appropriate Requirements [ARARs]), then ASP Special Analytical Services (SAS) or other appropriate methods will be utilized.

The quality assurance/quality control objectives for all measurement data include completeness, representativeness, comparability, precision, and accuracy.

3.1 COMPLETENESS

The analyses performed must be appropriate and inclusive. The parameters selected for analysis are chosen to meet the objectives of the study.

Completeness of the analyses will be assessed by comparing the number of parameters intended to be analyzed with the number of parameters successfully determined and validated. Data must meet QC acceptance criteria for 100 percent or more of requested determinations.

3.2 REPRESENTATIVENESS

Samples must be taken of the population and, where appropriate, the population will be characterized statistically to express the degree to which the data accurately and

precisely represent a characteristic of a population, parameter variations at a sampling point, a process, or environmental condition.

Non-dedicated sampling devices will be decontaminated using PFAS sampling guidelines between sampling points by washing and rinsing with pesticide-grade methanol, followed by a thorough rinse with distilled water that is also PFAS free. Specific cleaning techniques are described in the Field Sampling Procedure. Two types of blank samples will accompany each sample set where Target Compound List (TCL) volatiles are to be analyzed (water matrix only). A trip blank, consisting of a 40 ml VOA vial of organic-free water prepared by the laboratory, will accompany each set of sample bottles from the laboratory to the field and back. This bottle will remain sealed throughout the shipment and sampling process. This blank will be analyzed for TCL volatile organic compounds along with the groundwater samples to ensure that contamination with TCL volatile compounds has not occurred during the bottle preparation, shipment, and sampling phase of the project. To check for contaminant carryover when non-dedicated sampling equipment is used, a rinsate blank will be submitted to the laboratory. This blank will also be analyzed for TCL volatile organic compounds. The TCL compounds are identified in the United States Environmental Protection Agency (USEPA) Contract Laboratory Program dated 10/2016 or as periodically updated.

The analysis results obtained from the determination of identical parameters in field duplicate samples can be used to further assess the representativeness of the sample data.

3.3 COMPARABILITY

Consistency in the acquisition, preparation, handling, and analysis of samples is necessary in order for the results to be compared where appropriate. Additionally, the results obtained from analyses of the samples will be compared with the results obtained in previous studies, if available.

To ensure the comparability of analytical results with those obtained in previous or future testing, all samples will be collected and analyzed by NYSDEC-approved methods. The NYSDEC-ASP mandated holding times for various analyses will be strictly adhered to.

3.4 PRECISION AND ACCURACY

The validity of the data produced will be assessed for precision and accuracy. Analytical methods which will be used include gas chromatography/mass spectrometry (GC/MS), gas chromatography (GC), colorimetry, atomic spectroscopy, gravimetric and titrametric techniques. The following outlines the procedures for evaluating precision and accuracy, routine monitoring procedures, and corrective actions to maintain analytical quality control. All data evaluations will be consistent with NYSDEC-ASP procedures (June 2000). Data will be 100 percent compliant with NYSDEC-ASP requirements. Matrix spike and matrix spike duplicates will be collected to confirm accuracy and precision at a rate of one (1) per 20 soil and/or groundwater samples taken.

The number of duplicate, spike and blank samples analyzed will be a minimum of one (1) duplicate for every 20 samples per each medium of groundwater and soil. The inclusion and frequency of analysis of field blanks will be on the order of one (1) per every 20 samples (soil). For the aqueous matrix field blanks will be collected at a frequency of one per day. Samples to be analyzed for volatile organic compounds will be accompanied by a trip blank for each shipment and field blanks (water matrix) or field blanks (soil). An equipment blank for PFAS will be collected once per day per matrix, regardless of whether equipment being used is disposable at a frequency of one (1) per 20 samples taken for both soil and groundwater.

Quality assurance audit samples will be prepared and submitted by the laboratory QA manager for each analytical procedure used. The degree of accuracy and the recovery of analyte to be expected for the analysis of QA samples and spiked samples is dependent upon the matrix, method of analysis, and compound or element being determined. The concentration of the analyte relative to the detection limit is also a major factor in determining the accuracy of the measurement. The lower end of the analytical range for most analyses is generally accepted to be five (5) times the detection limit. At or above this level, the determination and spike recoveries for metals

in water samples will be expected to range from 75 to 125 percent. The recovery of organic surrogate compounds and matrix spiking compounds determined by GC/MS will be compared to the guidelines for recovery of individual compounds as established by the United States Environmental Protection Agency Contract Laboratory Program dated 7/85 or as periodically updated.

The quality of results obtained for inorganic ion and demand parameters will be assessed by comparison of QC data with laboratory control charts for each test.

4.0 SAMPLING PROCEDURES

4.1 SAMPLING PROGRAM

The sampling program for this project will include soil, groundwater and soil vapor. Soil samples will be collected from split spoon sampling or macrocore devices retrieved from soil borings. Groundwater samples will be collected from groundwater monitoring wells using low flow purging techniques. A description of this method is shown on **Table 4.1**. Soil vapor samples will be collected from vapor points screened in the vadose zone using Summa Canisters. A summary of the sample containers, bottle types, preservatives and holding times is shown on **Table 4.2.** The sampling to be conducted for this project is shown on **Table 4.3.**

4.1.1 DRILLING/SAMPLING PROCEDURES

Soil and groundwater samples will be collected by means of a soil boring program. Soil borings shall be completed using the hollow stem auger drilling methods, direct push methods, or rotary drilling methods, whichever methods are determined to be best suited to site conditions by the SESI project manager and SESI field team leader.

Soil samples will be collected from soil borings and analyzed in accordance with the NYSDEC-approved Work Plan. Monitoring wells for groundwater sample collection will be installed in select completed soil borings. Either hollow stem auger (HSA) or direct push drilling methods may be utilized for monitoring well completion.

Soil samples shall be collected continuously during drilling so that a complete soil profile is examined and described by the SESI field geologist. The sampling method employed shall be ASTM D-1586/Split Barrel Sampling using a standard 2-foot long, 2-inch outside diameter split- spoon sampler with a 140-pound hammer, in cases where HSA methods are used. Upon retrieval of the sampling barrel, the collected sample shall be placed in glass jars and labeled, stored on site (on ice in a cooler if necessary), and transmitted to the appropriate testing laboratory or storage facility. Chain-of-custody procedures will be practiced following Section 15, EPA-600/4-82-029, Handbook for Sampling and Sample Preservation of Water and Waste Waters.

A geologist or engineer will be on Site during the drilling operations to fully describe each soil sample, following the New York State Soil Description Procedure, and to retain representative portions of each sample.

The drilling contractor will be responsible for obtaining accurate and representative samples, informing the geologist of changes in drilling pressure, keeping a separate general log of soils encountered including blow counts [i.e., the number of blows from a soil sampling drive weight (140 pounds)] required to drive the split-spoon sampler in 6-inch increments and installing monitoring wells to levels directed by the supervising geologist following specifications further outlined in this protocol.

4.1.2 MONITORING WELL COMPLETION

Monitoring wells will be constructed of 0.010-inch slot size PVC well screen and riser casing. Other materials utilized for completion will be washed silica sand (Q-Rock No. 4 or approved equivalent) bentonite grout, Portland cement, and a protective steel locking well casing and cap with locks. The depth of the wells will be determined based on the depth to water, type of contaminant and field conditions encountered.

The monitoring well installation method for wells installed within unconsolidated sediments shall be to place the screen and riser assembly into the casing once the screen interval has been selected. At that time, a washed silica sand pack will be placed around the well screen if required to prevent screen plugging. If a sand pack is not warranted, the auger string will be pulled back to allow the native aquifer material to collapse 2 to 3 feet above the top of the screen. Bentonite pellets (2 ft thick layer) will then be added to the annulus between the casing and the inside auger to insure proper sealing. Cement/bentonite grout will continue to be added during the extraction of the augers until the entire aquifer thickness has been sufficiently sealed off from horizontal and/or vertical flow above the screened interval. During placement of sand and bentonite pellets, frequent measurements will be made to check the height of the sand pack and thickness of bentonite layers by a weighted drop tape measure.

A bolt-down protective curb box will be installed, flush with the ground, or steel “stick-up” protective casing and secured by a Portland cement seal. The cement seal shall extend

laterally at least 1 foot in all directions from the protective casing and shall slope gently away to drain water away from the well.

4.1.3 WELL DEVELOPMENT

All monitoring wells will be developed or cleared of all fine-grained materials and sediments that have settled in or around the well during installation so that the screen is transmitting representative portions of the groundwater. The development will be by one (1) of two (2) methods, pumping or bailing groundwater from the well until it yields relatively sediment-free water.

A decontaminated pump or bailer will be used and subsequently decontaminated after each use following procedures outlined in the Decontamination Protocol. Pumping or bailing will cease when the turbidity falls below 50 NTUs or until specific conductivity, pH, and temperature are stable (i.e., consecutive readings are within 10 percent with no overall upward or downward trends in measurements). Based on previous groundwater sampling results, well development water is to be collected/containerized and will be properly treated/disposed of.

4.1.4 DECONTAMINATION

All drilling equipment and associated tools including augers, drill rods, sampling equipment, wrenches and any other equipment or tools that have come in contact with contaminated materials will be decontaminated before any drilling on Site begins, between each well, and prior to removing any equipment from the Site. The preferred decontamination procedure will be to scrape the equipment from any residual soils and then rinse with water and Alconox®. Every effort will be made to minimize the generation of contaminated water. Any contaminated water generated will be drummed. The contaminated water drums will be disposed of at an appropriate facility after approval and sampling in accordance with the specific facility requirements.

4.1.5 PFAS SAMPLING CONSIDERATIONS

This section contains the materials limitations for Per- and polyfluoroalkyl substances (PFAS) sampling in accordance with the NYSDEC Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (June 2021). Specific details of the sampling plan

for PFAS are spelled out in Appendix D, the Emerging Contaminants Sampling Plan. PFAS sampling considerations are further discussed in Appendix B, the Quality Assurance Project Plan.

The groundwater samples will be analyzed for PFAS using Modified USEPA Method 537. Reporting limits for PFOA and PFOS will not exceed 2 nanograms per liter (ng/L). Category B deliverables and an electronic data deliverable will be completed.

PFAS are very persistent in the environment and in the human body. Due to their presence in a variety of products, persistence in the environment and very low drinking water standards, care must be used when groundwater sampling for PFAS to avoid cross contamination from the sampling equipment and personal protective equipment (PPE).

No fabric softener will be used on clothing to be worn in field. Cosmetics, moisturizers, hand cream, unauthorized sunscreen, insect repellant or other related products will not be used the morning of sampling. The field samplers will wear powder-free nitrile gloves while filling and sealing the sample bottles. The sampling equipment components and sample containers will not come in contact with material that may potentially contain PFAS such as aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials will be avoided. Food and drink packaging materials will be avoided, as well.

Sampling will be performed using certified PFAS-free sampling materials such as stainless steel, high density polyethylene (HDPE), PVC, silicone, acetate or polypropylene pump and tubing. Rinse water must be laboratory-provided certified PFAS-free distilled or de-ionized water. Standard two step decontamination using Alconox® detergent and clean certified PFAS-free water rinse will be performed for equipment that does come in contact with PFAS materials.

No waterproof field books, plastic clipboards, binders, or spiral hard cover will be used for PFAS containers. No adhesives (i.e. Post-It® Notes), sharpies, or permanent markers will be used for PFAS containers. The PFAS containers will be labeled with ball point pens. PFAS samples will be stored in separate cooler filled with regular ice only with no chemical (blue) ice packs.

Pre-cleaned sample bottles with closures, coolers, sample labels and a chain of custody form will be provided by the laboratory. See Emerging Contaminant Sampling Plan for additional information (Appendix D of the Remedial Investigation Work Plan).

4.2 GROUNDWATER SAMPLING PROGRAM

4.2.1 WELL EVACUATION

Prior to sampling a monitoring well, the static water level will be recorded. All well data will be recorded on a field sampling record. The wells will be sampled in accordance with the USEPA guidelines for the Low Flow Purging Sampling (LFPS). The purpose of LFPS is to collect groundwater samples from monitoring wells that are representative of ambient groundwater conditions in the aquifer. The LFPS method reduces turbidity which is needed particularly when sampling for metals.

4.2.2 SAMPLING PROCEDURE

The wells will be sampled using the USEPA LFPS technique. A flow rate of 100 ml to 250 ml per minute is used to purge the wells. Drawdown should not exceed 0.3 feet. The pump intake is lowered to the mid-point of the water column or as subsurface features such as bedrock fractures or more permeable zones warrant. At the initiation of low flow purging a water level is recorded as well as field parameters. Field parameters are then monitored every five (5) minutes during low flow purging using a flow through cell. When three (3) consecutive measurements of pH differ by 0.1 units or less, with ORP within 10 mv or less, turbidity varies 10 percent or less, conductivity differs by 3 percent or less and dissolved oxygen by 10 percent or less, sampling may begin. Flow through cells are used so continuous real time readings are made. When the parameters stabilize the flow through cell is disconnected and sample bottles are filled directly from the tubing. Low-flow sampling procedures are summarized on **Table 4.1.**

4.3 SOIL VAPOR SAMPLING

Soil vapor sampling will be conducted in accordance with NYSDOH Guidance for Evaluating Soil Vapor Intrusion in New York State (October 2006 and the subsequent May 2017 updates to the Soil Vapor/Indoor Air Decision Matrices). Soil vapor samples will be collected in the vadose zone from shallow (five [5] feet) vapor points. Each vapor point will be installed in a shallow boring drilled either by hand-operated equipment (e.g. hand auger or percussion hammer drill), or by a small truck-mounted drill rig. Drilling equipment used shall be based on soil conditions, and the method that provides the most practical approach.

Each vapor point will consist of an inert sampling tube (polyethylene, stainless steel, or Teflon®) with a six (6)-inch screened section at the bottom through which soil vapors can be sampled. The screen slot size will be 0.0075 inches. A sampling zone will be created around the screened section by backfilling with one (1) to two (2) feet of porous coarse sand or glass beads, and at least three (3) feet of bentonite will be placed above the porous sampling zone to form a seal from the surface. Native clean soil will be packed around the remaining annulus to the ground surface.

The regulator will be set to collect a soil vapor sample at a flow rate of less than 0.2 liters per minute. After the summa canister is filled, the valve will be closed.

