Remedial Action Work Plan

PRD Electronics Manufacturing Site
NYSDEC BCP No. C224342

PREPARED FOR

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Certification

I, Catherine Lynn Applegate, certify that I am currently a NYS registered professional engineer and that this Remedial Action Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10).

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No.	Date	Revision
1	12/15/2022	Include results of Supplemental RI
2	1/10/2023	Per NYSDEC comment letter dated 03/21/2022
3	1/13/2023	Per NYSDEC comment email dated 1/13/2023
4	1/18/2023	Per NYSDEC 2nd comment email dated 01/13/2023
5	1/23/2023	Per NYDEC comment email dated 1/23/2023
6	2/8/2023	Per NYSDEC comment emails dated 1/26/2023 and 1/30/2023
7	2/25/2023	Per NYSDEC comment email dated 2/22/2023

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Introduction

1.1 General

VHB Engineering, Surveying, Landscape Architecture and Geology, P.C. (VHB), on behalf of YYY Brooklyn NY LLC c/o Maddd Equities, LLC (Applicant), has prepared this Remedial Action Work Plan (RAWP) for the former PRD Electronics Manufacturing Site, located at 67 Prince Street (a.k.a. 202-208 Tillary Street) in Brooklyn, New York (Site). The Site comprises the two (2) contiguous tax lots identified as Block 2050, Lot 100 and Lot 98 on the City of New York Tax Maps and is located in the downtown section of Brooklyn. **Figure 1** shows the Site location and **Figure 2** shows a map of the Site boundary on the New York City Tax Map. The New York City Housing Authority (NYCHA) Ingersoll House apartment complexes are located east and south of the Site. The Tillary Street Women's Shelter, Prince Street, the NYC 84th Precinct Police Department, and a NYC Fire Department Station are located west of the Site. **Figure 3** shows the surrounding land usage. This RAWP was revised in December 2022 to include the results of the Supplemental Remedial Investigation and in January/February 2023 to report the results of supplemental soil vapor sampling in units of micrograms per cubic meter (µg/m^3); to specify the proposed volume of soil to be excavated as part of remedial activities; to clarify the basis for excavation of soil and to distinguish between a Track 2 restricted residential remedy and a contingent Track 4 remedy.

YYY Brooklyn NY LLC c/o Maddd Equities, LLC submitted an application in November 2021 to the Brownfield Cleanup Program (BCP). The remedial activities will be conducted under the New York State Department of Environmental Conservation (NYSDEC) BCP (Site # C224342). This RAWP was prepared in accordance with the guidance provided in the NYSDEC Technical Guidance DER-10 Technical Guidance for Site Investigation and Remediation (DER-10), and the NYSDEC BCP Law and regulations.

The Site redevelopment includes construction of a commercial and residential mixed-use building. The scope of work to be completed as part of this RAWP includes the following activities:

- Site preparation and demolition of existing five-story building, while maintaining the existing basement slab as part of the redevelopment;
- Installation of a foundation element for 421-a affordable housing component and disposal of associated soil material;
- Waste characterization sampling for purposes of determining the proper off-site disposal facility for the excavated contaminated soil material;
- Excavation, transport and off-site disposal of approximately 54 cubic yards (CY) of contaminated historic fill from two hotspots, SB-1 and SB-8:
    - The basis for removal of soil in the area of SB-1 is exceedances of RR SCOs at 12 to 15 feet[1] below ground surface (bgs) and removal of soils from 15 to 20 feet bgs that create an odor nuisance condition, as defined in Commissioner Policy CP-51 Section G. A total of 43 CY is proposed for excavation surrounding SB-1;
    - The basis for removal of soil in the area of SB-8 is exceedances of RR SCOs at 0 to 2 feet bgs. A total of 11 CY is proposed for excavation surrounding SB-8. Additional soil may be excavated from this area for development purposes and is not included in the total estimated volume above.
- Dewatering in the source area under the building slab where the excavation will be as deep as 20 bgs;
- Continuous screening of soil/fill during soil disturbance activities;
- Soils/material management specific to the handling as well as transportation/disposal of materials generated during RAWP;
- Work Zone and Perimeter Air Monitoring for Dust, Vapor and Nuisance Odors during ground intrusive activities and during demolition of contaminated or potentially contaminated structures;
- Backfill of excavated areas with approved clean backfill and/or ¾-inch blue stone;
- Collection of confirmatory post-excavation soil samples and in-situ post-excavation samples collected during the RI to demonstrate compliance with the preferred Track 2 RR SCOs remedy;
- Institutional Control in the form of an environmental easement for the controlled property which will:
    - Require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);

[1] The existing basement slab which will remain in place is 12 feet bgs. Hotspot SB-1 is beneath the existing basement slab, so excavation will occur from 12-15 feet bgs.

- Allow the use and development of the controlled property for restricted residential use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- Restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or NYCDOHMH; and
- Require compliance with the Department approved Site Management Plan.

› Site Management Plan, which includes the following:

- A Plan that identifies all use restrictions for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:
  - Institutional Controls: The Environmental Easement discussed in above.
- This Plan includes, but may not be limited to
  - descriptions of the provisions of the environmental easement including any land use and groundwater use restrictions;
  - provisions for the management and inspection of the identified engineering controls;
  - maintaining site access controls and Department notification; and
  - the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls.

› Evaluation of a post-construction soil vapor intrusion investigation for any occupied buildings on the Site;

› Due to the high water table, a vapor barrier system will be installed beneath the building slab and along the foundation sides as a green remedial measure;

› In the event that a Track 2 restricted residential use is not achieved, a contingent Track 4 cleanup will be implemented. The Track 4 remedy will require a cover system as a remedial element to allow for restricted residential use of the Site in areas where the upper two feet of exposed surface soil will exceed the applicable SCOs, and the remedy will achieve Track 4 restricted residential cleanup;

› When a cover system is used, the Track 4 cover system will consist of a combination of the foundation, pavement and clean soil in the landscaped areas. Any fill material brought to the Site will meet the requirements for the identified Site use as set forth in 6 NYCRR Part 375-6.7(d); and

› Final Engineering Report

1.2 Site Description

The 0.749 acre Site is located in the downtown section of Brooklyn and is identified as Block 2050, Lot 100, Lot 98. An air rights portion of Block 2050 Lot 1 will be utilized for the project but is not part of the BCP Site boundary. **Figure 1** shows the Site location and **Figure 2**

shows a map of the Site boundary on the New York City Tax Map. The lots will be subsequently merged into one (1) lot identified as Lot 100. An RP602 form has been submitted with the New York City (NYC) Department of Finance (DOF) and is pending. Currently, the approximately 0.749 acre Site is developed with a five-story self-storage building with a full basement that occupies the entirety of Block 2050, Lot 100, and an outdoor at-grade asphalt-paved parking lot that occupies the Lot 98. The building covers approximately 19,450 square feet of Lot 100 and has approximately 114,500 square feet of interior space, including an interior loading dock. The building was operated by American Self Storage as a public storage facility with more than 1,300 storage units, but the building has been vacant since August 2021. Lot 98 consists of an at-grade outdoor parking area and is approximately 6,032 square feet. This Lot is also no longer being used for parking. The Site is currently owned by YYY Brooklyn NY LLC.

1.3 Summary of Redevelopment Plan

The proposed future use of the Site will consist of a new commercial and residential mixed-use building including a full basement. The merged lots have a total zoning lot area of 0.749 acres. The proposed building footprint has an approximate area of 20,142 square feet, with the 1,147 square foot at-grade terrace located along the southern boundary of the Site. The remainder of the Site will be occupied by the attended parking lot with an approximate area of 4,235 square feet. The basement of the structure will include a gas meter room, mechanical room, compactor room, bicycle storage room, a building supervisor office/workshop, water heater room, switchboard room, fire pump room, telecommunications room, plumbing equipment room, two (2) stormwater detention tanks, and elevator/stairway space. The first floor will include a parking garage/outdoor parking area with space for 70 vehicles, an outdoor terrace area, commercial space, a lobby/reception area, a mail room, package room, marketing office, and elevator/stairway access. According to development plans, 25% of residential units will designated affordable through the NYC Housing Preservation and Development (HPD) Mandatory Inclusionary Housing (MIH) program (approximately 116 units).