Each canister will be listed according to a specific sample I.D. on a chain of custody form. Sample canisters will be delivered to the laboratory within 24 hours and analyzed for volatile organic compounds (VOCs) by method TO-15. The detection limit for VOCs will be 1 $\mu g/m^3$ or less

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The soil vapor sampling effort will include the use of inert helium tracer gas to verify that the soil vapor samples are not diluted by ambient air. The atmosphere around the sampling tube will be enriched with the tracer gas, and the soil vapor sample will be collected in the presence of the enriched tracer atmosphere. This will be accomplished by placing an inverted plastic pail over the sampling point and filling the pail with the tracer gas via a small tube penetrating the site of the pail. Refer to NYSDOH Guidance for Evaluating Indoor Air Intrusion in New York State (October 2006).

Weather conditions in the 48 hours prior to the test, and during the test, will be noted, including average wind speed, precipitation, temperature, and barometric pressure.

4.4 SAMPLE PRESERVATION AND SHIPMENT

Since all bottles will contain the necessary preservatives as shown in **Table 4.2**, they need only be filled. The 40 ml VOA vials must be filled brim full with no air bubbles. The other bottles should be filled to within about one (1) inch from the top.

The bottles will be sent from the laboratory in coolers which will be organized on a per site basis. Following sample collection, the bottles should be placed on ice in the shipping cooler. The samples will be cooled to 4°C, but not frozen.

Final packing and shipment of coolers will be performed in accordance with guidelines outlined in the ASP.

5.0 SAMPLE CUSTODY

The program for sample custody and sample transfer is in compliance with the NYSDEC-ASP, as periodically updated. If samples may be needed for legal purposes, chain-of-custody procedures, as defined by NEIC Policies and Procedures (USEPA-330/9-78-001-R, Revised June 1988) will be used. Sample chain-of-custody is initiated by the laboratory with selection and preparation of the sample containers. To reduce the chance for error, the number of personnel handling the samples should be minimized.

5.1 FIELD SAMPLE CUSTODY

A chain-of-custody record accompanies the samples from initial sample container selection and preparation at the laboratory, shipment to the field for sample containment and preservation, and return to the laboratory. Two (2) copies of this record follow the samples to the laboratory. The laboratory maintains one (1) file copy and the completed original is returned to the site inspection team. Individual sample containers provided by the laboratory are used for shipping samples. The shipping containers are insulated and ice is used to maintain samples at approximately 4°C until samples are returned and in the custody of the laboratory. All sample bottles within each shipping container are individually labeled and controlled. Samples are to be shipped to the laboratory within 24-48 hours of the day of collection depending on parameter holding times.

Each sample shipping container is assigned a unique identification number by the laboratory. This number is recorded on the chain-of-custody record and is marked with indelible ink on the outside of the shipping container. The field sampler will indicate the sample designation/location number in the space provided on the appropriate chain-of-custody form for each sample collected. The shipping container is closed and a seal provided by the laboratory is affixed to the latch. This seal must be broken to open the container, and this indicates possible tampering if the seal is broken before receipt at the laboratory. The laboratory will contact the site investigation team leader and the sample will not be analyzed if tampering is apparent.

5.2 LABORATORY SAMPLE CUSTODY

The site investigation team leader or Project Quality Assurance Officer notifies the laboratory of upcoming field sampling activities and the subsequent transfer of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The laboratory sample program meets the following criteria:

- The laboratory has designated a sample custodian who is responsible for maintaining custody of the samples and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check the original chain-of-custody documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian signs the chain-of-custody record and records the date and time received.
- Care is exercised to annotate any labeling or descriptive errors. In the event of discrepant documentation, the laboratory will immediately contact the site investigation team leader as part of the corrective action process. A qualitative assessment of each sample container is performed to note any anomalies, such as broken or leaking bottles.

This assessment is recorded as part of the incoming chain-of-custody procedure:

1. The samples are stored in a secured area at a temperature of approximately 4°C until analyses are to commence.
2. A laboratory chain-of-custody record accompanies the sample or sample fraction through final analysis for control.
3. A copy of the chain-of-custody form will accompany the laboratory report and will become a permanent part of the project records.

5.3 FINAL EVIDENCE FILES

Final evidence files include all originals of laboratory reports and are maintained under documented control in a secure area.

A sample or an evidence file is under custody if:

- It is in your possession; it is in your view, after being in your possession.

- It was in your possession and you placed it in a secure area.
- It is in a designated secure area.

6.0 CALIBRATION PROCEDURES

Instruments and equipment used to gather, generate or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the appropriate manufacturer's specifications or project specific requirements. The procedures for instrument calibration, calibration verification, and the frequency of calibrations are described in the ASP. The calibration of instruments used for the determination of metals will be as described in the appropriate CLP standard operating procedures.

Calibration of other instruments required for measurements associated with these analyses will be in accordance with the manufacturer's recommendations and the standard operating procedures of the laboratory.

7.0 ANALYTICAL PROCEDURES

Analytical procedures shall conform to the most recent revision of the NYSDEC-ASP (June 2005) and are summarized on **Table 7.1.** In the absence of USEPA or NYSDEC guidelines, appropriate procedures shall be submitted for approval by NYSDEC prior to use.

The procedures for the sample preparation and analysis for organic compounds are as specified in the NYSDEC-ASP. Analytical cleanups are mandatory where matrix interferences are noted. No sample shall be diluted any more than a factor of five. The sample shall be either re-extracted, re-sonicated, re-stream distilled, etc. or be subjected to any one analytical cleanup noted in SW846 or a combination thereof. The analytical laboratory shall expend such effort and discretion to demonstrate good laboratory practice and demonstrate an attempt to best achieve the method detection limit.

7.1 VOLATILE ORGANICS

For the analysis of water samples for Target Compound List (TCL), VOCs, no sample preparation is required. The analytical procedure for volatiles is detailed in NYSDEC-ASP (Volume I, Section D-I). A measured portion of the sample is placed in the purge and trap apparatus and the sample analysis is performed by gas chromatography/mass spectrometry for the first round. USEPA Method 8260 will be used, plus tentatively identified compounds (TICs). USEPA Methods 8010 or 8020 (gas chromatography with different detectors) will be used if subsequent rounds with lower limits of detection are warranted.

7.2 SEMI-VOLATILE ORGANIC COMPOUNDS

The extraction and analytical procedures used for preparation of water, soil and sediment samples for the analysis of the TCL semi-volatile organic compounds are described in NYSDEC-ASP Volume I, Section D-III. USEPA Method 8270 will be used, plus tentatively identified compounds (TICs).

Instrument calibration, compound identification, and quantitation are performed as described in Section 6 of this document and in the NYSDEC-ASP.

The reporting limit for 1,4-dioxane is 0.1 mg/kg in soil and 0.35 ug/L in groundwater.

7.3 PESTICIDE AND PCB COMPOUNDS

The sample preservation procedures for gas chromatography for pesticides and PCB's will be as described in the NYSDEC-ASP methods (Section D-IV). The analysis of standard mixes, blanks and spiked samples will be performed at the prescribed frequency with adherence to the 72-hour requirement described in the method.

7.4 METALS

Water, soil and waste samples will be analyzed for the metals listed in **Table 7.1.** The detection limits for these metals are as specified in the NYSDEC-ASP, Section D-V. The instrument detection limits will be determined using calibration standards and procedures specified in the NYSDEC-ASP. The detection limits for individual samples may be higher due to the sample matrix. The procedures for these analyses will be as described in the NYSDEC-ASP.

The analyses for metals will be performed by atomic absorption spectroscopy (AAS) or inductively-coupled plasma emission spectroscopy (ICPES), as specified in the ASP with regard to AAS flame analysis.

7.5 PER- AND POLYFLUOROALKYL SUBSTANCES

The NYSDEC has developed a list of 21 PFAS Analytes List on **Table 7.1** for remedial programs. These are:

- Perfluorobutanesulfonic acid
- Perfluorohexanesulfonic acid
- Perfluoroheptanesulfonic acid
- Perfluorooctanesulfonic acid
- Perfluorodecanesulfonic acid
- Perfluorobutanoic acid

- Perfluoropentanoic acid
- Perfluorohexanoic acid
- Perfluoroheptanoic acid
- Perfluorooctanoic acid
- Perfluorononanoic acid
- Perfluorodecanoic acid
- Perfluoroundecanoic acid
- Perfluorododecanoic acid
- Perfluorotridecanoic acid
- Perfluorotetradecanoic acid
- 6:2 Fluorotelomer sulfonate
- 8:2 Fluorotelomer sulfonate
- Perfluroroctanesulfonamide
- N-methyl perfluorooctanesulfonamidoacetic acid
- N-ethyl perfluorooctanesulfonamidoacetic acid

Currently, ELAP does not offer certification for Per- and polyfluoroalkyl substances (PFAS) compounds in matrices other than finished drinking water. Per the NYSDEC June 2019 memo on emergent contaminant sampling, the analytical procedure for soil and groundwater sampling of PFAS is Modified EPA Method 537. The reporting limit for PFAS in soil samples is 0.5 ug/kg. Reporting limits for PFOA and PFOS in groundwater should not exceed 2 ng/L.

The laboratory standard operating procedures are included in **Attachment B**. The laboratory method detection limits (MDLs) for PFAS compounds are included in **Attachment C**.

7.6 SITE SPECIFICITY OF ANALYSES

Work plans prepared for remedial actions for sites contain recommendations for the chemical parameters to be determined for each site. Thus, some or all of the referenced methods will apply to the analysis of samples collected at the individual waste sites. Analyses of Target Compound List (TCL) analytes will be performed on all samples.

To ensure that the field sampling and laboratory analytical practices are acceptable, the data associated with the samples will be validated by a third party (in accordance with requirements of DER-10). The validation approach and results will be presented in a data usability summary report (DUSR) to be included in the Report.

TABLES

TABLE 4.1--SAMPLING PROCEDURE FOR MONITORING WELLS USING LOW-STESS (LOW-FLOW) METHODS

Step	Description	Details
1	Record initial static water level.	**Device:** electric contact probe accurate to the nearest 0.1 foot.
2	Lower sampling device into well. Slowly lower the pump, safety cable, tubing and electrical lines into the well to the depth specified for that well.	Pump intake must be no less than 2 feet from the bottom of the well to prevent disturbance and resuspension of sediments which may be at the bottom of the well.
3	Measure water level again: Before starting the pump, measure the water level again with the pump in the well. Leave the water level measuring device in the well.	
4	Purge Well	Start pumping the well at 200 to 500 milliliters per minute (ml/min). The water level should be monitored approximately every five minutes. Ideally, a steady flow rate should be maintained that results in a stabilized water level (drawdown of 0.3 ft or less). Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. As noted above, care should be taken to maintain pump suction and to avoid entrainment of air in the tubing.
5	Record each adjustment made to the pumping rate and the water level measured immediately after each adjustment.	
6	Monitor Indicator Parameters	1. During purging of the well, monitor and record the field indicator parameters (turbidity, temperature, specific conductance, pH, Eh, and DO) approximately every five minutes. The well is considered stabilized and ready for sample collection when the indicator parameters have stabilized for three consecutive readings as follows (Puls and Barcelona, 1996): a. 0.1 for pH b. 3% for specific conductance

Step	Description	Details
		(conductivity) c. 10 mv for redox potential d. 10% for DO and turbidity
7	The pump must not be removed from the well between purging and sampling.	Dissolved oxygen and turbidity usually require the longest time to achieve stabilization.
8	Collect Samples	Emerging contaminant samples will be collected first. Collect samples at a flow rate between 100 and 250 ml/min and such that drawdown of the water level within the well does not exceed the maximum allowable drawdown of 0.3 ft. VOC samples must be collected first and directly into sample containers. All sample containers should be filled with minimal turbulence by allowing the ground water to flow from the tubing gently down the inside of the container.
9	Ground water samples to be analyzed for volatile organic compounds (VOCs) require pH adjustment. The appropriate EPA Program Guidance should be consulted to determine whether pH adjustment is necessary.	If pH adjustment is necessary for VOC sample preservation, the amount of acid to be added to each sample vial prior to sampling should be determined, drop by drop, on a separate and equal volume of water (e.g., 40 ml). Groundwater purged from the well prior to sampling can be used for this purpose.
10	Remove Pump and Tubing	After collection of the samples, the tubing, unless permanently installed, must be properly discarded or dedicated to the well for resampling by hanging the tubing inside the well.
11	Measure and record well depth.	
12	Close and lock the well.	
13	Samples are capped, labeled and placed in laboratory coolers with ice packs or bagged ice.	
14	All equipment is cleaned with successive rinses of pesticide-grade methanol and distilled water.	Dedicated line is disposed of or left at

Step	Description	Details
		well site.
15	Equipment/wash blanks are collected when non-dedicated sampling equipment is used.	
16	Chain-of-custody forms are completed in triplicate.	The original and one carbon copy are put into a zip-lock bag and placed into the cooler. The original will be returned following sample analysis. A second carbon copy is kept on file.
17	Cooler is sealed with strapping tape and chain-of-custody seals to assure integrity and to prevent tampering of sample.	

TABLE 4.2--SAMPLE CONTAINERIZATION

PARAMETER & ANALYTICAL METHOD	NO.	BOTTLE TYPE	PRESERVATIVE[1]	HOLDING TIME
Aqueous Samples				
VOCs – USEPA 8260C	3	40 mL, glass vial with septum cap	Hydrochloric Acid to pH <2 Ice to 4°C	14 days
SVOCs (BNAs) and 1,4-Dioxane – USEPA 8270 SIM	2	1-liter amber glass bottle	Ice to 4°C	7 days (until extraction) 40 days (extracted)
Pesticides – USEPA 8081B	2	1-liter amber glass bottle	Ice to 4°C	7 days (until extraction) 40 days (extracted)
PCBs – USEPA 8082A	2	1-liter amber glass bottle	Ice to 4°C	7 days (until extraction) 40 days (extracted)
Metals[2]	1	1-liter, plastic bottle	Nitric acid to pH <2 NaOH for cyanide Ice to 4°C	180 days Cyanide: 14 days Mercury: 28 days
Cyanide – USEPA 9010C/9012B	1	1-liter, plastic	Sodium Hydroxide to pH >12 Ice to 4°C	14 days
PFAS Compounds – USEPA Modified Method 537	2	500 ml HDPE or Polypropylene with non-Teflon lid	None	14 days
Soil, Sediment, Solid Waste Samples:				
VOCs – USEPA 8260C	3	5-gram EnCore samplers	Chilled to 0 - 6°C	14 days
SVOCs (BNAs) and 1,4-Dioxane – USEPA 8270D SIM if RL cannot be reached	1	4-oz. glass jar with Teflon lid	Chilled to 0 - 6°C	14 days (until extraction, 40 days extracted)
Pesticides – USEPA 8081B	1	4-oz. glass jar with Teflon lid	Chilled to 0 - 6°C	14 days (until extraction) 40 days (extracted)
PCBs – USEPA 8082A	1	4-oz. glass jar with Teflon lid	Chilled to 0 - 6°C	None
Metals[3]	1	4-oz. glass jar with Teflon lid	Chilled to 0 - 6°C	180 days Cyanide: 14 days Mercury: 28 days
PFAS Compounds – USEPA Modified Method 537	2	500 ml HDPE or Polypropylene with non-Teflon lid	None	28 days
Soil Vapor / Indoor Air Samples:				
VOCs – USEPA TO-15	1	Summa Canister	None	30 days

(1) All samples will be preserved with ice during collection and shipment.
(2) Metals refers to the 24 metals and cyanide in the Target Compound List (NYSDEC-CLP 11/87). Metals will be analyzed by Method 6020B, 7470A for mercury, and 9010C/9012B for cyanide
(3) Metals refers to the 24 metals and cyanide in the Target Compound List (NYSDEC-CLP 11/87). Metals will be analyzed by Method 6010D, 7471B for mercury, and 9010C/9012B for cyanide
(4) A complete list of compounds is provided on Table 7.1.

Table 4.3--Sampling Overview

Matrix	Samples Collected	Field and Trip Blanks	Matrix Spike Matrix Spike Duplicates (number and type)	Duplicate Samples (number and type)
Groundwater	Four (4)	1 per 20 samples or 1 per day	N/A	N/A
Soil	Ten (10)	1 per 20 samples or 1 per day	1 per 20 samples	1 duplicate for every 20 samples
Soil Vapor*	Seven (7) total	N/A	N/A	N/A

* If soil vapor samples are to be collected 1 ambient air sample will be taken per 20 samples

TABLE 7.1–CONTRACT-REQUIRED QUANTITATION LEVELS AND ANALYTICAL METHODS FOR ASP INORGANICS, ASP VOLATILES, ASP SEMI-VOLATILES, ASP PESTICIDES, AND PCBS

Target Compound List (TCL) and Contract-Required Quantitation Limit

SECTION 1 - ASP INORGANICS Method: NYSDEC-ASP-91-4					
	PARAMETER	CONTRACT-REQUIRED DETECTION LEVEL* (µg/L)		PARAMETER	CONTRACT-REQUIRED DETECTION LEVEL* (µg/L)
1.	Aluminum	200	13.	Magnesium	5,000
2.	Antimony	60	14.	Manganese	15
3.	Arsenic	15	15.	Mercury	0.2
4.	Barium	200	16.	Nickel	40
5.	Beryllium	5	17.	Potassium	5,000
6.	Cadmium	5	18.	Selenium	35
7.	Calcium	5,000	19.	Silver	10
8.	Chromium	10	20.	Sodium	5,000
9.	Cobalt	50	21.	Thallium	25
10.	Copper	25	22.	Vanadium	50
11.	Iron	100	23.	Zinc	60
12.	Lead	10	24.	Cyanide	10

SECTION 2 – ASP ORGANICS (VOLATILES) Method: NYSDEC-ASP-91-1					
	VOLATILE	CONTRACT-REQUIRED QUANTITATION LIMIT** (µg/L)		VOLATILE	CONTRACT-REQUIRED QUANTITATION LIMIT** (µg/L)
1.	Chloromethane	5.0	18.	1,2-Dichloropropane	5.0
2.	Bromomethane	5.0	19.	cis-1,3-Dichloropropene	5.0
3.	Vinyl Chloride	5.0	20.	Trichloroethene	5.0
4.	Chloroethane	5.0	21.	Dibromochloromethane	5.0
5.	Methylene Chloride	5.0	22.	1,1,2-Trichloroethane	5.0
6.	Acetone	10.0	23.	Benzene	5.0
7.	Carbon Disulfide	5.0	24.	Trans-1.3-Dichloropropene	5.0
8.	1,1-Dichloroethylene	5.0	25.	Bromoform	5.0
9.	1,1-Dichloroethane	5.0	26.	2-Hexanone	10.0
10.	1,2-Dichloroethylene (total)	5.0	27.	4-Methyl, 1,2-Pentanone	10.0
11.	Chloroform	5.0	28.	Tetrachloroethylene	5.0
12.	1,2-Dichloroethane	5.0	29.	Toluene	5.0
13.	2-Butanone	10.0	30.	Chlorobenzene	5.0
14.	1,1,1-Trichloroethane	5.0	31.	Ethylbenzene	5.0
15.	Carbon Tetrachloride	5.0	32.	Styrene	5.0
16.	Bromodichloromethane	5.0	33.	Total Xylenes	5.0
17.	1,1,2,2-Tetrachloroethane	5.0			

SECTION 3 - ASP ORGANICS (SEMI-VOLATILES) Method: NYSDEC-ASP-91-2					
SEMI-VOLATILE		CONTRACT-REQUIRED QUANTITATION LIMIT (µg/l)	SEMI-VOLATILE		CONTRACT-REQUIRED QUANTITATION LIMIT (µg/l)
1.	Phenol	5.0	33.	Acenaphthene	5.0
2.	Bis(2-chloroethyl)ether	5.0	34.	2,4-Dinitrophenol	10.0
3.	2-Chlorophenol	5.0	35.	4-Nitrophenol	10.0
4.	1,3-Dichlorobenzene	5.0	36.	Dibenzofuran	5.0
5.	1,4-Dichlorobenzene	5.0	37.	Dinitrotoluene	5.0
6.	1,2-Dichlorobenzene	5.0	38.	Diethylphthalate	5.0
7.	2-Methylphenol	5.0	39.	4-Chlorophenyl phenyl ether	5.0
8.	2,2'oxybis(1-Chloropropane)	5.0	40.	Fluorene	5.0
9.	4-Methylphenol	5.0	41.	4-Nitroanile	10.0
10.	N-Nitroso-dipropylamine	5.0	42.	4,6-Dinitro-2-methylphenol	10.0
11.	Hexachloroethane	5.0	43.	N-nitrosodiphenyl amine	5.0
12.	Nitrobenzene	5.0	44.	4-Bromophenyl phenyl ether	5.0
13.	Isophorone	5.0	45.	Hexachlorobenzene	5.0
14.	2-Nitrophenol	5.0	46.	Pentachlorophenol	10.0
15.	2,4-Dimethylphenol	5.0	47.	Phenanthrene	5.0
16.	Bis(2-Chloroethoxy) methane	5.0	48.	Anthracene	5.0
17.	2,4-Dichlorophenol	5.0	49.	Carbazole	5.0
18.	1,2,4-Trichlorobenzene	5.0	50.	Di-n-butyl phthalate	5.0
19.	Naphthalene	5.0	51.	Fluoranthene	5.0
20.	4-Chloroaniline	5.0	52.	Pyrene	5.0
21.	Hexachlorobutadiene	5.0	53.	Butyl benzyl phthalate	5.0
22.	4-Chloro-3-methylphenol	5.0	54.	3,3'-Dichloro benzidine	5.0
23.	2-Methylnaphthalene	5.0	55.	Benz(a)anthracene	5.0
24.	Hexachlorocyclopentadiene	5.0	56.	Chrysene	5.0
25.	2,4,6-Trichlorophenol	5.0	57.	Bis(2-ethylhexyl) phthalate	5.0
26.	2,4,5-Trichlorophenol	10.0	58.	Di-n-octyl phthalate	5.0
27.	2-Chloronapthalene	5.0	59.	Benzo(b)fluoranthene	5.0
28.	2-Nitroananiline	10.0	60.	Benzo(k)fluoranthene	5.0
29.	Dimethyl phthalate	5.0	61.	Benzo(a)pyrene	5.0
30.	Acenaphthylene	5.0	62.	Indeno(1,2,3-cd) pyrene	5.0
31.	2,6-Dinitrotoluene	5.0	63.	Dibenz(a,h) anthracene	5.0
32.	3-Nitroaniline	10.0	64.	Benzo(g,h,i)perylene	5.0

SECTION 3 - ASP ORGANICS (PESTICIDES/PCBS) Method: NYSDEC-ASP-91-3					
PESTICIDE/PCB		CONTRACT-REQUIRED QUANTITATION LIMIT (µg/l)	PESTICIDE/PCB		CONTRACT-REQUIRED QUANTITATION LIMIT (µg/l)
1.	Alpha-BHC	0.05	15.	4,4'-DDT	0.10
2.	Beta-BHC	0.05	16.	Methoxychlor	0.5
3.	Delta-BHC	0.05	17.	Endrin ketone	0.10
4.	Gamma-BHC (lindane)	0.05	18.	Endrin aldehyde	0.10
5.	Heptachlor	0.05	19.	Alpha-Chlordane	0.05
6.	Aldrin	0.05	20.	Gamma-Chlordane	0.05
7.	Heptachlor epoxide	0.05	21.	Toxaphene	5.0
8.	Endosulfan I	0.05	22.	AROCHLOR-1016	1.0
9.	Dieldrin	0.10	23.	AROCHLOR-1221	1.0
10.	4,4'-DDE	0.10	24.	AROCHLOR-1232	1.0
11.	Endrin	0.10	25.	AROCHLOR-1242	1.0
12.	Endosulfan II	0.10	26.	AROCHLOR-1248	1.0
13.	4,4'-DDD	0.10	27.	AROCHLOR-1254	1.0
14.	Endosulfan sulfate	0.10	28.	AROCHLOR-1260	1.0

*Matrix: groundwater. For soil matrix, multiply CRDL by 100.
**Quantitation limit for medium-level soil is 1,200 µg/kg (wet weight basis).

Method: EPA Modified 537 Perfluorinated Alkyl Acids by Isotope Dilution			
		Reporting Limit—Groundwater (ng/l)	Method Detection Limit—Groundwater (ng/l)
1	Perfluorobutanoic Acid (PFBA)	2.00	0.408
2	Perfluoropentanoic Acid (PFPeA)	2.00	0.396
3	Perfluorobutanesulfonic Acid (PFBS)	2.00	0.238
4	Perfluorohexanoic Acid (PFHxA)	2.00	0.328
5	Perfluoroheptanoic Acid (PFHpA)	2.00	0.225
6	Perfluorohexanesulfonic Acid (PFHxS)	2.00	0.376
7	Perfluorooctanoic Acid (PFOA)	2.00	0.236
8	1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2 FTS)	2.00	1.33
9	Perfluoroheptanesulfonic Acid (PFHpS)	2.00	0.688
10	Perfluorononanoic Acid (PFNA)	2.00	0.312
11	Perfluorooctanesulfonic Acid (PFOS)	2.00	0.504
12	Perfluorodecanoic Acid (PFDA)	2.00	0.304
13	1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	2.00	1.21
14	N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	2.00	0.648
15	Perfluoroundecanoic Acid (PFUnA)	2.00	0.260
16	Perfluorodecanesulfonic Acid (PFDS)	2.00	0.980
17	Perfluorooctanesulfonamide (FOSA)	2.00	0.580
18	N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2.00	0.804
19	Perfluorododecanoic Acid (PFDoA)	2.00	0.372
20	Perfluorotridecanoic Acid (PFTrDA)	2.00	0.327
21	Perfluorotetradecanoic Acid (PFTA)	2.00	0.248

Method: EPA Modified 537 Perfluorinated Alkyl Acids by Isotope Dilution		
	Reporting Limit—Soil (ng/g)	**Method Detection Limit—Soil (ng/g)**
Perfluorobutanoic Acid (PFBA)	0.500	0.023
Perfluoropentanoic Acid (PFPeA)	0.500	0.046
Perfluorobutanesulfonic Acid (PFBS)	0.250	0.039
Perfluorohexanoic Acid (PFHxA)	0.500	0.053
Perfluoroheptanoic Acid (PFHpA)	0.250	0.045
Perfluorohexanesulfonic Acid (PFHxS)	0.250	0.061
Perfluorooctanoic Acid (PFOA)	0.250	0.042
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2 FTS)	0.500	0.180
Perfluoroheptanesulfonic Acid (PFHpS)	0.500	0.137
Perfluorononanoic Acid (PFNA)	0.250	0.075
Perfluorooctanesulfonic Acid (PFOS)	0.250	0.130
Perfluorodecanoic Acid (PFDA)	0.250	0.067
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	0.500	0.287
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	0.500	0.202
Perfluoroundecanoic Acid (PFUnA)	0.500	0.047
Perfluorodecanesulfonic Acid (PFDS)	0.500	0.153
Perfluorooctanesulfonamide (FOSA)	0.500	0.098
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	0.500	0.085
Perfluorododecanoic Acid (PFDoA)	0.500	0.070
Perfluorotridecanoic Acid (PFTrDA)	0.500	0.205
Perfluorotetradecanoic Acid (PFTA)	0.500	0.054

Attachment A:

Resumes of SESI Project Team

FUAD DAHAN, Ph.D., P.E., LSRP

Principal



EDUCATION

2002 - Ph.D. Environmental Engineering; Purdue University, W. Lafayette IN
1997 - M.S. Chemical Engineering; Drexel University, Philadelphia PA
1994 - B.S. Chemistry; American University of Beirut, Beirut Lebanon

PROFESSIONAL REGISTRATIONS

Professional Engineer - State of New Jersey (# 24GE05012100)
Professional Engineer - State of New York (# 090531)
Licensed Site Remediation Professional (# 629363)
Member of the American Society of Civil Engineers
Member of the Green and Sustainable Remediation Committee of the Interstate Technology & Regulatory Council

EXPERIENCE

Dr. Dahan has over 15 years of environmental engineering experience. His diverse experience includes environmental treatment system applications, design, research and monitoring. He has worked on federal, state, and private projects. Dr. Dahan joined SESI in 2013 as a Senior Project Manager. He managed multi-million dollar projects and programs for large corporations including Fortune 500 companies.