The above-ground portion of the existing five-story building was demolished starting in January 2022. The existing basement foundation will remain in place, The foundation walls and basement slab for the new building will be constructed within the extent of the existing basement. The remediation of the Site includes the excavation of two source areas identified as (1) SB-1 and SV-1 located beneath the existing slab; and (2) SB-8 within the former parking lot. Access to the area of SB-1 and SV-1 will be facilitated by the excavation of the existing structure since this source area is located under the existing basement slab. Excavated areas will be backfilled with approved clean backfill, and/or ¾-inch stone.

The zoning designation of the Site is part of the Special Downtown Brooklyn District as of July 26, 2001 and is identified as Zoning District No. C6-4. This zoning designation is descriptive of commercial and residential use. The proposed use is consistent with existing zoning for the Site.

The Redevelopment Plans are provided as **Appendix A**.

1.4 Site Physical Condition

1.4.1 Topography

The Site is located approximately 20 feet above mean sea level and slopes downward toward the northeast. Rainfall is expected to run off impervious surfaces toward the City storm water drains along adjacent streets.

1.4.2 Site Geology

Geologic and hydrogeologic data were obtained from soil borings installed at the Site as part of the Remedial Investigation (RI) conducted in October 2020, initially for the NYC Office of Environmental Remediation. The stratigraphy of the Site, from the surface down, consists of approximately 12 feet of urban historic fill overlying six (6) feet of fine to medium grain sand. The urban historic fill layer consists of brown silty sand with varying amounts of gravel, concrete and brick fragments. Bedrock was not encountered from grade to 18 feet bgs.

1.4.3 Hydrogeologic Conditions

Depth to groundwater data was observed to range from approximately 18 feet bgs along Prince Street to 7 feet bgs along Tillary Street, which is consistent with the topography of the Site. Depth measurements were reported by Meuser Rutledge Consulting Engineers in the Geotechnical Report dated September 2020, by Brinkerhoff in the Remedial Investigation (RI) Report dated October 2020 and by VHB (who acquired Brinkerhoff) in the Supplemental RI Report dated October 2022.

A summary of the depth to groundwater data is presented in the **Table 1** below. Regional groundwater flow direction is anticipated to flow north, towards the East River.

Table 1. Depth to Groundwater Data

Well ID	Well Location	Date Sampled	Investigation	Depth to Groundwater (ft bgs)
MR-9P (El +21.0 ft.)	Prince Street (South)	7/27/2020	Geotechnical	18.1
		7/28/2020	Geotechnical	18.1
		7/30/3030	Geotechnical	18.2
		7/18/2022	Supplemental RI	18.1
MR-2P[1] (El +14.7 ft.)	Tillary Street (North)	7/8/2020	Geotechnical	7.8
		7/9/2020	Geotechnical	8.0
		7/18/2022	Supplemental RI	6.85
MW-1	Tillary Street (North)	7/18/2022	Supplemental RI	7.27

TWP-1[2]	15 feet Northeast of MR-2P	10/22/2020	RI	15.5
TWP-2[3]	Former Parking Lot	10/22/2020	RI	14.0
TWP-3[3]	Former Parking Lot	10/22/2020	RI	14.5

Notes:
1. Following a stabilization period, depth to groundwater for MR-2P stabilized at 4.6 ft. bgs (Refer to 2020 Geotechnical Report)
2. TWPs were not surveyed.

1.5 Previous Environmental Investigation Findings

The following environmental assessments and investigation reports have been prepared for the Site, which are provided in **Appendix B.**

- Phase I ESA, dated July 14, 2015, prepared by Brinkerhoff;
- Phase I ESA, dated February 18, 2019, prepared Brinkerhoff;
- Remedial Investigation Workplan, dated September 2020, prepared by Brinkerhoff;
- Geotechnical Report – Phase 1 Investigation, dated September 18, 2020, prepared by Mueser Rutledge;
- Remedial Investigation Report, dated October 2020, prepared by Brinkerhoff;
- Supplemental Remedial Investigation Work Plan, dated June 3, 2022, prepared by VHB;
- Supplemental Remedial Investigation Report, dated October 2022, prepared by VHB, and;
- Groundwater Elevations Letter, dated November 22, 2022, prepared by Brinkerhoff.

1.5.1 Phase I Environmental Site Assessment dated July 14, 2015

The Phase I ESA, dated July 14, 2015, performed by Brinkerhoff for requestor YYY Brooklyn NY LLC for 202-208 Tillary Street, Brooklyn, New York (Block 2050, Lot 100) identified that the Site was developed with residences, stores, and stables from at least the 1880s until 1948 when the present-day structure was constructed and utilized as a manufacturing facility. The former uses of the building included a Polytechnic Research & Development Co. Inc. Receiving Dep't., PRD Electronics Inc. Receiving Dep't., residential use, a potential garage identified as "Garage Atndt H", headwear/curtain/textile companies, a binding company, wholesalers/traders, a beverage company, a vegetable company, and a self-storage facility.

The Phase I ESA identified the following Recognized environmental Condition (REC):

According to the EDR environmental database search, the subject property was identified in the ERNS database at the 202 Tillary Street address. According to the report, the Spill No. 9000207 listing is related to a 150-gallon diesel oil spill that occurred on April 6, 1990. The report indicated that the oil spilled while a delivery truck was approaching the fuel dock and

it struck a curb. The police and fire department were on site, and a cleanup was undertaken. The material spilled from the truck's fuel tank.

On April 29, 1997, a traffic accident at the intersection of Tillary Street and Prince Street caused a 110-gallon diesel spill. The spill was assigned Spill No. 9701275. The spill was contained by the Fire Department of New York Haz. Mat. Division. Corrective action was taken, and the spill was closed on April 29, 1997.

The Environmental Data Resources, Inc. ("EDR") environmental database search identified two spills and found that a prior facility on the Site was listed in the Facility Index System/Facility Registry System ("FINDS") as EPA ID 110042331759 and in the United States Air Emissions Data ("US AIRS") database. Brinkerhoff also noted the following environmental concerns: historic fill, potential asbestos containing material ("ACM") and potential lead-based paint ("LBP").

1.5.2 Phase I Environmental Site Assessment dated February 18, 2019

The Phase I ESA, dated February 18, 2019, was performed by Brinkerhoff for requestor YYY Brooklyn NY LLC for the adjoining parking lot area located on the northwestern portion of Block 2050, Lot 1 (which later became Lot 98). The assessment was conducted in connection to the purchase of air rights in the area. At the time of the survey, the lot was utilized as an automobile parking lot and driveway. Brinkerhoff identified the following REC:

According to historical data, this portion of the subject property appeared to be developed with several structures along Prince Street and Fleet Street prior to at least 1887. Although no structures were currently present, supporting documentation regarding the prior heating source of the former structures were not identified or provided to Brinkerhoff. Therefore, the potential exists for heating oil underground storage tanks (USTs) to be present at the Site associated with the former structures.

1.5.3 Remedial Investigation Work Plan dated September 5, 2019

A Remedial Investigation Work Plan dated September 5, 2019 was prepared by Brinkerhoff and submitted to the New York City Office of Environmental Remediation (NYCOER) to satisfy the requirements of the E-Designation for hazardous materials that is associated with the Site. For the purposes of due diligence, to determine if the above identified AOCs could potentially impact the proposed Site redevelopment plans, and to partially satisfy future NYCOER remedial investigation requirements, a RI was completed in October 2020 and included completion of the following:

- Conducted a Site inspection to identify AOCs and physical obstructions (i.e., structures, buildings, etc.);
- Conducted a Geophysical Investigation in accessible areas to detect subsurface anomalies indicative of potential Underground Storage Tanks (USTs);
- Installed eight (8) soil borings across the entire project site and collected 12 soil samples for chemical analysis from the soil borings to evaluate soil quality;

- Installed three (3) temporary groundwater monitoring well points throughout the Site to establish groundwater flow and collected three (3) groundwater samples for chemical analysis to evaluate groundwater quality; and
- Installed seven (7) soil vapor probes across the entire project site and collected seven (7) samples for chemical analysis.