Previously, when Dr. Dahan worked at SAIC, he managed a $5 million project to treat industrial wastewater at federal facilities. He also managed remediation projects at the McGuire Air Force base in NJ.

When Dr. Dahan worked at URSCorp, he prepared the final report for an $8 million remediation project. He provided daily field supervision of construction operations for that project to ensure conformity with the project specifications.

REPRESENTATIVE PROJECTS

Oil Terminal – Hackensack, NJ: Completed the remediation of an oil terminal with LNAPL along the bank of the Passaic River. The designed and implemented remedial approach resulted in $2 million of remediation cost savings and it readied the site for re-development in record time. The remedial strategy included soil excavation and disposal, and in-situ chemical injection for groundwater.

Oil Terminal and Production – Perth Amboy, NJ: Lead engineer for the conceptual site model for LNAPL contamination at an oil production terminal. Developed several remedial investigation and approaches for different areas of concerns (AOCs) to treat free-product and dissolved phase petroleum contamination in groundwater and soils. Applied varied remedial strategies depending on the type of contaminant and its release in each AOC.

Concord Hotel and Resort – Sullivan County, NY: Completed the remediation of a 25-acre Brownfield site. The remediation work included the design of the cap, treatment of DNAPL and LANPL plumes in the groundwater. The project was completed including the NYSDEC required documentation to receive a Certificate of Completion (COC).

Grossingers Hotel and Resort – Sullivan County, NY: Completed the remediation of a 17-acre Brownfield site. Remediated #6 fuel oil that leaked from underground storage tanks over several years into fractured bedrock and spread over 1.5 acre area.

Runnells Landfill – Berkeley Heights, NJ: Led the environmental clean-up of the 6-acre construction and debris landfill, to develop the landfill into a hotel. The work included the removal and the disposal of the landfill material to bring the site to grade. It involved the design of a venting system that will underlie the hotel building and the design of the new capping system in accordance with the NJDEP requirements.

AC Dutton Lumber Yard – Poughkeepsie, NY: Completed the remediation of an 11-acre Brownfield site that will be developed for residential/commercial and recreational use. The work included the design of the cap and the completion of the NYSDEC required documentation to receive a Certificate of Completion (COC).

Joint Base – McGuire Dix Lakehurst, NJ: Instrumental in the remediation of three Operable Units at the Joint Base. The work included investigation of the three operable units to determine the nature and extent of remediation. It also included the design of remedial strategies that included in-situ remediation technologies, excavation, and ex-situ remediation.

Holston Army Base – Kingsport, TN: Project manager for the implementation of three innovative technologies to treat the industrial wastewater. Coordinated with researchers at the Stevens Institute of Technology to design bench and pilot scale tests to test the treatment technologies. Led the design of the full-scale implementation of the technologies.

Science Applications International Corp (SAIC or Leidos) – Fairfield NJ: Led the remedial design for RCRA sites—which are part of an Air Force Base—that were impacted with chlorinated and petroleum VOCs, Metals, and SVOCs. Conducted the Feasibility Study that developed the remediation strategy for impacted soils, groundwater, and sediments. Conducted treatability study examining in situ chemical oxidation (ISCO) as treatment technology for soils and groundwater. The treatability study developed mass balances for the contaminants in the solid, water and gas phases to track the oxidation by-products. Conducted bench scale and pilot scale studies for industrial water treatment system. Scaled up the treatment system from a pilot to full-scale application. Developed a treatment strategy of benzene and chlorinated VOC co-mingled plumes.

Brown & Caldwell – Allendale NJ: Designed remedial action for an actively occupied facility and conducted efforts to generate feasibility studies to remediate tetrachloroethylene (PCE) impacted groundwater for ISRA regulated site. Technologies studied included in-situ enhanced bioremediation, in-situ chemical oxidation, pump-and-treat and soil vapor extraction. Following RCRA guidelines, evaluated remediation technologies for mercury impacted soils including in-situ solidification stabilization, in-situ vitrification, and excavation and ex-situ treatment.

TRAINING/CERTIFICATION

Advanced Tools for In-Situ Remediation
NJ DEP Soil Remediation Standards: Applications and Implications
Phytotechnologies - ITRC Internet-Based Training Course
Green Remediation: Environmental-Energy-Economics
OSHA Safety Training
OSHA Supervisor Safety Training

SHENG LONG, LSRP

Project Engineer

EDUCATION

M.S., Earth and Environmental Engineering, Columbia University
B.S., Environmental Science, Sun Yat-Sen University, Guangzhou, China

PROFESSIONAL REGISTRATIONS

EIT
New Jersey Licensed Site Remediation Professional

PATENTS

System and Method for Providing High Availability Machine Learning Servers for Online Anomaly Detection in a Water Utility Network (China: 201310581956.0)

EXPERIENCE

An environmental professional with nearly a decade of experience, Sheng has extensive experience in providing site remediations, from site assessments and investigations, through remediation design and implementation and reporting. Throughout the course of his environmental work, he has performed project management, engineering design, date analysis and visualization, and modeling. He has worked with various regulatory agencies, among them the New Jersey Department of Environmental Protection (NJDEP), the New York State Department of Environmental Conservation (NYSDEC), and the New York City Department of Environmental Protection (NYCDEP).

REPRESENTATIVE PROJECTS

Chlorinated Solvent DNAPL Site With Multiple Offsite Contributions, Point Pleasant Beach, NJ – As the project manager/engineer for the Site, Sheng designed and managed soil ex-situ treatment with persulfate, achieving a contaminant mass reduction rate of ~99.4%. He also executed in-situ groundwater treatment using persulfate, including performance assessments. In addition, he created and implemented a remedial investigation plan leveraging Membrane Interface Probe technology and managed the design, installation, and maintenance of a soil vapor extraction system. Finally, he performed 3D plume visualization, mass calculations, data analysis, hydrogeology testing, and fate and transport analysis.

Unregulated Landfill Site, Stanhope, NJ – In his role as project manager/engineer, Sheng led the full-scale landfill site and remedial investigations featuring GIS technologies, culminating in the successful completion and acceptance of Site Investigation/Remedial Investigation reports by NJDEP. During this project he performed ecological evaluations and assessments, compliance calculations, RA activities, and completed the Remedial Action Report.

Industrial Site with Offsite Migration, Jersey City, NJ – As the project manager/engineer for the project, Sheng designed and conducted investigation_distinguish different light non-aqueous phase liquid (LNAPL) releases and prepared the Interim Remedial Measures Report and Receptor Evaluation. An RAP for Groundwater and a CEA were established for the property.

Former Nuclear Submarine Fuel Manufactory Site, New Haven, CT – For this project, Sheng completed Phase I ESA due diligence, a process that included review of nuclear contamination remediation files.

Former Dry Cleaner, Hewitt, NJ – As the project manager/engineer for the investigation, Sheng designed and performed investigations to evaluate potable well exposures and eliminate potential immediate environmental concerns scenario. In addition, he designed the bedrock aquifer investigation plan involving rock lithology logging, vertical flow test and sectional sampling.

PCB-Containing LNAPL Site under ACO, Jersey City, NJ – Sheng served as the project manager/engineer for the site work, designing an investigation and remediation plan to comply with both NJDEP standards and EPA risk-based requirements and performing cost risk modeling to establish remediation funding source estimate. In addition, he conducted a receptor evaluation and developed an ecological evaluation strategy.

Daycare Site with Vapor Intrusion Issues, Newark, NJ – As the project manager/engineer, Sheng conducted site-specific groundwater screen level calculations for surrounding properties and performed fate and transport modeling to establish groundwater CEA. In addition, he performed diagnostic activities and performance evaluation associated with the sub-slab depressurization system.

NYCDEP Wastewater Resource Recovery Facilities, New York, NY – In his role as project manager/engineer, Sheng managed quarterly whole effluent toxicity sampling at various NYCDEP wastewater resource recovery facilities.

Water Distribution Networks Contamination Warning System Development, Guangzhou, China **–** Sheng designed sensor placement method, event detecting method, real-time SCADA system, and transport model for the pipe system. This project earned the Silver Medal for Innovative Development in Environmental Field of Nanhai.

TRAINING/CERTIFICATION

NYSDEC 4-hour Erosion and Sediment Control Training
OSHA 8-hour HAZWOPER Supervisor Training
OSHA 10-hour Outreach Training Program
OSHA 40-hour HAZWOPER

Attachment B:

Laboratory Standard Operating Procedures for PFAS

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

Under NYSDEC's Part 375 Remedial Programs

January 2021



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ERRATA SHEET for

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) Under NYSDEC's Part 375 Remedial Programs Issued January 17, 2020

Citation and Page Number	Current Text	Corrected Text	Date
Title of Appendix I, page 32	Appendix H	Appendix I	2/25/2020
Document Cover, page 1	Guidelines for Sampling and Analysis of PFAS	Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs	9/15/2020
Routine Analysis, page 9	"However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1 or ISO 25101."	"However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533."	9/15/2020
Additional Analysis, page 9, new paragraph regarding soil parameters	None	"In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (EPA Method 9060), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils."	9/15/2020
Data Assessment and Application to Site Cleanup Page 10	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFAS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Target levels for cleanup of PFAS in other media, including biota and sediment, have not yet been established by the DEC.	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Water Sample Results Page 10	PFAS should be further assessed and considered as a potential contaminant of concern in groundwater or surface water (…) If PFAS are identified as a contaminant of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water (…) If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	9/15/2020
Soil Sample Results, page 10	"The extent of soil contamination for purposes of delineation and remedy selection should be determined by having certain soil samples tested by Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed for PFAS. Soil exhibiting SPLP results above 70 ppt for either PFOA or PFOS (individually or combined) are to be evaluated during the cleanup phase."	"Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values. " [Interim SCO Table] "PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP. As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf. "	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Testing for Imported Soil Page 11	Soil imported to a site for use in a soil cap, soil cover, or as backfill is to be tested for PFAS in general conformance with DER-10, Section 5.4(e) for the PFAS Analyte List (Appendix F) using the analytical procedures discussed below and the criteria in DER-10 associated with SVOCs. If PFOA or PFOS is detected in any sample at or above 1 µg/kg, then soil should be tested by SPLP and the leachate analyzed for PFAS. If the SPLP results exceed 10 ppt for either PFOA or PFOS (individually) then the source of backfill should be rejected, unless a site-specific exemption is provided by DER. SPLP leachate criteria is based on the Maximum Contaminant Levels proposed for drinking water by New York State's Department of Health, this value may be updated based on future Federal or State promulgated regulatory standards. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable. PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Footnotes	None	[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances. [2] The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the soil cleanup objective for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	9/15/2020
Additional Analysis, page 9	In cases… soil parameters, such as Total Organic Carbon (EPA Method 9060), soil…	In cases… soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil…	1/8/2021
Appendix A, General Guidelines, fourth bullet	List the ELAP-approved lab(s) to be used for analysis of samples	List the ELAP- certified lab(s) to be used for analysis of samples	1/8/2021
Appendix E, Laboratory Analysis and Containers	Drinking water samples collected using this protocol are intended to be analyzed for PFAS by ISO Method 25101.	Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101	1/8/2021

Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs

Objective

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) performs or oversees sampling of environmental media and subsequent analysis of PFAS as part of remedial programs implemented under 6 NYCRR Part 375. To ensure consistency in sampling, analysis, reporting, and assessment of PFAS, DER has developed this document which summarizes currently accepted procedures and updates previous DER technical guidance pertaining to PFAS.

Applicability

All work plans submitted to DEC pursuant to one of the remedial programs under Part 375 shall include PFAS sampling and analysis procedures that conform to the guidelines provided herein.

As part of a site investigation or remedial action compliance program, whenever samples of potentially affected media are collected and analyzed for the standard Target Analyte List/Target Compound List (TAL/TCL), PFAS analysis should also be performed. Potentially affected media can include soil, groundwater, surface water, and sediment. Based upon the potential for biota to be affected, biota sampling and analysis for PFAS may also be warranted as determined pursuant to a Fish and Wildlife Impact Analysis. Soil vapor sampling for PFAS is not required.

Field Sampling Procedures

DER-10 specifies technical guidance applicable to DER's remedial programs. Given the prevalence and use of PFAS, DER has developed "best management practices" specific to sampling for PFAS. As specified in DER-10 Chapter 2, quality assurance procedures are to be submitted with investigation work plans. Typically, these procedures are incorporated into a work plan, or submitted as a stand-alone document (e.g., a Quality Assurance Project Plan). Quality assurance guidelines for PFAS are listed in Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS.

Field sampling for PFAS performed under DER remedial programs should follow the appropriate procedures outlined for soils, sediments or other solids (Appendix B), non-potable groundwater (Appendix C), surface water (Appendix D), public or private water supply wells (Appendix E), and fish tissue (Appendix F).

QA/QC samples (e.g. duplicates, MS/MSD) should be collected as specified in DER-10, Section 2.3(c). For sampling equipment coming in contact with aqueous samples only, rinsate or equipment blanks should be collected. Equipment blanks should be collected at a minimum frequency of one per day per site or one per twenty samples, whichever is more frequent.

Analysis and Reporting

As of October 2020, the United States Environmental Protection Agency (EPA) does not have a validated method for analysis of PFAS for media commonly analyzed under DER remedial programs (non-potable waters, solids). DER has developed the following guidelines to ensure consistency in analysis and reporting of PFAS.

The investigation work plan should describe analysis and reporting procedures, including laboratory analytical procedures for the methods discussed below. As specified in DER-10 Section 2.2, laboratories should provide a full Category B deliverable. In addition, a Data Usability Summary Report (DUSR) should be prepared by an independent, third party data validator. Electronic data submissions should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

DER has developed a *PFAS Analyte List* (Appendix F) for remedial programs to understand the nature of contamination at sites. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any analytes, the DER project manager, in consultation with the DER chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site. As with other contaminants that are analyzed for at a site, the *PFAS Analyte List* may be refined for future sampling events based on investigative findings.

Routine Analysis

Currently, New York State Department of Health's Environmental Laboratory Approval Program (ELAP) does not offer certification for PFAS in matrices other than finished drinking water. However, laboratories analyzing environmental samples for PFAS (e.g., soil, sediments, and groundwater) under DER's Part 375 remedial programs need to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533. Laboratories should adhere to the guidelines and criteria set forth in the DER's laboratory guidelines for PFAS in non-potable water and solids (Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids). Data review guidelines were developed by DER to ensure data comparability and usability (Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids).

LC-MS/MS analysis for PFAS using methodologies based on EPA Method 537.1 is the procedure to use for environmental samples. Isotope dilution techniques should be utilized for the analysis of PFAS in all media. Reporting limits for PFOA and PFOS in aqueous samples should not exceed 2 ng/L. Reporting limits for PFOA and PFOS in solid samples should not exceed 0.5 µg/kg. Reporting limits for all other PFAS in aqueous and solid media should be as close to these limits as possible. If laboratories indicate that they are not able to achieve these reporting limits for the entire *PFAS Analyte List*, site-specific decisions regarding acceptance of elevated reporting limits for specific PFAS can be made by the DER project manager in consultation with the DER chemist.

Additional Analysis

Additional laboratory methods for analysis of PFAS may be warranted at a site, such as the Synthetic Precipitation Leaching Procedure (SPLP) and Total Oxidizable Precursor Assay (TOP Assay).

In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils.

SPLP is a technique used to determine the mobility of chemicals in liquids, soils and wastes, and may be useful in determining the need for addressing PFAS-containing material as part of the remedy. SPLP by EPA Method 1312 should be used unless otherwise specified by the DER project manager in consultation with the DER chemist.

Impacted materials can be made up of PFAS that are not analyzable by routine analytical methodology. A TOP Assay can be utilized to conceptualize the amount and type of oxidizable PFAS which could be liberated in the environment, which approximates the maximum concentration of perfluoroalkyl substances that could be generated

if all polyfluoroalkyl substances were oxidized. For example, some polyfluoroalkyl substances may degrade or transform to form perfluoroalkyl substances (such as PFOA or PFOS), resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from a source. The TOP Assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by routine analytical methodology.[1]

Commercial laboratories have adopted methods which allow for the quantification of targeted PFAS in air and biota. The EPA's Office of Research and Development (ORD) is currently developing methods which allow for air emissions characterization of PFAS, including both targeted and non-targeted analysis of PFAS. Consult with the DER project manager and the DER chemist for assistance on analyzing biota/tissue and air samples.

Data Assessment and Application to Site Cleanup

Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.

Water Sample Results

PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water if PFOA or PFOS is detected in any water sample at or above 10 ng/L (ppt) and is determined to be attributable to the site, either by a comparison of upgradient and downgradient levels, or the presence of soil source areas, as defined below. In addition, further assessment of water may be warranted if either of the following screening levels are met:

a. any other individual PFAS (not PFOA or PFOS) is detected in water at or above 100 ng/L; or
b. total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ng/L

If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.

Soil Sample Results

Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values.

Guidance Values for Anticipated Site Use	PFOA (ppb)	PFOS (ppb)
Unrestricted	0.66	0.88
Residential	6.6	8.8
Restricted Residential	33	44
Commercial	500	440
Industrial	600	440
Protection of Groundwater[2]	1.1	3.7

[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances.
[2] The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).

PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP.

As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf.

Testing for Imported Soil

Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable.

PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.

Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS

The following guidelines (general and PFAS-specific) can be used to assist with the development of a QAPP for projects within DER involving sampling and analysis of PFAS.

General Guidelines in Accordance with DER-10

- Document/work plan section title – Quality Assurance Project Plan
- Summarize project scope, goals, and objectives
- Provide project organization including names and resumes of the project manager, Quality Assurance Officer (QAO), field staff, and Data Validator
    - The QAO should not have another position on the project, such as project or task manager, that involves project productivity or profitability as a job performance criterion
- List the ELAP certified lab(s) to be used for analysis of samples
- Include a site map showing sample locations
- Provide detailed sampling procedures for each matrix
- Include Data Quality Usability Objectives
- List equipment decontamination procedures
- Include an "Analytical Methods/Quality Assurance Summary Table" specifying:
    - Matrix type
    - Number or frequency of samples to be collected per matrix
    - Number of field and trip blanks per matrix
    - Analytical parameters to be measured per matrix
    - Analytical methods to be used per matrix with minimum reporting limits
    - Number and type of matrix spike and matrix spike duplicate samples to be collected
    - Number and type of duplicate samples to be collected
    - Sample preservation to be used per analytical method and sample matrix
    - Sample container volume and type to be used per analytical method and sample matrix
    - Sample holding time to be used per analytical method and sample matrix
- Specify Category B laboratory data deliverables and preparation of a DUSR

Specific Guidelines for PFAS

- Include in the text that sampling for PFAS will take place
- Include in the text that PFAS will be analyzed by LC-MS/MS for PFAS using methodologies based on EPA Method 537.1
- Include the list of PFAS compounds to be analyzed (*PFAS Analyte List*)
- Include the laboratory SOP for PFAS analysis
- List the minimum method-achievable Reporting Limits for PFAS
    - Reporting Limits should be less than or equal to:
        - Aqueous – 2 ng/L (ppt)
        - Solids – 0.5 µg/kg (ppb)
- Include the laboratory Method Detection Limits for the PFAS compounds to be analyzed
- Laboratory should have ELAP certification for PFOA and PFOS in drinking water by EPA Method 537, 537.1, EPA Method 533, or ISO 25101
- Include detailed sampling procedures
    - Precautions to be taken
    - Pump and equipment types
    - Decontamination procedures
    - Approved materials only to be used
- Specify that regular ice only will be used for sample shipment
- Specify that equipment blanks should be collected at a minimum frequency of 1 per day per site for each matrix

Appendix B - Sampling Protocols for PFAS in Soils, Sediments and Solids

General

The objective of this protocol is to give general guidelines for the collection of soil, sediment and other solid samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Containers

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in to contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel spoon
- stainless steel bowl
- steel hand auger or shovel without any coatings

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a pre-cleaned trowel or shovel should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) should then be collected using a pre-cleaned, stainless steel spoon. Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the sample is obtained, it should be deposited into a stainless steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the middle until the material is homogenized. At this point the material within the bowl can be placed into the laboratory provided container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix C - Sampling Protocols for PFAS in Monitoring Wells

General

The objective of this protocol is to give general guidelines for the collection of groundwater samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including plumbers tape and sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel inertia pump with HDPE tubing
- peristaltic pump equipped with HDPE tubing and silicone tubing
- stainless steel bailer with stainless steel ball
- bladder pump (identified as PFAS-free) with HDPE tubing

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Monitoring wells should be purged in accordance with the sampling procedure (standard/volume purge or low flow purge) identified in the site work plan, which will determine the appropriate time to collect the sample. If sampling using standard purge techniques, additional purging may be needed to reduce turbidity levels, so samples contain a limited amount of sediment within the sample containers. Sample containers that contain sediment may cause issues at the laboratory, which may result in elevated reporting limits and other issues during the sample preparation that can compromise data usability. Sampling personnel should don new nitrile gloves prior to sample collection due to the potential to contact PFAS containing items (not related to the sampling equipment) during the purging activities.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Additional equipment blank samples may be collected to assess other equipment that is utilized at the monitoring well
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A purge log shall document the location of the sample, sampling equipment, groundwater parameters, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix D - Sampling Protocols for PFAS in Surface Water

General

The objective of this protocol is to give general guidelines for the collection of surface water samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel cup

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Where conditions permit, (e.g. creek or pond) sampling devices (e.g. stainless steel cup) should be rinsed with site medium to be sampled prior to collection of the sample. At this point the sample can be collected and poured into the sample container.

If site conditions permit, samples can be collected directly into the laboratory container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix E - Sampling Protocols for PFAS in Private Water Supply Wells

General

The objective of this protocol is to give general guidelines for the collection of water samples from private water supply wells (with a functioning pump) for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials (e.g. plumbers tape), including sample bottle cap liners with a PTFE layer.

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Locate and assess the pressure tank and determine if any filter units are present within the building. Establish the sample location as close to the well pump as possible, which is typically the spigot at the pressure tank. Ensure sampling equipment is kept clean during sampling as access to the pressure tank spigot, which is likely located close to the ground, may be obstructed and may hinder sample collection.

Prior to sampling, a faucet downstream of the pressure tank (e.g., washroom sink) should be run until the well pump comes on and a decrease in water temperature is noted which indicates that the water is coming from the well. If the homeowner is amenable, staff should run the water longer to purge the well (15+ minutes) to provide a sample representative of the water in the formation rather than standing water in the well and piping system including the pressure tank. At this point a new pair of nitrile gloves should be donned and the sample can be collected from the sample point at the pressure tank.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- If equipment was used, collect one equipment blank per day per site and a minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers.
- A field reagent blank (FRB) should be collected at a rate of one per 20 samples. The lab will provide a FRB bottle containing PFAS free water and one empty FRB bottle. In the field, pour the water from the one bottle into the empty FRB bottle and label appropriately.
- Request appropriate data deliverable (Category B) and an electronic data deliverable
- For sampling events where multiple private wells (homes or sites) are to be sampled per day, it is acceptable to collect QC samples at a rate of one per 20 across multiple sites or days.

Documentation

A sample log shall document the location of the private well, sample point location, owner contact information, sampling equipment, purge duration, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate and available (e.g. well construction, pump type and location, yield, installation date). Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appendix F - Sampling Protocols for PFAS in Fish

This appendix contains a copy of the latest guidelines developed by the Division of Fish and Wildlife (DFW) entitled “General Fish Handling Procedures for Contaminant Analysis” (Ver. 8).

Procedure Name: General Fish Handling Procedures for Contaminant Analysis

Number: FW-005

Purpose: This procedure describes data collection, fish processing and delivery of fish collected for contaminant monitoring. It contains the chain of custody and collection record forms that should be used for the collections.

Organization: Environmental Monitoring Section
Bureau of Ecosystem Health
Division of Fish and Wildlife (DFW)
New York State Department of Environmental Conservation (NYSDEC)
625 Broadway
Albany, New York 12233-4756

Version: 8

Previous Version Date: 21 March 2018

Summary of Changes to this Version: Updated bureau name to Bureau of Ecosystem Health. Added direction to list the names of all field crew on the collection record. Minor formatting changes on chain of custody and collection records.

Originator or Revised by: Wayne Richter, Jesse Becker

Date: 26 April 2019

Quality Assurance Officer and Approval Date: Jesse Becker, 26 April 2019

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

GENERAL FISH HANDLING PROCEDURES FOR CONTAMINANT ANALYSES

A. Original copies of all continuity of evidence (i.e., Chain of Custody) and collection record forms must accompany delivery of fish to the lab. A copy shall be directed to the Project Leader or as appropriate, Wayne Richter. All necessary forms will be supplied by the Bureau of Ecosystem Health. Because some samples may be used in legal cases, it is critical that each section is filled out completely. Each Chain of Custody form has three main sections:

   1. The top box is to be filled out **and signed** by the person responsible for the fish collection (e.g., crew leader, field biologist, researcher). This person is responsible for delivery of the samples to DEC facilities or personnel (e.g., regional office or biologist).

   2. The second section is to be filled out **and signed** by the person responsible for the collections while being stored at DEC, before delivery to the analytical lab. This may be the same person as in (1), but it is still required that they complete the section. Also important is the **range of identification numbers** (i.e., tag numbers) included in the sample batch.

   3. Finally, the bottom box is to record any transfers between DEC personnel and facilities. Each subsequent transfer should be **identified, signed, and dated**, until laboratory personnel take possession of the fish.

B. The following data are required on each **Fish Collection Record** form:

   1. Project and Site Name.

   2. DEC Region.

   3. All personnel (and affiliation) involved in the collection.

   4. Method of collection (gill net, hook and line, etc.)

   5. Preservation Method.

C. The following data are to be taken on each fish collected and recorded on the **Fish Collection Record** form:

   1. Tag number - Each specimen is to be individually jaw tagged at time of collection with a unique number. Make sure the tag is turned out so that the number can be read without opening the bag. Use tags in sequential order. For small fish or composite samples place the tag inside the bag with the samples. The Bureau of Ecosystem Health can supply the tags.

   2. Species identification (please be explicit enough to enable assigning genus and species). Group fish by species when processing.

   3. Date collected.

   4. Sample location (waterway and nearest prominent identifiable landmark).

   5. Total length (nearest mm or smallest sub-unit on measuring instrument) and weight (nearest g or

smallest sub-unit of weight on weighing instrument). Take all measures as soon as possible with calibrated, protected instruments (e.g. from wind and upsets) and prior to freezing.

6. Sex - fish may be cut enough to allow sexing or other internal investigation, but do not eviscerate. Make any incision on the right side of the belly flap or exactly down the midline so that a left-side fillet can be removed.

D. General data collection recommendations:

1. It is helpful to use an ID or tag number that will be unique. It is best to use metal striped bass or other uniquely numbered metal tags. If uniquely numbered tags are unavailable, values based on the region, water body and year are likely to be unique: for example, R7CAY11001 for Region 7, Cayuga Lake, 2011, fish 1. If the fish are just numbered 1 through 20, we have to give them new numbers for our database, making it more difficult to trace your fish to their analytical results and creating an additional possibility for errors.

2. Process and record fish of the same species sequentially. Recording mistakes are less likely when all fish from a species are processed together. Starting with the bigger fish species helps avoid missing an individual.

3. If using Bureau of Ecosystem Health supplied tags or other numbered tags, use tags in sequence so that fish are recorded with sequential Tag Numbers. This makes data entry and login at the lab and use of the data in the future easier and reduces keypunch errors.

4. Record length and weight as soon as possible after collection and before freezing. Other data are recorded in the field upon collection. An age determination of each fish is optional, but if done, it is recorded in the appropriate “Age” column.

5. For composite samples of small fish, record the number of fish in the composite in the Remarks column. Record the length and weight of each individual in a composite. All fish in a composite sample should be of the same species and members of a composite should be visually matched for size.

6. Please submit photocopies of topographic maps or good quality navigation charts indicating sampling locations. GPS coordinates can be entered in the Location column of the collection record form in addition to or instead for providing a map. These records are of immense help to us (and hopefully you) in providing documented location records which are not dependent on memory and/or the same collection crew. In addition, they may be helpful for contaminant source trackdown and remediation/control efforts of the Department.