1.5.4 Geotechnical Report dated September 18, 2020

A geotechnical investigation was conducted by Meuser Rutledge between June 30, 2020 through August 4, 2020 to evaluate the subsurface conditions and provide recommendations for the foundation and construction. The subsurface investigation included nine borings, MR-1 through MR-9P and five test pits. Boreholes MR-2P and MR-9P were completed with standpipe piezometers. The Geotechnical Report dated September 18, 2020 concluded that there exists a "variation in the depth to suitable bearing material across the proposed building site and a shallow groundwater level".

1.5.5 Remedial Investigation Report dated October 2020 (revised October 2022)

A Remedial Investigation Report (RIR) dated October 2020 was prepared by Brinkerhoff and submitted to the NYCOER to satisfy the requirements of the E-Designation for hazardous materials that is associated with the Site and was submitted with the BCP Application as a complete RI under the BCP as well. To address comments provided by NYSDEC regarding the BCP application, the initial RIR was revised in October 2022 to include the QAQC analysis of soil, groundwater and soil vapor sampling. The DUSR was performed by New Environmental Horizons, Inc. (NEH). The following RI scope of work was conducted:

- Conducted a Site inspection to identify AOCs and physical obstructions (i.e., structures, buildings, etc.);
- Conducted a Geophysical Investigation in accessible areas to detect subsurface anomalies indicative of potential Underground Storage Tanks (USTs);
- Installed eight (8) soil borings across the Site and collected 12 soil samples for chemical analysis from the soil borings to evaluate soil quality;
- Installed three (3) temporary groundwater monitoring well points throughout the Site to establish groundwater flow and collected three (3) groundwater samples for chemical analysis to evaluate groundwater quality; and
- Installed seven (7) soil vapor probes across the Site and collected seven (7) samples for chemical analysis.
- Performed QAQC analysis of all sampling and prepared a DUSR including for emerging contaminants samples

1.5.5.1 Summary of Remedial Investigation Findings

The RI revealed the following findings:

1. Surface elevation of the property is approximately 20 above mean sea level;

2. Depth to groundwater is approximately 15 feet bgs at the Site;
3. Groundwater flow is generally from north beneath the site towards the East River;
4. Bedrock was not encountered at the Site during the RI;
5. A geophysical investigation conducted on October 27, 2020, did not identify anomalies indicative of subsurface debris or other buried objects in the parking lot portion of the Site only.
6. The stratigraphy of the Site, from the surface down, consists of approximately 12 feet of urban historic fill overlying up to six (6) feet of fine to medium grain sand with some silt and clay. The urban historic fill layer consists of gray and brown sand with varying amounts of gravel, concrete and brick fragments.
7. Twelve (12) soil/fill samples collected during the RI were compared to the NYSDEC Part 375 Table 375-6.8 Unrestricted Use (UU) and Restricted-Residential (RR) Soil Cleanup Objectives (SCOs).
    - The results for the two (2) shallow soil/fill samples SB-7 (0-2) and SB-8 (0-2) collected between grade and 2 feet bgs in the current parking lot indicated:
        - VOCs, Pesticides, and Polychlorinated biphenyls (PCBs) were not detected above UU SCOs or RR SCOs in either soil samples;
        - Several SVOCs consisting of benzo(a)anthracene (6.4 mg/kg), benzo(a)pyrene (6.8 mg/kg), benzo(b)fluoranthene (8.7 mg/kg), chrysene (5.3 mg/kg), dibenzo(a,h)anthracene (0.8 mg/kg), and indeno(1,2,3-cd)pyrene (3.8 mg/kg) exceeded the RR SCOs in soil sample SB-8 (0-2);
        - One (1) SVOC, benzo(k)fluoranthene (2.5 mg/kg), exceeded the UU SCOs in soil sample SB-8 (0-2);
        - Metals consisting of nickel (31.3 mg/kg) in soil sample SB-7 (0-2) and lead (73.6 mg/kg) in soil sample SB-8 exceeded the UU SCOs.
    - The results for the two (2) deep soil/fill samples SB-1 (12-14) and SB-4 (12-14) collected between 12 and 14 feet bgs in the location of the existing cellar and the proposed elevator pits indicated:
        - PCBs were not detected above UU SCOs or RR SCOs in either soil samples;
        - Several VOCs including benzene (11 mg/kg), toluene (520 mg/kg), ethylbenzene (180 mg/kg), total xylenes (310 mg/kg), and 1,2,4-trimethylbenzene (93 mg/kg) exceeding RR SCOs and 1,4-dichlorobenzene (1.9 mg/kg), naphthalene (43 mg/kg), n-propylbenzene (30 mg/kg), 1,3,5-trimethylbenzene (25 mg/kg) exceeded UU SCOs in soil sample SB-1 (12-14);
        - One (1) VOC, 2-butanone (0.23 mg/kg) exceeded the UU SCOs in soil sample SB-4 (12-14);
        - One (1) SVOC, benzo(a)anthracene (1.5 mg/kg) exceeded RR SCOs in soil sample SB-1 (12-14);
        - SVOCs including naphthalene (17 mg/kg), chrysene (1.3 mg/kg), 2-methylphenol (3 mg/kg), 3-methylphenol/4-methylphenol (5.9 mg/kg) exceeded UU SCOs in soil sample SB-1 (12-14);

- One (1) pesticide, 4,4-dichlorodiphenyldichloroethane (4,4-DDD) (0.044 mg/kg), exceeded UU SCOs in soil sample SB-1 (12-14);
- Two (2) pesticides, including 4,4-dichlorodiphenyldichloroethylene (4,4-DDE) (0.004 mg/kg) and 4,4-dichlorodiphenyltrichloroethane (4,4-DDT) (0.005 mg/kg) exceeded UU SCOs in soil sample SB-4 (12-14);
- Several metals, including lead (65.5 mg/kg), mercury (0.199 mg/kg), and nickel (39 mg/kg), exceeded UU SCO in soil sample SB-1 (12-14);
- One (1) metal, mercury (0.211 mg/kg), exceeded UU SCOs in soil sample SB-4 (12-14).

› The results for the four (4) deep soil/fill samples SB-2 (12-14), SB-3 (12-14), SB-5 (12-14) and SB-6 (12-14), collected between 12 and 14 feet bgs in the location of the existing building indicated:

- Pesticides, PCBs, and metals were not detected above UU SCOs or RR SCOs in any of the soil samples;
- Several VOCs, including toluene (1.3 mg/kg), total xylenes (1.4 mg/kg), and 2-butanone (0.25 mg/kg) exceeded UU SCOs in soil sample SB-2 (12-14);
- One (1) VOC, acetone (0.08 mg/kg), exceeded UU SCOs in soil sample SB-3 (12-14).
- The results for the two (2) deep soil/fill samples SB-7 (12-14) and SB-8 (12-14) collected between 12 and 14 feet bgs in the current parking lot indicated:
- VOCs, SVOCs, Pesticides, and PCBs were not detected above UU SCOs or RR SCOs in any of the soil samples;
- One (1) metal, nickel (38.3 mg/kg), exceeded UU SCOs in soil sample SB-8 (12-14).

› The results for the two (2) deep soil samples SB-1 (16-18) and SB-4 (16-18) collected between 16 and 18 feet bgs in the location of the current cellar and proposed elevator pits indicated:

- Pesticides and PCBs were not detected above UU SCOs or RR SCOs in any of the soil samples;
- Several VOCs, including benzene (16 mg/kg), toluene (540 mg/kg), ethylbenzene (190 mg/kg), total xylenes (300 mg/kg), and 1,2,4-trimethylbenzene (110 mg/kg) exceeded RR SCOs and naphthalene (52 mg/kg), n-propylbenzene (29 mg/kg), and 1,3,5-trimethylbenzene (26 mg/kg) exceeded UU SCOs in soil sample SB-1 (16-18);
- Several SVOCs, including benzo(a)anthracene (1.3 mg/kg) exceeded RR SCOs and naphthalene (20 mg/kg), chrysene (1.3 mg/kg), 2-methylphenol (7.1 mg/kg), and 3-methylphenol/4-methylphenol (14 mg/kg) exceeded UU SCOs in soil sample SB-1 (16-18);
- Two (2) metals, including lead (226 mg/kg) and mercury (0.264 mg/kg), exceeded UU SCOs in soil sample SB-4 (16-18).