7. When recording data on fish measurements, it will help to ensure correct data recording for the data recorder to call back the numbers to the person making the measurements.

E. Each fish is to be placed in its own individual plastic bag. For small fish to be analyzed as a composite, put all of the fish for one composite in the same bag but use a separate bag for each composite. It is important to individually bag the fish to avoid difficulties or cross contamination when processing the fish for chemical analysis. Be sure to include the fish’s tag number inside the bag, preferably attached to the fish with the tag number turned out so it can be read. Tie or otherwise secure the bag closed. **The Bureau of Ecosystem Health will supply the bags.** If necessary, food grade bags may be procured from a suitable vendor (e.g., grocery store). It is preferable to redundantly label each bag with a manila tag tied between the knot and the body of the bag. This tag should be labeled with the project name, collection location, tag number, collection date, and fish species. If scales are collected, the scale envelope should be labeled with

the same information.

F. Groups of fish, by species, are to be placed in one large plastic bag per sampling location. **The Bureau of Ecosystem Health will supply the larger bags.** Tie or otherwise secure the bag closed. Label the site bag with a manila tag tied between the knot and the body of the bag. The tag should contain: project, collection location, collection date, species and **tag number ranges**. Having this information on the manila tag enables lab staff to know what is in the bag without opening it.

G. Do not eviscerate, fillet or otherwise dissect the fish unless specifically asked to. If evisceration or dissection is specified, the fish must be cut along the exact midline or on the right side so that the left side fillet can be removed intact at the laboratory. If filleting is specified, the procedure for taking a standard fillet (SOP PREPLAB 4) must be followed, including removing scales.

H. Special procedures for PFAS: Unlike legacy contaminants such as PCBs, which are rarely found in day to day life, PFAS are widely used and frequently encountered. Practices that avoid sample contamination are therefore necessary. While no standard practices have been established for fish, procedures for water quality sampling can provide guidance. The following practices should be used for collections when fish are to be analyzed for PFAS:

No materials containing Teflon.
No Post-it notes.
No ice packs; only water ice or dry ice.
Any gloves worn must be powder free nitrile.
No Gore-Tex or similar materials (Gore-Tex is a PFC with PFOA used in its manufacture).
No stain repellent or waterproof treated clothing; these are likely to contain PFCs.
Avoid plastic materials, other than HDPE, including clipboards and waterproof notebooks.
Wash hands after handling any food containers or packages as these may contain PFCs.
Keep pre-wrapped food containers and wrappers isolated from fish handling.
Wear clothing washed at least six times since purchase.
Wear clothing washed without fabric softener.
Staff should avoid cosmetics, moisturizers, hand creams and similar products on the day of sampling as many of these products contain PFCs (Fujii et al. 2013). Sunscreen or insect repellent should not contain ingredients with “fluor” in their name. Apply any sunscreen or insect repellent well downwind from all materials. Hands must be washed after touching any of these products.

I. All fish must be kept at a temperature <45° F (<8° C) immediately following data processing. As soon as possible, freeze at -20° C ± 5° C. Due to occasional freezer failures, daily freezer temperature logs are required. The freezer should be locked or otherwise secured to maintain chain of custody.

J. In most cases, samples should be delivered to the Analytical Services Unit at the Hale Creek field station. Coordinate delivery with field station staff and send copies of the collection records, continuity of evidence forms and freezer temperature logs to the field station. For samples to be analyzed elsewhere, non-routine collections or other questions, contact Wayne Richter, Bureau of Ecosystem Health, NYSDEC, 625 Broadway, Albany, New York 12233-4756, 518-402-8974, or the project leader about sample transfer. Samples will then be directed to the analytical facility and personnel noted on specific project descriptions.

K. A recommended equipment list is at the end of this document.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF FISH AND WILDLIFE
FISH COLLECTION RECORD

Project and Site Name _____ DEC Region _____

Collections made by (include all crew) _____

Sampling Method: □Electrofishing □Gill netting □Trap netting □Trawling □Seining □Angling □Other _____

Preservation Method: □Freezing □Other _____ Notes (SWFDB survey number): _____

FOR LAB USE ONLY- LAB ENTRY NO.	COLLECTION OR TAG NO.	SPECIES	DATE TAKEN	LOCATION	AGE	SEX &/OR REPROD. CONDIT	LENGTH ( )	WEIGHT ( )	REMARKS

richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17, 4/26/19

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
CHAIN OF CUSTODY

I, _____, of _____ collected the
(Print Name) (Print Business Address)

following on _____, 20____ from _____
(Date) (Water Body)

in the vicinity of _____
(Landmark, Village, Road, etc.)

Town of _____, in _____ County.

Item(s) _____

_____

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on _____, 20_____.

_____ _____
Signature Date

I, _____, received the above mentioned sample(s) on the date specified and assigned identification number(s) _____ to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

_____ _____
Signature Date

SECOND RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
THIRD RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
FOURTH RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
RECEIVED IN LABORATORY BY (Print Name)	TIME & DATE	REMARKS
SIGNATURE	UNIT	
LOGGED IN BY (Print Name)	TIME & DATE	ACCESSION NUMBERS
SIGNATURE	UNIT	

richter: revised 21 April 2014; becker: 23 March 2017, 26 April, 2019

NOTICE OF WARRANTY

By signature to the chain of custody (reverse), the signatory warrants that the information provided is truthful and accurate to the best of his/her ability. The signatory affirms that he/she is willing to testify to those facts provided and the circumstances surrounding the same. Nothing in this warranty or chain of custody negates responsibility nor liability of the signatories for the truthfulness and accuracy of the statements provided.

HANDLING INSTRUCTIONS

On day of collection, collector(s) name(s), address(es), date, geographic location of capture (attach a copy of topographic map or navigation chart), species, number kept of each species, and description of capture vicinity (proper noun, if possible) along with name of Town and County must be indicated on reverse.

Retain organisms in manila tagged plastic bags to avoid mixing capture locations. Note appropriate information on each bag tag.

Keep samples as cool as possible. Put on ice if fish cannot be frozen within 12 hours. If fish are held more than 24 hours without freezing, they will not be retained or analyzed.

Initial recipient (either DEC or designated agent) of samples from collector(s) is responsible for obtaining and recording information on the collection record forms which will accompany the chain of custody. This person will seal the container using packing tape and writing his signature, the time and the date across the tape onto the container with indelible marker. Any time a seal is broken, for whatever purpose, the incident must be recorded on the Chain of Custody (reason, time, and date) in the purpose of transfer block. Container then is resealed using new tape and rewriting signature, with time and date.

EQUIPMENT LIST

Scale or balance of appropriate capacity for the fish to be collected.

Fish measuring board.

Plastic bags of an appropriate size for the fish to be collected and for site bags.

Individually numbered metal tags for fish.

Manila tags to label bags.

Small envelops, approximately 2” x 3.5”, if fish scales are to be collected.

Knife for removing scales.

Chain of custody and fish collection forms.

Clipboard.

Pens or markers.

Paper towels.

Dish soap and brush.

Bucket.

Cooler.

Ice.

Duct tape.

Appendix G – PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	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	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) developed the following guidelines for laboratories analyzing environmental samples for PFAS under DER programs. If laboratories cannot adhere to the following guidelines, they should contact DER's Quality Assurance Officer, Dana Barbarossa, at dana.barbarossa@dec.ny.gov prior to analysis of samples.

Isotope Dilution

Isotope dilution techniques should be utilized for the analysis of PFAS in all media.

Extraction

For water samples, the entire sample bottle should be extracted, and the sample bottle rinsed with appropriate solvent to remove any residual PFAS.

For samples with high particulates, the samples should be handled in one of the following ways:

1. Spike the entire sample bottle with isotope dilution analytes (IDAs) prior to any sample manipulation. The sample can be passed through the SPE and if it clogs, record the volume that passed through.
2. If the sample contains too much sediment to attempt passing it through the SPE cartridge, the sample should be spiked with isotope dilution analytes, centrifuged and decanted.
3. If higher reporting limits are acceptable for the project, the sample can be diluted by taking a representative aliquot of the sample. If isotope dilution analytes will be diluted out of the sample, they can be added after the dilution. The sample should be homogenized prior to taking an aliquot.

If alternate sample extraction procedures are used, please contact the DER remedial program chemist prior to employing. Any deviations in sample preparation procedures should be clearly noted in the case narrative.

Signal to Noise Ratio

For all target analyte ions used for quantification, signal to noise ratio should be 3:1 or greater.

Blanks

There should be no detections in the method blanks above the reporting limits.

Ion Transitions

The ion transitions listed below should be used for the following PFAS:

PFOA	413 > 369
PFOS	499 > 80
PFHxS	399 > 80
PFBS	299 > 80
6:2 FTS	427 > 407
8:2 FTS	527 > 507
N-EtFOSAA	584 > 419
N-MeFOSAA	570 > 419

Branched and Linear Isomers

Standards containing both branched and linear isomers should be used when standards are commercially available. Currently, quantitative standards are available for PFHxS, PFOS, NMeFOSAA, and NEtFOSAA. As more standards become available, they should be incorporated in to the method. All isomer peaks present in the standard should be integrated and the areas summed. Samples should be integrated in the same manner as the standards.

Since a quantitative standard does not exist for branched isomers of PFOA, the instrument should be calibrated using just the linear isomer and a technical (qualitative) PFOA standard should be used to identify the retention time of the branched PFOA isomers in the sample. The total response of PFOA branched and linear isomers should be integrated in the samples and quantitated using the calibration curve of the linear standard.

Secondary Ion Transition Monitoring

Quantifier and qualifier ions should be monitored for all target analytes (PFBA and PFPeA are exceptions). The ratio of quantifier ion response to qualifier ion response should be calculated for each target analyte and the ratio compared to standards. Lab derived criteria should be used to determine if the ratios are acceptable.

Reporting

Detections below the reporting limit should be reported and qualified with a J qualifier.

The acid form of PFAS analytes should be reported. If the salt form of the PFAS was used as a stock standard, the measured mass should be corrected to report the acid form of the analyte.

Appendix I - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

These guidelines are intended to be used for the validation of PFAS analytical results for projects within the Division of Environmental Remediation (DER) as well as aid in the preparation of a data usability summary report. Data reviewers should understand the methodology and techniques utilized in the analysis. Consultation with the end user of the data may be necessary to assist in determining data usability based on the data quality objectives in the Quality Assurance Project Plan. A familiarity with the laboratory's Standard Operating Procedure may also be needed to fully evaluate the data. If you have any questions, please contact DER's Quality Assurance Officer, Dana Barbarossa, at dana.barbarossa@dec.ny.gov.

Preservation and Holding Time

Samples should be preserved with ice to a temperature of less than 6°C upon arrival at the lab. The holding time is 14 days to extraction for aqueous and solid samples. The time from extraction to analysis for aqueous samples is 28 days and 40 days for solids.

Temperature greatly exceeds 6ºC upon arrival at the lab*	Use professional judgement to qualify detects and non-detects as estimated or rejected
Holding time exceeding 28 days to extraction	Use professional judgement to qualify detects and non-detects as estimated or rejected if holding time is grossly exceeded

*Samples that are delivered to the lab immediately after sampling may not meet the thermal preservation guidelines. Samples are considered acceptable if they arrive on ice or an attempt to chill the samples is observed.

Initial Calibration

The initial calibration should contain a minimum of five standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%. Linear fit calibration curves should have an R^2 value greater than 0.990.

The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.

%RSD >20%	J flag detects and UJ non detects
R^2 >0.990	J flag detects and UJ non detects
Low-level calibration check <50% or >150%	J flag detects and UJ non detects
Mid-level calibration check <70% or >130%	J flag detects and UJ non detects

Initial Calibration Verification

An initial calibration verification (ICV) standard should be from a second source (if available). The ICV should be at the same concentration as the mid-level standard of the calibration curve.

ICV recovery <70% or >130%	J flag detects and non-detects

Continuing Calibration Verification

Continuing calibration verification (CCV) checks should be analyzed at a frequency of one per ten field samples. If CCV recovery is very low, where detection of the analyte could be in question, ensure a low level CCV was analyzed and use to determine data quality.

CCV recovery <70 or >130%	J flag results

Blanks

There should be no detections in the method blanks above the reporting limits. Equipment blanks, field blanks, rinse blanks etc. should be evaluated in the same manner as method blanks. Use the most contaminated blank to evaluate the sample results.

Blank Result	Sample Result	Qualification
Any detection	<Reporting limit	Qualify as ND at reporting limit
Any detection	>Reporting Limit and >10x the blank result	No qualification
>Reporting limit	>Reporting limit and <10x blank result	J+ biased high

Field Duplicates

A blind field duplicate should be collected at rate of one per twenty samples. The relative percent difference (RPD) should be less than 30% for analyte concentrations greater than two times the reporting limit. Use the higher result for final reporting.

RPD >30%	Apply J qualifier to parent sample

Lab Control Spike

Lab control spikes should be analyzed with each extraction batch or one for every twenty samples. In the absence of lab derived criteria, use 70% - 130% recovery criteria to evaluate the data.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects

Matrix Spike/Matrix Spike Duplicate

One matrix spike and matrix spike duplicate should be collected at a rate of one per twenty samples. Use professional judgement to reject results based on out of control MS/MSD recoveries.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only
RPD >30%	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only

Extracted Internal Standards (Isotope Dilution Analytes)

Problematic analytes (e.g. PFBA, PFPeA, fluorotelomer sulfonates) can have wider recoveries without qualification. Qualify corresponding native compounds with a J flag if outside of the range.

Recovery <50% or >150%	Apply J qualifier
Recovery <25% or >150% for poor responding analytes	Apply J qualifier
Isotope Dilution Analyte (IDA) Recovery <10%	Reject results

Secondary Ion Transition Monitoring

Quantifier and qualifier ions should be monitored for all target analytes (PFBA and PFPeA are exceptions). The ratio of quantifier ion response to qualifier ion response should be calculated from the standards for each target analyte. Lab derived criteria should be used to determine if the ratios are acceptable. If the ratios fall outside of the laboratory criteria, qualify results as an estimated maximum concentration.

Signal to Noise Ratio

The signal to noise ratio for the quantifier ion should be at least 3:1. If the ratio is less than 3:1, the peak is discernable from the baseline noise and symmetrical, the result can be reported. If the peak appears to be baseline noise and/or the shape is irregular, qualify the result as tentatively identified.