- Total Perfluorooctanoic Acid (PFOA)/Perfluorooctane Sulfonate (PFOS) concentration was detected at 0.00133 mg/kg (1,330 parts per trillion [ppt]) in soil sample SB-7 (0-2).

8. Three (3) groundwater samples collected during the RI were compared to the NYSDEC TOGS 1.1.1 Ambient Water Quality Standards (NY-AWQS). The results indicated:
   - SVOCs, Pesticides, or PCBs were not detected above the NY-AWQS.
   - Two (2) VOCs, sec-butylbenzene (7.4 µg/L) and 1,2,4,5-tetramethylbenzene (12 µg/L) were detected exceeding the NY-AWQS in groundwater sample TWP-1;
   - Several total and dissolved metals were identified in groundwater samples exceeding their respective NY-AWQS values.
   - Emerging contaminant 1,4-Dioxane was not detected in groundwater. Total Perfluorooctanoic Acid (PFOA) and Perfluorooctane Sulfonate (PFOS) concentrations were detected at 0.122 µg/L (122,000 ppt) in TWP-1.
9. Seven (7) soil vapor samples (SV-1 through SV-7) were collected during the RI and were compared to the NYSDOH Final Guidance on Soil Vapor Intrusion (May 2017) Matrix A, B and C values. The results indicated:
   - Chlorinated-related VOCs, including vinyl chloride (max 598 [micrograms per cubic meter] µg/m^3), methylene chloride (max 184 µg/m^3), cis-1,2-dichloroethene (max 1,300 µg/m^3), trichloroethene (TCE) (max 3.97 µg/m^3), and tetrachloroethene (PCE) (max 54.9 µg/m^3) were detected in several soil vapor samples.
   - Concentrations of vinyl chloride (598 µg/m^3) and cis-1,2-dichloroethene (1,300 µg/m^3) were detected above the mitigate action level established by the NYSDOH in soil vapor sample SV-1.
   - Methylene chloride (184 µg/m^3) was detected above the monitor/mitigate action level established by the NYSDOH in soil vapor sample SV-4.
10. The DUSR was prepared by NEH and reviewed by VHB. The findings of the DUSR are summarized below:
    - In most data packages the analytical data considered usable exceed 98% and in no data package did the percentage of analytical data considered not usable exceed 4%.
    - The analysis for 1,4-dioxane in two groundwater samples (TWP-2 and TWP-3) was rejected and determined to be not usable for project decisions. This finding was based on the analytical method utilized by the laboratory, Method 8260C (VOA), which is inadequate for determination of this compound.

1.5.6 Supplemental RI Workplan dated June 3, 2022

In response to a March 21, 2022 letter from NYSDEC requesting additional samples to delineate the potential for off-site migration of soil vapor and groundwater contaminants, VHB prepared a Supplemental RI Workplan. The scope of work included the following:

- Installation of one permanent, downgradient groundwater monitoring well;
- Sampling of the newly installed monitoring well and two existing piezometers wells, MR-2P and MR-9P, which were installed during the geotechnical investigation and;
- Collection of one soil vapor point at the boundary of the western adjacent property.

1.5.7 Supplemental RI Report dated October 2022

A Supplemental RI was conducted by VHB in July 2022 in accordance with the NYSDEC-approved Supplemental RI Workplan. The sample locations are shown in Figure 4 of the Supplemental RI and also in **Figure 4** of this Remedial Action Work Plan. The findings of the Supplemental RI are summarized below:

1. Three groundwater samples were collected from the newly installed permanent monitoring well ,MW-1, and the two existing piezometer wells, MR-2P and MR-9P.
2. Depth to groundwater was observed to be approximately 18 feet bgs in MR-9P along Prince Street and approximately 7 feet bgs in MW-1 and MR-2P along Tillary Street.
3. Analytical results were compared to the NYSDEC TOGS 1.1.1 Ambient Water Quality Standards (NY-AWQS) and reported:
   - VOCs were either not detected or not detected above the NY-AWQS.
   - SVOCs were either not detected or not detected above the NY-AWQS.
   - Pesticides and PCBs were not detected.
   - Several metals were reported above the NY-AWQS and included the following: manganese in MW-1 (3.26 mg/L), MR-2P (1.51 mg/L), and MR-9P (0.560 mg/L): selenium in MW-1 (12.1 µg/L) and MR-2P (26.1 µg/L): and magnesium in MR-9P (40.8 mg/L).
   - Emerging contaminant 1,4-Dioxane was not detected, however, several perfluorinated alkyl acids were detected including PFOA in MW-1 (120 ng/L), MR-2P (228 ng/L) and MR-9P (148 ng/L) and PFOS in MW-1 (676 ng/L), MR-2P (295 ng/L) and MR-9P (35.0 ng/L).
4. One soil vapor sample was collected and analytical results were compared to the NYSDOH Soil Vapor Guidance Values (SVGV) (revised May 2017) Matrix A, B, and C guidance values:
   - Chlorinated VOCs including vinyl chloride (max 0.79 µg/m^3), methylene chloride (max 3.8 µg/m^3), TCE (max 26 µg/m^3); and carbon tetrachloride (max 1.5 µg/m^3) were reported.

The sample results are shown in Figures 5 and 6 of the Supplemental RI and also in **Figures 5 and 6** of this Remedial Action Work Plan.

1.5.8 Groundwater Elevation Letter November 22, 2022 Supplemental RI Report October 2022

In response to inquiry from NYSDEC regarding the groundwater elevations at the Site, VHB evaluated the existing data from previous environmental and geotechnical investigations to assess the groundwater conditions at the Site. The results of this review are summarized below:

1. The general topography of the Site slopes downward towards Tillary Street.
2. The groundwater elevations range from approximately 3 feet at Prince Street to 5 feet at Tillary Street.
3. Current top of slab elevations for the proposed building, range from 7.4 feet at Prince Street to 5.9 feet at Tillary Street.
4. The groundwater elevation is several feet below the top of slab along Prince Street, but this distances towards the east.
5. The groundwater elevation is at or marginally below the top of slab along Tillary Street.

The location of the wells included in this evaluation are shown in **Figure 7**. The groundwater elevations and top of slab elevations are shown in the cross-sections in **Figures 8 and 9**.

2

Remedial Action Objectives

Based on the results of the RI and the Remedial Action Objectives (RAOs) presented in the NYSDEC DER-10, the following RAOs have been identified for this Site:

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.

Soil – RAOs for Public Health Protection

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

Soil – RAOs for Environmental Protection

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

Soil Vapor – RAOs for Public Health Protection

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

RAOs for sediment and surface water are not applicable to this Site.

3

Remedial Alternatives Analysis

The goal of the remedy selection process is to select a remedy that is protective of human health and the environment taking into consideration the current, intended and reasonably anticipated future use of the property. The remedy selection process begins by establishing RAOs for media in which chemical constituents were found in exceedance of applicable standards, criteria, and guidance values (SCGs). Remedial alternatives are then developed and evaluated based on the following ten criteria:

- Protection of human health and the environment;
- Compliance with SCGs;
- Short-term effectiveness and impacts;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume of contaminated material;
- Implementability;
- Cost effectiveness;
- Community acceptance;
- Land use; and
- Sustainability.