Branched and Linear Isomers

Observed branched isomers in the sample that do not have a qualitative or quantitative standard should be noted and the analyte should be qualified as biased low in the final data review summary report. Note: The branched isomer peak should also be present in the secondary ion transition.

Reporting Limits

If project-specific reporting limits were not met, please indicate that in the report along with the reason (e.g. over dilution, dilution for non-target analytes, high sediment in aqueous samples).

Peak Integrations

Target analyte peaks should be integrated properly and consistently when compared to standards. Ensure branched isomer peaks are included for PFAS where standards are available. Inconsistencies should be brought to the attention of the laboratory or identified in the data review summary report.

Attachment C:
MDLs for PFAS

Date Created: 06/04/21
Created By: Michelle Callahan
File: PM10691-1
Page: 1

Soils Engineering Services, Inc.

NY PFAAs via LCMSMS-Isotope Dilution (WATER)

Holding Time: 14 days
Container/Sample Preservation: 1 - 2 Plastic/1 Plastic/1 H20 Plastic

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
Perfluorobutanoic Acid (PFBA)	375-22-4	2	0.408	ng/l	67-148	30	67-148	30	30			
Perfluorobutanoic Acid (PFBA)	375-22-4	0.5	0.0227	ng/g	71-135	30	71-135	30	30			
Perfluoropentanoic Acid (PFPeA)	2706-90-3	0.5	0.046	ng/g	69-132	30	69-132	30	30			
Perfluoropentanoic Acid (PFPeA)	2706-90-3	2	0.396	ng/l	63-161	30	63-161	30	30			
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	0.25	0.039	ng/g	72-128	30	72-128	30	30			
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	2	0.238	ng/l	65-157	30	65-157	30	30			
Perfluorohexanoic Acid (PFHxA)	307-24-4	0.5	0.0525	ng/g	70-132	30	70-132	30	30			
Perfluorohexanoic Acid (PFHxA)	307-24-4	2	0.328	ng/l	69-168	30	69-168	30	30			
Perfluoroheptanoic Acid (PFHpA)	375-85-9	2	0.2252	ng/l	58-159	30	58-159	30	30			
Perfluoroheptanoic Acid (PFHpA)	375-85-9	0.25	0.0451	ng/g	71-131	30	71-131	30	30			
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	0.25	0.0605	ng/g	67-130	30	67-130	30	30			
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	2	0.376	ng/l	69-177	30	69-177	30	30			
Perfluorooctanoic Acid (PFOA)	335-67-1	0.25	0.0419	ng/g	69-133	30	69-133	30	30			
Perfluorooctanoic Acid (PFOA)	335-67-1	2	0.236	ng/l	63-159	30	63-159	30	30			
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	0.5	0.1795	ng/g	64-140	30	64-140	30	30			
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	27619-97-2	2	1.332	ng/l	49-187	30	49-187	30	30			
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	0.5	0.1365	ng/g	70-132	30	70-132	30	30			
Perfluoroheptanesulfonic Acid (PFHpS)	375-92-8	2	0.688	ng/l	61-179	30	61-179	30	30			
Perfluorononanoic Acid (PFNA)	375-95-1	2	0.312	ng/l	68-171	30	68-171	30	30			
Perfluorononanoic Acid (PFNA)	375-95-1	0.25	0.075	ng/g	72-129	30	72-129	30	30			
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	2	0.504	ng/l	52-151	30	52-151	30	30			
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	0.25	0.13	ng/g	68-136	30	68-136	30	30			
Perfluorodecanoic Acid (PFDA)	335-76-2	2	0.304	ng/l	63-171	30	63-171	30	30			
Perfluorodecanoic Acid (PFDA)	335-76-2	0.25	0.067	ng/g	69-133	30	69-133	30	30			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	2	1.212	ng/l	56-173	30	56-173	30	30			
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	0.5	0.287	ng/g	65-137	30	65-137	30	30			
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSA	2355-31-9	2	0.648	ng/l	60-166	30	60-166	30	30			
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSA	2355-31-9	0.5	0.2015	ng/g	63-144	30	63-144	30	30			
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	0.5	0.0468	ng/g	64-136	30	64-136	30	30			
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	2	0.26	ng/l	60-153	30	60-153	30	30			
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	2	0.98	ng/l	38-156	30	38-156	30	30			
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	0.5	0.153	ng/g	59-134	30	59-134	30	30			
Perfluorooctanesulfonamide (FOSA)	754-91-6	0.5	0.098	ng/g	67-137	30	67-137	30	30			
Perfluorooctanesulfonamide (FOSA)	754-91-6	2	0.58	ng/l	46-170	30	46-170	30	30			
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	0.5	0.0845	ng/g	61-139	30	61-139	30	30			
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	2	0.804	ng/l	45-170	30	45-170	30	30			
Perfluorododecanoic Acid (PFDoA)	307-55-1	2	0.372	ng/l	67-153	30	67-153	30	30			
Perfluorododecanoic Acid (PFDoA)	307-55-1	0.5	0.07	ng/g	69-135	30	69-135	30	30			
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	2	0.3272	ng/l	48-158	30	48-158	30	30			
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	0.5	0.2045	ng/g	66-139	30	66-139	30	30			
Perfluorotetradecanoic Acid (PFTA)	376-06-7	2	0.248	ng/l	59-182	30	59-182	30	30			
Perfluorotetradecanoic Acid (PFTA)	376-06-7	0.5	0.054	ng/g	69-133	30	69-133	30	30			

Please Note that the RL information provided in this table is calculated using a 100% Solids factor (Soil/Solids only)
Please Note that the information provided in this table is subject to change at anytime at the discretion of Alpha Analytical, In

Date Created: 06/04/21
Created By: Michelle Callahan
File: PM10691-1

Soils Engineering Services, Inc.

NY PFAAs via LCMSMS-Isotope Dilution (WATER)

Holding Time: 14 days
Container/Sample Preservation: 1 - 2 Plastic/1 Plastic/1 H20 Plastic

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria		
PFOA/PFOS, Total		0.25	0.0419	ng/g				30	30			
PFOA/PFOS, Total		2	0.236	ng/l				30	30			
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*									*61-135*		
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*									*58-132*		
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*									*62-163*		
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*									*58-150*		
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	*NONE*									*70-131*		
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	*NONE*									*74-139*		
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	*NONE*									*57-129*		
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	*NONE*									*66-128*		
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	*NONE*									*60-129*		
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	*NONE*									*71-129*		
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	*NONE*									*71-134*		
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	*NONE*									*78-139*		
Perfluoro[13C8]Octanoic Acid (M8PFOA)	*NONE*									*62-129*		
Perfluoro[13C8]Octanoic Acid (M8PFOA)	*NONE*									*75-130*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-	*NONE*									*14-147*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-	*NONE*									*20-154*		
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	*NONE*									*59-139*		
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	*NONE*									*72-140*		
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	*NONE*									*79-136*		
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	*NONE*									*69-131*		
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	*NONE*									*75-130*		
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	*NONE*									*62-124*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-	*NONE*									*19-175*		
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-	*NONE*									*10-162*		
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid	*NONE*									*24-116*		
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid	*NONE*									*31-134*		
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	*NONE*									*61-155*		
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	*NONE*									*55-137*		
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	*NONE*									*10-112*		
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	*NONE*									*10-117*		
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (	*NONE*									*34-137*		
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (	*NONE*									*27-126*		
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	*NONE*									*48-131*		
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	*NONE*									*54-150*		
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	*NONE*									*22-136*		
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	*NONE*									*24-159*		

Please Note that the RL information provided in this table is calculated using a 100% Solids factor (Soil/Solids only)
Please Note that the information provided in this table is subject to change at anytime at the discretion of Alpha Analytical, In

Appendix F:

Community Air Monitoring Plan

SESI
CONSULTING ENGINEERS

COMMUNITY AIR MONITORING PLAN

Grand Union Hotel Bowling Alley Site
140 and 148-150 Westchester Ave.
Port Chester, New York 10573
NYSDEC BCP Site # C360222

Prepared For:

Port Chester OZ Fund III QOZB, LLC
181 Westchester Ave. Suite 301a
Port Chester, New York 10573

Prepared By:

SESI CONSULTING ENGINEERS
959 Route 46E, 3rd Floor
Parsippany, New Jersey 07054

Project No.: 11895

April 2025
Revised June 2026

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TABLE 3.1 NYS PROJECT PERSONNEL

1.0 INTRODUCTION

This document presents the Community Air Monitoring Plan (CAMP) for the Remedial Action Work Plan (RAWP) for the property known as the Grand Union Hotel Bowling Alley Site (BCP# C360222) at 146 Westchester Avenue, Port Chester, New York (the "Site").

The Site consists of 0.4486 acres of land identified on the Westchester County Assessors map as 143.30-2-70. The Site previously consisted of two (2) parcels identified as Block 2, Lots 17 and 65. The former Block 2, Lot 17 is improved by three (3) buildings and a parking lot. The former Block 2, Lot 65 is improved with an asphalt parking lot.

The Site is bound to the east by New Broad Street and commercial/residential properties. The Site is bound to the south by JP Upholstery Shop, to the west by Pearl Street and a parking lot and to the north by Westchester Avenue, restaurants, a local theater, and apartments.

2.0 OBJECTIVES

The objective of the CAMP is to provide a measure of protection for the downwind community from potential airborne contaminant releases that may arise during all ground intrusive activities, and potentially contaminated soil and material handling and staging. In addition, the CAMP is intended to minimize dust and contaminants from leaving the work zone.

3.0 METHODS

The CAMP will include continuous monitoring for particulate matter (e.g., airborne "dust") and volatile organic compounds (VOCs) during the planned remedial investigation activities. Any CAMP exceedances will be reported to the New York State Department of Environmental Conservation (NYSDEC) and New York State Department of Health (NYSDOH) on the same business day and as soon as possible. Notification of the exceedance will be sent via email along with the reason for the exceedance, the measure(s) taken to address the exceedance, and if the exceedance was resolved. In addition, the following NYSDEC and NYSDOH personnel will be provided weekly CAMP data summaries for review.

Table 3.1—NYS Project Personnel

Name	Contact Information
Greta Kowalski, NYSDEC Project Manager	Greta.Kowalski@dec.ny.gov (518) 402-2029
Steve Berninger NYSDOH	Beei.health.ny.gov (518) 402-7860

3.1 CONTINUOUS MONITORING

Continuous monitoring for particulates and VOCs will be conducted during all ground intrusive activities including soil borings, monitoring well installations, soil vapor probe installations, and excavation activities.

3.2 PERIODIC MONITORING

Periodic monitoring for VOCs will be conducted during soil-intrusive activities at the Site. "Periodic" monitoring during soil-intrusive activities consists of taking a reading upon arrival at an excavation area, monitoring while excavation occurs and taking a reading prior to leaving an excavation area. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during excavation or sampling activities.

4.0 VOC MONITORING, RESPONSE LEVELS, AND ACTIONS

VOCs must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work will be performed using a photoionization detector (PID) equipped with a 10.6 ev lamp. The equipment will be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment will be recalibrated as needed throughout the workday. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shut down.
- All 15-minute readings must be recorded and be available for State (NYSDEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

5.0 PARTICULATE MONITORING, RESPONSE LEVELS, AND ACTIONS

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

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter ($\mu g/m^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 $\mu g/m^3$ above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 $\mu g/m^3$ above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 $\mu g/m^3$ of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (NYSDEC and NYSDOH) personnel to review.

6.0 SPECIAL REQUIREMENTS FOR WORK WITHIN 20 FEET OF POTENTIALLY EXPOSED INDIVIDUAL 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 ppm, 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 µg/m^3, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 µg/m^3 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.

7.0 COMMUNICATION WITH NYSDEC AND NYSDOH

Daily CAMP data summary reports will be provided to the NYSDEC and NYSDOH project managers. These reports will include figures showing work zone, wind direction,

monitoring stations and downloaded CAMP data. The reports will also include any CAMP exceedances and the corrective actions taken. CAMP exceedances will be reported within one (1) business day.

Appendix G:

NYSDEC Soil Cleanup Objectives

375-6.8 Soil cleanup objective tables.

(a) Unrestricted use soil cleanup objectives.

Table 375-6.8(a):Unrestricted Use Soil Cleanup Objectives

Contaminant	CAS Number	Unrestricted Use
Metals		
Arsenic	7440-38-2	13 [c]
Barium	7440-39-3	350 [c]
Beryllium	7440-41-7	7.2
Cadmium	7440-43-9	2.5 [c]
Chromium, hexavalent [e]	18540-29-9	1[b]
Chromium, trivalent [e]	16065-83-1	30 [c]
Copper	7440-50-8	50
Total Cyanide [e, f]		27
Lead	7439-92-1	63 [c]
Manganese	7439-96-5	1600 [c]
Total Mercury		0.18 [c]
Nickel	7440-02-0	30
Selenium	7782-49-2	3.9[c]
Silver	7440-22-4	2
Zinc	7440-66-6	109 [c]
PCBs/Pesticides		
2,4,5-TP Acid (Silvex) [f]	93-72-1	3.8
4,4'-DDE	72-55-9	0.0033 [b]
4,4'-DDT	50-29-3	0.0033 [b]
4,4'-DDD	72-54-8	0.0033 [b]
Aldrin	309-00-2	0.005 [c]
alpha-BHC	319-84-6	0.02
beta-BHC	319-85-7	0.036
Chlordane (alpha)	5103-71-9	0.094

Table 375-6.8(a):Unrestricted Use Soil Cleanup Objectives

Contaminant	CAS Number	Unrestricted Use
delta-BHC [g]	319-86-8	0.04
Dibenzofuran [f]	132-64-9	7
Dieldrin	60-57-1	0.005 [c]
Endosulfan I [d, f]	959-98-8	2.4
Endosulfan II [d, f]	33213-65-9	2.4
Endosulfan sulfate [d, f]	1031-07-8	2.4
Endrin	72-20-8	0.014
Heptachlor	76-44-8	0.042
Lindane	58-89-9	0.1
Polychlorinated biphenyls	1336-36-3	0.1
Semivolatile organic compounds		
Acenaphthene	83-32-9	20
Acenapthylene [f]	208-96-8	100 [a]
Anthracene [f]	120-12-7	100 [a]
Benz(a)anthracene [f]	56-55-3	1 [c]
Benzo(a)pyrene	50-32-8	1 [c]
Benzo(b)fluoranthene [f]	205-99-2	1 [c]
Benzo(g,h,i)perylene [f]	191-24-2	100
Benzo(k)fluoranthene [f]	207-08-9	0.8 [c]
Chrysene [f]	218-01-9	1 [c]
Dibenz(a,h)anthracene [f]	53-70-3	0.33 [b]
Fluoranthene [f]	206-44-0	100 [a]
Fluorene	86-73-7	30
Indeno(1,2,3-cd)pyrene [f]	193-39-5	0.5 [c]
m-Cresol [f]	108-39-4	0.33 [b]
Naphthalene [f]	91-20-3	12
o-Cresol [f]	95-48-7	0.33 [b]

Table 375-6.8(a):Unrestricted Use Soil Cleanup Objectives

Contaminant	CAS Number	Unrestricted Use
p-Cresol [f]	106-44-5	0.33 [b]
Pentachlorophenol	87-86-5	0.8 [b]
Phenanthrene [f]	85-01-8	100
Phenol	108-95-2	0.33 [b]
Pyrene [f]	129-00-0	100
Volatile organic compounds		
1,1,1-Trichloroethane [f]	71-55-6	0.68
1,1-Dichloroethane [f]	75-34-3	0.27
1,1-Dichloroethene [f]	75-35-4	0.33
1,2-Dichlorobenzene [f]	95-50-1	1.1
1,2-Dichloroethane	107-06-2	0.02 [c]
cis -1,2-Dichloroethene [f]	156-59-2	0.25
trans-1,2-Dichloroethene [f]	156-60-5	0.19
1,3-Dichlorobenzene [f]	541-73-1	2.4
1,4-Dichlorobenzene	106-46-7	1.8
1,4-Dioxane	123-91-1	0.1 [b]
Acetone	67-64-1	0.05
Benzene	71-43-2	0.06
n-Butylbenzene [f]	104-51-8	12
Carbon tetrachloride [f]	56-23-5	0.76
Chlorobenzene	108-90-7	1.1
Chloroform	67-66-3	0.37
Ethylbenzene [f]	100-41-4	1
Hexachlorobenzene [f]	118-74-1	0.33[b]
Methyl ethyl ketone	78-93-3	0.12
Methyl tert-butyl ether [f]	1634-04-4	0.93
Methylene chloride	75-09-2	0.05

Table 375-6.8(a):Unrestricted Use Soil Cleanup Objectives

Contaminant	CAS Number	Unrestricted Use
n - Propylbenzene [f]	103-65-1	3.9
sec-Butylbenzene [f]	135-98-8	11
tert-Butylbenzene [f]	98-06-6	5.9
Tetrachloroethene	127-18-4	1.3
Toluene	108-88-3	0.7
Trichloroethene	79-01-6	0.47
1,2,4-Trimethylbenzene [f]	95-63-6	3.6
1,3,5-Trimethylbenzene[f]	108-67-8	8.4
Vinyl chloride[f]	75-01-4	0.02
Xylene (mixed)	1330-20-7	0.26

All soil cleanup objectives (SCOs) are in parts per million (ppm).

Footnotes

[a] The SCOs for unrestricted use were capped at a maximum value of 100 ppm. See Technical Support Document (TSD), section 9.3.

[b] For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the Track 1 SCO value.

[c] For constituents where the calculated SCO was lower than the rural soil background concentration, as determined by the Department and Department of Health rural soil survey, the rural soil background concentration is used as the Track 1 SCO value for this use of the site.

[d] SCO is the sum of endosulfan I, endosulfan II and endosulfan sulfate.

[e] The SCO for this specific compound (or family of compounds) is considered to be met if the analysis for the total species of this contaminant is below the specific SCO.

[f] Protection of ecological resources SCOs were not developed for contaminants identified in Table 375-6.8(b) with “NS”. Where such contaminants appear in Table 375-6.8(a), the applicant may be required by the Department to calculate a protection of ecological resources SCO according to the TSD.

(b) Restricted use soil cleanup objectives.

Table 375-6.8(b): Restricted Use Soil Cleanup Objectives

Contaminant	CAS Number	Protection of Public Health				Protection of Ecological Resources	Protection of Ground-water
		Residential	Restricted-Residential	Commercial	Industrial		
Metals							
Arsenic	7440-38-2	16[f]	16[f]	16[f]	16[f]	13[f]	16[f]
Barium	7440-39-3	350[f]	400	400	10,000 [d]	433	820
Beryllium	7440-41-7	14	72	590	2,700	10	47
Cadmium	7440-43-9	2.5[f]	4.3	9.3	60	4	7.5
Chromium, hexavalent [h]	18540-29-9	22	110	400	800	1[e]	19
Chromium, trivalent [h]	16065-83-1	36	180	1,500	6,800	41	NS
Copper	7440-50-8	270	270	270	10,000 [d]	50	1,720
Total Cyanide [h]		27	27	27	10,000 [d]	NS	40
Lead	7439-92-1	400	400	1,000	3,900	63[f]	450
Manganese	7439-96-5	2,000[f]	2,000[f]	10,000 [d]	10,000 [d]	1600[f]	2,000[f]
Total Mercury		0.81[j]	0.81[j]	2.8[j]	5.7[j]	0.18[f]	0.73
Nickel	7440-02-0	140	310	310	10,000 [d]	30	130
Selenium	7782-49-2	36	180	1,500	6,800	3.9[f]	4[f]
Silver	7440-22-4	36	180	1,500	6,800	2	8.3
Zinc	7440-66-6	2200	10,000 [d]	10,000 [d]	10,000 [d]	109[f]	2,480
PCBs/Pesticides							
2,4,5-TP Acid (Silvex)	93-72-1	58	100[a]	500[b]	1,000[c]	NS	3.8
4,4'-DDE	72-55-9	1.8	8.9	62	120	0.0033 [e]	17
4,4'-DDT	50-29-3	1.7	7.9	47	94	0.0033 [e]	136
4,4'- DDD	72-54-8	2.6	13	92	180	0.0033 [e]	14
Aldrin	309-00-2	0.019	0.097	0.68	1.4	0.14	0.19
alpha-BHC	319-84-6	0.097	0.48	3.4	6.8	0.04[g]	0.02
beta-BHC	319-85-7	0.072	0.36	3	14	0.6	0.09
Chlordane (alpha)	5103-71-9	0.91	4.2	24	47	1.3	2.9

Table 375-6.8(b): Restricted Use Soil Cleanup Objectives

Contaminant	CAS Number	Protection of Public Health				Protection of Ecological Resources	Protection of Ground-water
		Residential	Restricted-Residential	Commercial	Industrial		
delta-BHC	319-86-8	100[a]	100[a]	500[b]	1,000[c]	0.04[g]	0.25
Dibenzofuran	132-64-9	14	59	350	1,000[c]	NS	210
Dieldrin	60-57-1	0.039	0.2	1.4	2.8	0.006	0.1
Endosulfan I	959-98-8	4.8[i]	24[i]	200[i]	920[i]	NS	102
Endosulfan II	33213-65-9	4.8[i]	24[i]	200[i]	920[i]	NS	102
Endosulfan sulfate	1031-07-8	4.8[i]	24[i]	200[i]	920[i]	NS	1,000[c]
Endrin	72-20-8	2.2	11	89	410	0.014	0.06
Heptachlor	76-44-8	0.42	2.1	15	29	0.14	0.38
Lindane	58-89-9	0.28	1.3	9.2	23	6	0.1
Polychlorinated biphenyls	1336-36-3	1	1	1	25	1	3.2
Semivolatiles							
Acenaphthene	83-32-9	100[a]	100[a]	500[b]	1,000[c]	20	98
Acenapthylene	208-96-8	100[a]	100[a]	500[b]	1,000[c]	NS	107
Anthracene	120-12-7	100[a]	100[a]	500[b]	1,000[c]	NS	1,000[c]
Benz(a)anthracene	56-55-3	1[f]	1[f]	5.6	11	NS	1[f]
Benzo(a)pyrene	50-32-8	1[f]	1[f]	1[f]	1.1	2.6	22
Benzo(b)fluoranthene	205-99-2	1[f]	1[f]	5.6	11	NS	1.7
Benzo(g,h,i)perylene	191-24-2	100[a]	100[a]	500[b]	1,000[c]	NS	1,000[c]
Benzo(k)fluoranthene	207-08-9	1	3.9	56	110	NS	1.7
Chrysene	218-01-9	1[f]	3.9	56	110	NS	1[f]
Dibenz(a,h)anthracene	53-70-3	0.33[e]	0.33[e]	0.56	1.1	NS	1,000[c]
Fluoranthene	206-44-0	100[a]	100[a]	500[b]	1,000[c]	NS	1,000[c]
Fluorene	86-73-7	100[a]	100[a]	500[b]	1,000[c]	30	386
Indeno(1,2,3-cd)pyrene	193-39-5	0.5[f]	0.5[f]	5.6	11	NS	8.2
m-Cresol	108-39-4	100[a]	100[a]	500[b]	1,000[c]	NS	0.33[e]
Naphthalene	91-20-3	100[a]	100[a]	500[b]	1,000[c]	NS	12

Table 375-6.8(b): Restricted Use Soil Cleanup Objectives

Contaminant	CAS Number	Protection of Public Health				Protection of Ecological Resources	Protection of Ground-water
		Residential	Restricted-Residential	Commercial	Industrial		
o-Cresol	95-48-7	100[a]	100[a]	500[b]	1,000[c]	NS	0.33[e]
p-Cresol	106-44-5	34	100[a]	500[b]	1,000[c]	NS	0.33[e]
Pentachlorophenol	87-86-5	2.4	6.7	6.7	55	0.8[e]	0.8[e]
Phenanthrene	85-01-8	100[a]	100[a]	500[b]	1,000[c]	NS	1,000[c]
Phenol	108-95-2	100[a]	100[a]	500[b]	1,000[c]	30	0.33[e]
Pyrene	129-00-0	100[a]	100[a]	500[b]	1,000[c]	NS	1,000[c]
Volatiles							
1,1,1-Trichloroethane	71-55-6	100[a]	100[a]	500[b]	1,000[c]	NS	0.68
1,1-Dichloroethane	75-34-3	19	26	240	480	NS	0.27
1,1-Dichloroethene	75-35-4	100[a]	100[a]	500[b]	1,000[c]	NS	0.33
1,2-Dichlorobenzene	95-50-1	100[a]	100[a]	500[b]	1,000[c]	NS	1.1
1,2-Dichloroethane	107-06-2	2.3	3.1	30	60	10	0.02[f]
cis-1,2-Dichloroethene	156-59-2	59	100[a]	500[b]	1,000[c]	NS	0.25
trans-1,2-Dichloroethene	156-60-5	100[a]	100[a]	500[b]	1,000[c]	NS	0.19
1,3-Dichlorobenzene	541-73-1	17	49	280	560	NS	2.4
1,4-Dichlorobenzene	106-46-7	9.8	13	130	250	20	1.8
1,4-Dioxane	123-91-1	9.8	13	130	250	0.1[e]	0.1[e]
Acetone	67-64-1	100[a]	100[b]	500[b]	1,000[c]	2.2	0.05
Benzene	71-43-2	2.9	4.8	44	89	70	0.06
Butylbenzene	104-51-8	100[a]	100[a]	500[b]	1,000[c]	NS	12
Carbon tetrachloride	56-23-5	1.4	2.4	22	44	NS	0.76
Chlorobenzene	108-90-7	100[a]	100[a]	500[b]	1,000[c]	40	1.1
Chloroform	67-66-3	10	49	350	700	12	0.37
Ethylbenzene	100-41-4	30	41	390	780	NS	1
Hexachlorobenzene	118-74-1	0.33[e]	1.2	6	12	NS	3.2
Methyl ethyl ketone	78-93-3	100[a]	100[a]	500[b]	1,000[c]	100[a]	0.12

Table 375-6.8(b): Restricted Use Soil Cleanup Objectives

Contaminant	CAS Number	Protection of Public Health				Protection of Ecological Resources	Protection of Ground-water
		Residential	Restricted-Residential	Commercial	Industrial		
Methyl tert-butyl ether	1634-04-4	62	100[a]	500[b]	1,000[c]	NS	0.93
Methylene chloride	75-09-2	51	100[a]	500[b]	1,000[c]	12	0.05
n-Propylbenzene	103-65-1	100[a]	100[a]	500[b]	1,000[c]	NS	3.9
sec-Butylbenzene	135-98-8	100[a]	100[a]	500[b]	1,000[c]	NS	11
tert-Butylbenzene	98-06-6	100[a]	100[a]	500[b]	1,000[c]	NS	5.9
Tetrachloroethene	127-18-4	5.5	19	150	300	2	1.3
Toluene	108-88-3	100[a]	100[a]	500[b]	1,000[c]	36	0.7
Trichloroethene	79-01-6	10	21	200	400	2	0.47
1,2,4-Trimethylbenzene	95-63-6	47	52	190	380	NS	3.6
1,3,5- Trimethylbenzene	108-67-8	47	52	190	380	NS	8.4
Vinyl chloride	75-01-4	0.21	0.9	13	27	NS	0.02
Xylene (mixed)	1330-20-7	100[a]	100[a]	500[b]	1,000[c]	0.26	1.6

All soil cleanup objectives (SCOs) are in parts per million (ppm).
NS=Not specified. See Technical Support Document (TSD).

Footnotes

[a] The SCOs for residential, restricted-residential and ecological resources use were capped at a maximum value of 100 ppm. See TSD section 9.3.

[b] The SCOs for commercial use were capped at a maximum value of 500 ppm. See TSD section 9.3.

[c] The SCOs for industrial use and the protection of groundwater were capped at a maximum value of 1000 ppm. See TSD section 9.3.

[d] The SCOs for metals were capped at a maximum value of 10,000 ppm. See TSD section 9.3.

[e] For constituents where the calculated SCO was lower than the contract required quantitation limit (CRQL), the CRQL is used as the SCO value.

[f] For constituents where the calculated SCO was lower than the rural soil background concentration as determined by the Department and Department of Health rural soil survey, the rural soil background concentration is used as the Track 2 SCO value for this use of the site.

[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). See TSD Table 5.6-1.