As required, a NYSDEC Track 1 Unrestricted Use scenario is evaluated for the remedial action. The following is a detailed description of the alternatives analyzed to address impacted media at the Site:

Alternative 1:

- Selection of NYSDEC 6NYCRR Part 375 Track 1 Unrestricted Use (UU) Soil Cleanup Objectives (SCOs).
- Removal of all soil/fill exceeding Track 1 UU SCOs throughout the Site and confirmation that Track 1 UU SCOs have been achieved with post-excavation endpoint sampling. Based on the results of the Remedial Investigation, it is expected that this alternative would be achieved by excavating the entire Site to a depth of approximately to 20 feet bgs to remove historic fill. Excavation will extend past 15 feet for the remedy due to nuisance conditions (odor), as defined in Commissioner Policy CP-51 Section G.
- Excavation, transport and off-site disposal of approximately 54 cubic yards (CY) of contaminated historic fill from two hotspots, SB-1 and SB-8:
    - The basis for removal of soil in the area of SB-1 is exceedances of RR SCOs at 12 to 15 feet[3] below ground surface (bgs) and removal of soils from 15 to 20 feet bgs that create an odor nuisance condition, as defined in Commissioner Policy CP-51 Section G. A total of 43 CY is proposed for excavation surrounding SB-1;
    - The basis for removal of soil in the area of SB-8 is exceedances of RR SCOs at 0 to 2 feet bgs. A total of 11 CY is proposed for excavation surrounding SB-8 as part of remediation. Additional soil may be excavated from this area for development purposes and is not included in the total estimated volume above.
- This alternative requires the demolition of the existing building, including the below grade foundation walls and basement slab.
- If soil/fill containing analytes at concentrations above UU SCOs is still present at the base of the excavation after removal of all soil required for construction of the new building's cellar level is complete, additional excavation would be performed to ensure complete removal of soil/ fill that does not meet Track 1 UU SCOs.
- No Engineering or Institutional Controls (EC/ICs) are required for a Track 1 cleanup. As part of development, a vapor barrier system would be installed as a green remedial measure.

Alternative 2:

- Establishment of NYSDEC 6NYCRR Part 375 RR SCOs (Track 2);
- Removal of soil/fill exceeding Track 2 RR SCOs and confirmation that Track 2 RR SCOs have been achieved with a combination of in-situ endpoint sampling results provided by the RI and post-excavation end point sampling. Based on the results of the RI, it is expected that this alternative would be achieved by the excavation of soil from the following areas:

[3] The existing basement slab which will remain in place is 12 feet bgs. Hotspot SB-1 is beneath the existing basement slab, so excavation will occur from 12-15 feet bgs.

- Excavation, transport and off-site disposal of approximately 54 cubic yards (CY) of contaminated historic fill from two hotspots, SB-1 and SB-8:
    - The basis for removal of soil in the area of SB-1 is exceedances of RR SCOs at 12 to 15 feet[4] below ground surface (bgs) and removal of soils from 15 to 20 feet bgs that create an odor nuisance condition, as defined in Commissioner Policy CP-51 Section G. A total of 43 CY is proposed for excavation surrounding SB-1;
    - The basis for removal of soil in the area of SB-8 is exceedances of RR SCOs at 0 to 2 feet bgs. A total of 11 CY is proposed for excavation surrounding SB-8 as part of remediation. Additional soil may be excavated from this area for development purposes and is not included in the total estimated volume above.
- This alternative requires the demolition of the existing building, including the below grade foundation walls and basement slab;
- If soil/fill containing analytes at concentrations above RR SCOs is still present at the base of the excavation, additional excavation would be performed to meet RR SCOs;
- This alternative leaves the existing sub grade foundation walls and basement slab in place. The new building slab will be constructed atop the existing basement slab and the existing foundation walls will be incorporated into the support of excavation system;
- As requested in by NYSDEC in comments dated November 1, 2022, this alternative includes installation of a sub-slab depressurization system (SSDS) installed in a clean gravel layer beneath the slab and vented to the building roof;
- Due to the high water table, a vapor barrier system will be installed beneath the building slab and along the foundation sides as a green remedial measure;
- In the event that a Track 2 restricted residential use is not achieved, a contingent Track 4 cleanup will be implemented. The Track 4 remedy will require a cover system as a remedial element to allow for restricted residential use of the Site in areas where the upper two feet of exposed surface soil will exceed the applicable SCOs, and the remedy will achieve Track 4 restricted residential cleanup;
- When a cover system is used, the Track 4 cover system will consist of a combination of the foundation, pavement and clean soil in the landscaped areas. Fill material brought to the Site will meet the requirements for the identified Site use as set forth in 6 NYCRR Part 375-6.7(d);
- A sub-slab depressurization system (SSDS) will be installed in a clean gravel layer beneath the slab and vent to the building roof;
- Imposition of an Institutional Control in the form of an environmental easement for the controlled property which will:

[4] The existing basement slab which will remain in place is 12 feet bgs. Hotspot SB-1 is beneath the existing basement slab, so excavation will occur from 12-15 feet bgs.

- Require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);
- Allow the use and development of the controlled property for restricted residential use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- Restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or NYCDOHMH; and
- Require compliance with the Department approved Site Management Plan.

› Site Management Plan, which includes the following:

- A Plan that identifies all use restrictions for the site and details the steps and media-specific requirements necessary to ensure the institutional and/or engineering controls remain in place and effective;
- This Plan includes, but may not be limited to
  - descriptions of the provisions of the environmental easement including any land use and groundwater use restrictions;
  - provisions for the management and inspection of the required controls;
  - maintaining site access controls and Department notification; and
  - the steps necessary for the periodic reviews and certification of the institutional controls; and

Alternative 3:

Alternative 3 is similar to Alternative 2 above, with the following exception, as per the NYDEC comments of November 1, 2022: As an alternative to the SSDS, a Soil Vapor Intrusion (SVI) investigation with full coverage of the structure will be conducted post-remedial action to assess the potential for exposure to soil vapor, with additional mitigative measures implemented if required based on the results of the SVI investigation.

3.1 Threshold Criteria

Protection of Public Health and the Environment

This criterion is an evaluation of the remedy's ability to protect public health and the environment, and an assessment of how risks posed through each existing or potential pathway of exposure are eliminated, reduced or controlled through removal, treatment, and implementation of ECs/ICs. Protection of public health and the environment must be achieved for all approved remedial actions.

Alternative 1 would be protective of human health and the environment by removing all soil/fill exceeding Track 1 Unrestricted Use SCOs and groundwater protection standards,

thus eliminating potential for direct contact with contaminated soil/fill once construction is complete and eliminating the risk of contaminants leaching into groundwater.

Alternative 2 would achieve comparable protections of human health and the environment by excavation and removal of localized soil/fill and ensuring that remaining soil/fill on-Site meets Track 2 RR SCOs. Construction the SSDS would provide mitigation of potential vapor intrusion into the building. Establishment of Track 2 RR SCOs would minimize the risk of contamination leaching into groundwater.

Alternative 3 would achieve comparable protections of human health and the environment by excavation and removal of localized soil/fill from two hot spot areas and ensuring that remaining soil/fill on-Site meets Track 2 RR SCOs. Excavation, transport and off-site disposal of approximately 54 cubic yards (CY) of contaminated historic fill from two hotspots, SB-1 and SB-8:

- The basis for removal of soil in the area of SB-1 is exceedances of RR SCOs at 12 to 15 feet[5] below ground surface (bgs) and removal of soils from 15 to 20 feet bgs that create an odor nuisance condition, as defined in Commissioner Policy CP-51 Section G. A total of 43 CY is proposed for excavation surrounding SB-1;
- The basis for removal of soil in the area of SB-8 is exceedances of RR SCOs at 0 to 2 feet bgs. A total of 11 CY is proposed for excavation surrounding SB-8 as part of remediation. Additional soil may be excavated from this area for development purposes and is not included in the total estimated volume above.

The SVI investigation would evaluate the potential for vapor migration, at which time additional mitigation measures could be employed if necessary. Establishment of Track 2 RR SCOs would minimize the risk of contamination leaching into groundwater.

For the three (3) alternatives, potential exposure to contaminated soils or groundwater during construction would be minimized by implementing a CHASP, an approved Soil/Materials Management Plan (SMMP), and a Community Air Monitoring Plan (CAMP). Potential contact with contaminated groundwater would be prevented as its use is prohibited by city laws and regulations. Utilization of a SSDS in **Alternative 2** provides additional protection from potential soil vapor, however, given the shallow depth to groundwater along Tillary Street, operation of the SSDS is deemed impracticable. An SVI investigation conducted under **Alternative 3** would provide assessment of the potential future migration of soil vapors into the new building..

3.2 Balancing Criteria

Compliance with Standards, Criteria and Guidance (SCGs)

This evaluation criterion assesses the ability of the alternative to achieve applicable standards, criteria, and guidance.

[5] The existing basement slab which will remain in place is 12 feet bgs. Hotspot SB-1 is beneath the existing basement slab, so excavation will occur from 12-15 feet bgs.

Alternative 1 would achieve compliance with the remedial goals, chemical-specific SCGs and RAOs for soil through removal of soil to achieve Track 1 Unrestricted SCOs and Protection of Groundwater SCOs. Compliance with SCGs for soil vapor would be achieved by installing a vapor barrier system below the new building's basement slab and continuing the vapor barrier outside of new subgrade foundation walls, as part of development.

Alternative 2 would achieve compliance with the remedial goals, chemical-specific SCGs and RAOs for soil by removing source material from the upper 15 feet and from 15 to 20 feet bgs due to an odor nuisance condition, as defined in Commissioner Policy CP-51 Section G, to achieve Track 2 RR SCOs. Compliance with SCGs for soil vapor would be achieved by installing a SSDS.

Alternative 3 would achieve compliance with the remedial goals, chemical-specific SCGs and RAOs for soil by removing source material from upper 15 feet and from 15 to 20 feet bgs due to an odor nuisance condition, as defined in Commissioner Policy CP-51 Section G, to achieve Track 2 RR SCOs. Compliance with SCGs for soil vapor would be achieved by conducting an SVI investigation to confirm compliance with applicable SCOs and the effectiveness of the remedy for soil vapor.

Health and safety measures contained in the CHASP and CAMP will be implemented during Site redevelopment under this RAWP. For each alternative, focused attention on means and methods employed during the remedial action would ensure that handling and management of contaminated material would be in compliance with applicable SCGs. These measures will protect on-Site workers and the surrounding community from exposure to Site-related contaminants.

Short-Term Effectiveness and Impacts

This evaluation criterion assesses the effects of the alternative during the construction and implementation phase until remedial action objectives are met. Under this criterion, alternatives are evaluated with respect to their short-term effects during the remedial action on public health and the environment during implementation of the remedial action, including protection of the community, protection of onsite workers and environmental impacts.

Short-term impacts could potentially be higher for **Alternative 1** since excavation of greater amounts of historical fill material would take place. However, focused attention to means and methods during a Track 1 removal action, including community air monitoring and appropriate truck routing, would minimize the overall impact of these activities. **Alternatives 2** and **3** have similar short-term effectiveness during their implementation, as each requires excavation of contaminated soil/fill material. All alternatives would result in short-term dust generation impacts associated with excavation, handling, load out of materials, and truck traffic.

An additional short-term adverse impact and risks to the community associated with the remedial alternatives are increased truck traffic and noise impacts. However, the project is required to comply with applicable NYC noise control standards and truck traffic will be

routed on the most direct course using major thoroughfares where possible and flag persons will be used to protect pedestrians at Site entrances and exits.

The potential adverse impact to the community, workers and the environment for the alternatives would be minimized through implementation of control plans including a CHASP, a CAMP, and a SMMP, during on-Site soil disturbance activities and would minimize the release of contaminants into the environment. All alternatives provide short-term effectiveness in protecting the surrounding community by decreasing the risk of contact with on-Site contaminants. Construction workers operating under appropriate management procedures and a CHASP would provide protection from on-Site contaminants by using personal protective equipment would be worn consistent with the documented risks within the respective work zones. The Site specific CHASP is provided in **Appendix C.**

Long-term effectiveness and permanence

This evaluation criterion addresses the results of a remedial action in terms of its permanence and quantity/nature of waste or residual contamination remaining at the Site after response objectives have been met, such as permanence of the remedial alternative, magnitude of remaining contamination, adequacy of controls including the adequacy and suitability of ECs/ICs that may be used to manage contaminant residuals that remain at the Site and assessment of containment systems and ICs that are designed to eliminate exposures to contaminants, and long-term reliability of ECs.

Alternative 1 would achieve long-term effectiveness and permanence related to on-Site contamination by permanently removing all impacted soil/fill above Track 1 Unrestricted SCOs and enabling unrestricted use of the property. Removal of on-Site contaminant sources will also prevent future groundwater contamination.

Alternative 2 would provide long-term effectiveness by removing source material or treatment (odors) and Track 2 RR SCO exceedances in the upper 15 feet and from 15 to 20 feet bgs due to an odor nuisance condition, as defined in Commissioner Policy CP-51 Section G, to achieve Track 2 RR SCOs and by installing an SSDS. The SSDS would be installed below the basement slab, and the presence of shallow groundwater along Tillary Street would have a negative impact on the operation of the SSDS, limiting the long-term effectiveness and permanence of this alternative.

Alternative 3 would provide long-term effectiveness by removing source material or treatment (odors) and Track 2 RR SCO exceedances in the upper 15 feet a and from 15 to 20 feet bgs due to an odor nuisance condition, as defined in Commissioner Policy CP-51 Section G, to achieve Track 2 RR SCOs. A SVI investigation would confirm compliance the effectiveness of the remedy for soil vapor.

Reduction of toxicity, mobility, or volume of contaminated material

This evaluation criterion assesses the remedial alternative's use of remedial technologies that permanently and significantly reduce toxicity, mobility, or volume of contaminants as their

principal element. The following is the hierarchy of source removal and control measures that are to be used to remediate a Site, ranked from most preferable to least preferable: removal and/or treatment, containment, elimination of exposure and treatment of source at the point of exposure. It is preferred to use treatment or removal to eliminate contaminants at a Site, reduce the total mass of toxic contaminants, cause irreversible reduction in contaminants mobility, or reduce of total volume of contaminated media.

Alternative 1 will permanently eliminate the toxicity, mobility, and volume of contaminants from on-Site soil by removing all soil in excess of Track 1 UU SCOs.

Alternative 2 would remove the contaminated soil/historic fill by excavation of hot spots to 20 feet bgs at the Site with a combined old and new slab system across the majority of the new building footprint. Excavation will extend past 15 feet for the remedy due to nuisance conditions (odor). The basis for removal is RR SCO exceedances (0 to 15 feet bgs) and source material (odors, 15 to 20 feet bgs). Remaining on-Site soil/fill would meet Track 2 RR SCOs.

Alternative 3 would remove the contaminated soil/historic fill by excavation of hot spots to 20 feet bgs at the Site with a combined old and new slab system across the majority of the new building footprint. Excavation will extend past 15 feet for the remedy due to nuisance conditions (odor). The basis for removal is RR SCO exceedances (0 to 15 feet bgs) and source material (odors, 15 to 20 feet bgs) as defined in Commissioner Policy CP-15 Section G. Remaining on-Site soil/fill would meet Track 2 RR SCOs.

All three alternatives would result in reducing the toxicity, mobility, and volume of contaminated material on-Site; however, **Alternative 1** would remove a greater total mass of contaminants from the Site. **Alternatives 2** and **3** propose removal of the same mass of contaminants and would each meet Track 2 RR SCOs.

Implementability

This evaluation criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation, including technical feasibility of construction and operation, reliability of the selected technology, ease of undertaking remedial action, monitoring considerations, administrative feasibility (e.g. obtaining permits for remedial activities), and availability of services and materials.

The techniques, materials, and equipment to implement **Alternatives 1**, **2** and **3** are readily available and have been proven to be effective in remediating the contaminants present on the Site. They use standard equipment and technologies that are well established in the industry. The reliability of each remedy is also high. **Alternative 1** requires the demolition of the existing building slab and foundation walls and will require additional support of excavation. However, given the shallow water table at the Site, especially along the Tillary Street boundary, implementation of the SSDS in **Alternative 2** beneath the building slab is deemed impracticable. Given the above, **Alternative 3** best meets the implementability criteria.

Cost effectiveness

This evaluation criterion addresses the cost of alternatives, including capital costs (such as construction costs, equipment costs, and disposal costs, engineering expenses) and Site Management costs (costs incurred after remedial construction is complete) necessary to ensure the continued effectiveness of a remedial action.

Alternative 3 would achieve the goals of the remediation with the lowest cost. **Alternative 1** has higher costs than **Alternatives 2 and 3**, due to the removal of the sub-grade building slab and foundation walls and the excavation/disposal of additional volume of soil/fill. Costs associated with **Alternative 1** could potentially be higher if soil with analytes above Track 1 UU SCOs is encountered below the excavation depth required for development. Additional costs would include installation of additional shoring/underpinning, disposal of additional soil, and import of clean soil for backfill. Costs to implement **Alternative 2** will be higher than that for **Alternative 3** due to the installation and operational costs of the SSDS. **Alternative 3** is the most cost effective alternative.

The remedial plan would couple the remedial action with the redevelopment of the Site, lowering total costs. The remedial plan will also consider the selection of the most appropriate disposal facilities to reduce transportation and disposal costs during cleanup and redevelopment of the Site.

Community Acceptance

This evaluation criterion addresses community opinion and support for the remedial action. Observations here will be supplemented by public comment received on the RAWP.

This RAWP will be subject to a public review under the NYSDEC BCP and will provide the opportunity for detailed public input on the remedial alternatives and the selected remedy. This public comment will be considered by NYSDEC prior to approval of this plan. The Citizen Participation Plan (CPP) for the project is provided in **Appendix D**. Observations here will be supplemented by public comment received on the RAWP. Under both alternatives, the overall goals of the remedial program, to protect public health and the environment and eliminate potential contaminant exposures, have been broadly supported by citizens in NYC communities.

Land use

This evaluation criterion addresses the proposed use of the property. This evaluation has considered reasonably anticipated future uses of the Site and takes into account: current use and historical and/or recent development patterns; applicable zoning laws and maps; NYS Department of State's Brownfield Opportunity Areas (BOA) pursuant to section 970-r of the general municipal law; applicable land use plans; proximity to real property currently used for residential use, and to commercial, industrial, agricultural, and/or recreational areas; environmental justice impacts, Federal or State land use designations; population growth patterns and projections; accessibility to existing infrastructure; proximity of the Site to important cultural resources and natural resources, potential vulnerability of groundwater to

contamination that might emanate from the Site, proximity to flood plains, geography and geology; and current Institutional Controls applicable to the Site.

The current, intended, and reasonably anticipated future land use of the Site and its surroundings are compatible with the selected remedy of soil remediation. The proposed future use of the Site will include commercial and residential units including a tower with 32 floors. A total of 116 affordable residential units will be located in Site building ranging from studio to three (3) bedrooms. Commercial space will be located on the first floor of the building will front along Tillary Street.

Following remediation, the Site will meet either Track 1 Unrestricted Use or Track 2 RR SCOs, both of which are protective of public health and the environment for its planned residential use. The proposed use is compliant with the property's zoning and is consistent with recent development patterns. The areas surrounding the Site is urban and consists of predominantly mixed residential and commercial buildings in zoning districts designated for commercial and residential uses. The development would remediate a property and provide a modern mixed-use residential/commercial building. The proposed development would clean up the property and make it safer, create new employment opportunities, living space for affordable and supportive housing and associated societal benefits to the community, and other economic benefits from land revitalization.

Temporary short-term project impacts are being mitigated through Site Management controls and truck traffic controls during remediation activities. Following remediation, the Site will meet either Track 1 Unrestricted Use SCOs or Track 2 RR SCOs, both of which are protective of public health and the environmental for its planned use.

The Site is not in close proximity to important cultural resources, including federal or state historic or heritage sites or Native American religious sites, natural resources, waterways, wildlife refuges, wetlands, or critical habitats of endangered or threatened species. The Site is located in an urban area and not in proximity to fish or wildlife and neither alternative would result in any potential exposure pathways of contaminant migration affecting fish or wildlife. The remedial action is also protective of groundwater natural resources. The Site does not lie in a Federal Emergency Management Agency (FEMA)-designated flood plain. All alternatives are equally protective of natural resources and cultural resources. Improvements in the current environmental condition of the property achieved by the alternatives considered in this plan are consistent with the City's goals for cleanup of contaminated land.

Sustainability of the Remedial Action

This criterion evaluates the overall sustainability of the remedial action alternatives and the degree to which sustainable means are employed to implement the remedial action including those that take into consideration NYC's sustainability goals defined in "PlaNYC": A Greener, Greater New York. Sustainability goals may include: maximizing the recycling and reuse of non-virgin materials; reducing the consumption of virgin and non-renewable resources; minimizing energy consumption and greenhouse gas emissions; improving energy efficiency; and promotion of the use of native vegetation and enhancing biodiversity during landscaping associated with Site development.

While **Alternatives 2** and **3** would potentially result in lower energy usage based on reducing the volume of material transported off-Site, both remedial alternatives are comparable with respect to the opportunity to achieve sustainable remedial action. The remedial plan for either alternative would take into consideration the shortest trucking routes during off-Site disposal of historic fill and other soils, which would reduce greenhouse gas emissions and conserve energy used to fuel trucks. The New York City Clean Soil Bank program is available for reuse of any clean native soils under either alternative. A complete list of green remedial activities considered as part of the NYCVCP is included in a Sustainability Statement provided as **Appendix E.**

4

Remedial Action

4.1 Summary of the Remedial Action

Based on the above analysis, **Alternative 3** is the selected remedial action. The objectives of the RAWP are the excavation, transport and off-site disposal of soil/ historic fill to achieve compliance with the Track 2 RR SCOs in support of the proposed Site mixed residential and commercial use redevelopment, dewatering of any contaminated groundwater encountered and mitigation of soil vapor at the Site. This RAWP consists of the following tasks:

- The demolition of the existing five-story building;
- Installation of a 421-a foundation element and associated soil disposal;
- Waste characterization sampling for purposes of determining the proper off-site disposal facility for the excavated contaminated soil material;
- Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.
- Excavation, transport and off-site disposal of approximately 54 CY of soil/historic fill exceeding RR SCOs in two hot spot areas, SB-1 and SB-8 and installation of a 421-a foundation element;
    - The basis for removal of soil in the area of SB-1 is exceedances of RR SCOs at 12 to 15 feet[6] below ground surface (bgs) and removal of soils from 15 to 20 feet bgs that create an odor nuisance condition, as defined in

[6] The existing basement slab which will remain in place is 12 feet bgs. Hotspot SB-1 is beneath the existing basement slab, so excavation will occur from 12-15 feet bgs.

Commissioner Policy CP-51 Section G. A total of 43 CY is proposed for excavation surrounding SB-1;

- The basis for removal of soil in the area of SB-8 is exceedances of RR SCOs at 0 to 2 feet bgs. A total of 11 CY is proposed for excavation surrounding SB-8 as part of remediation. Additional soil may be excavated from this area for development purposes and is not included in the total estimated volume above.

› Dewatering in the source area under the building where the excavation will be 20 feet bgs and water will be encountered;

› Continuous screening of soil/fill during soil disturbance activities;

› Soils/material management specific to the handling as well as transportation/disposal of materials generated during RAWP;

› Work Zone and Perimeter Air Monitoring for Dust, Vapor and Nuisance Odors during ground intrusive activities and during demolition of contaminated or potentially contaminated structures;

› Collection of post-excavation soil confirmatory samples and in-situ post-excavation samples collected during the RI to demonstrate compliance with the preferred Track 2 RR SCOs remedy;

› Demarcation of residual soil/fill;

› Backfill of excavated areas per the redevelopment plans with 1,200 CY of approved clean fill/topsoil and 124 CY of clean ¾-inch blue stone to a minimum depth of 4-inches;

› A vapor barrier membrane will be installed as a green remedial measure beneath the building slab and along the exterior portions of the below-grade foundation sidewalls to mitigate soil vapor migration into the building. The vapor barrier membrane will consist of the Stego® Wrap 20-Mil Vapor Barrier Membrane, manufactured by Stego Industries, LLC and W.R. Meadows PreCon 73-Mil waterproofing and vapor proofing membrane manufactured by W.R. Meadows. All welds, seams and penetrations will be properly sealed to prevent preferential pathways for vapor migration. The remedial engineer will certify in the Final Engineering Report (FER) that the vapor barrier system was designed and properly installed.

› Implementation of an SVI investigation pending completion of the remedial action to confirm the remedy meets the requirements of the NYDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006.

› In addition to the above activities, the following contingent measures are included in the event that these conditions are encountered during implementation of the RAWP activities:

- *Contingent* excavation and off-site disposal of petroleum or similarly impacted soil identified during soil disturbance and/or in the vicinity of unanticipated USTs;
- Contingent excavation and removal of unanticipated USTs encountered during soil disturbance activities;

- Contingent collection of post-excavation soil end-point samples from impacted soil removal areas or UST removal excavation areas in accordance with applicable local, State and Federal laws; and

› Imposition of an Institutional Control in the form of an environmental easement for the controlled property which will:

- Require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);
- Allow the use and development of the controlled property for restricted residential use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- Restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or NYCDOHMH; and
- Require compliance with the Department approved Site Management Plan.

› Site Management Plan, which includes the following:

- A Plan that identifies all use restrictions for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:
  - Institutional Controls: The Environmental Easement discussed in above.
- This Plan includes, but may not be limited to
  - descriptions of the provisions of the environmental easement including any land use and groundwater use restrictions;
  - provisions for the management and inspection of the identified engineering controls;
  - maintaining site access controls and Department notification; and
  - the steps necessary for the periodic reviews and certification of the institutional and/or engineering controls.

› Evaluation of a post-construction soil vapor intrusion investigation for any occupied buildings on the Site;

› In the event that a Track 2 restricted residential use is not achieved, a contingent Track 4 cleanup will be implemented. The Track 4 remedy will require a cover system as a remedial element to allow for restricted residential use of the Site in areas where the upper two feet of exposed surface soil will exceed the applicable SCOs, and the remedy will achieve Track 4 restricted residential cleanup.

› When a cover system is used, the Track 4 cover system will consist of a combination of the foundation, pavement and clean soil cover in the landscaped area. Fill material brought to the Site will meet the requirements for the identified Site use as set forth in 6 NYCRR Part 375-6.7(d);

› Preparation of a Final Engineering Report.

The remedial activities described herein will be performed in accordance with applicable federal, state, and local regulations. A construction health and safety plan (CHASP) is provided as **Appendix C**.

Site Preparation and Demolition of Current Building

Site preparation and building demolition are the responsibility of the Applicant, YYY Brooklyn NY LLC, and will include but not be limited to, the establishment of work zones, mobilization of support facilities, construction of decontamination facilities, and implementation of Site security measures (i.e., erection of security fencing around the Site and staging areas). The Applicant will maintain soil erosion control and sediment control measures prior to and during work operations described in the RAWP.

The Applicant has received a building demolition permit from the NYC Department of Buildings (Permit No. 322098056-01-DM) and shall ensure that all necessary permits are obtained prior to the commencement of any task included in the proposed RAWP. Demolition commenced in January 2022.

Prior to intrusive activities, Dig Safely New York (811) will be contacted by the Applicant's Contractor a minimum of three business days in advance of the work. Dig Safely New York will be informed of the nature of the work and the intent to excavate at the Site. The Applicant's Contractor will perform necessary utility markouts.

The cellar basement foundation will remain in place.

4.2 Soil Cleanup Objectives

Track 2 RR SCOs are proposed for this project and SCOs are defined in 6 NYCRR Part 375, Table 6.8 Track 2 Restricted-Residential Use. If Track 2 RR SCOs are not achieved, a Track 4 restricted residential cleanup will apply and includes the following:

1) Source removal or treatment (odors);

2) Removal of RR SCOs exceedances in the upper 2 feet; and

3) Inclusion of a site cover as a remedial element.

Discrete contaminant sources (such as hotspots) identified during the remedial action will be identified by GPS or surveyed. This information will be provided in the FER.

4.3 Excavation of Soil/Historic Fill

Excavation of approximately 54 CY of impacted soil/ historic fill, which was identified during the RI, is proposed from two (2) localized hot spot areas. Additional soil will be excavated from areas associated with the proposed redevelopment. Discrete contaminant sources identified during the remedial action will be identified by GPS or surveyed. This information will be provided in the FER. Dewatering will be required. The hot spot areas to be excavated are described below.

- The area surrounding SB-1 on Lot 100 and the adjacent elevator pit: Excavate the area encompassing SB-1 where concentrations of several VOCs and SVOCs were

identified during the RI at concentrations above the RR SCOs. The area will be excavated to a depth of approximately 20 feet bgs. Excavation will extend past 15 feet for the remedy due to nuisance conditions (odor). The basis for removal is RR SCO exceedances (0 to 15 feet bgs) and source material (odors, 15 to 20 feet bgs) as defined in Commissioner Policy CP-15 Section G. This area is located beneath the existing building slab. In conjunction with the excavation of this area, the proposed elevator pit area will be excavated to a depth of 20 feet bgs, where concentrations of vinyl chloride and cis-1,2-dichloroethene in soil vapor were detected (SV-1) during the RI above the mitigate action level established by the NYSDOH;

- Area surrounding SB-8 in Lot 98: Excavate the area encompassing SB-8 where concentrations of several VOCs and SVOCs were identified during the RI at concentrations above the RR SCOs. The area will be excavated to a depth of approximately 2 feet bgs;

Soil that is disturbed during the remedial activities will be managed in accordance with the soil/materials management procedures detailed in **Section 4.10** of this Work Plan. A Proposed Excavation Map showing the locations of soil disturbances is provided as **Figure 10**.

Per the redevelopment plans, the excavated areas will be backfilled with approximately 1,200 CY clean fill/topsoil and 124 CY ¾-inch blue stone. Import of materials from off-site sources will be in accordance with the procedures detailed in SMMP. Material for export and import will be appropriately segregated.

4.4 Endpoint Sampling

Endpoint samples will be analyzed for compounds and elements as described below utilizing the following methodology:

- Volatile organic compounds by EPA Method 8260;
- Semi-volatile organic compounds by EPA Method 8270;
- Target Analyte List metals;
- Total chromium and hexavalent chromium; and
- Pesticides/PCBs by EPA Method 8081/8082.

New York State Environmental Laboratory Accreditation Program (ELAP) certified labs will be used for all endpoint sample analyses. Labs performing endpoint sample analyses will be reported in the FER. The FER will provide a tabular and map summary of all endpoint sample results and will include all data including non-detects and applicable standards and/or guidance values.

4.4.1 Confirmation Endpoint Sampling

Removal actions for development purposes under this plan will be performed in conjunction with confirmation endpoint soil sampling. Sampling results from the RI will act as in-situ endpoint samples for a majority of the Site. A total of 17 endpoint samples [one (1) from the base of the excavation and four (4) from the sidewalls of the excavation] from two (2)

hotspots; and four (4) sidewall samples and three (3) base samples from the parking lot excavation area will be collected to determine the performance of the remedy with respect to attainment of SCOs; The proposed locations are shown on **Figure 11**, the Proposed Endpoint Sample Location Map. To evaluate attainment of Track 2 RR SCOs according to analytical methods described above. If Track 1 UU SCOs are pursued, samples will be analyzed for VOCs, SVOCs, pesticides, PCBs, and metals according to analytical methods described above.

4.4.2 Hotspot Endpoint Sampling

Five (5) endpoint samples will be collected from the sidewalls and base of excavation of each hotspot excavation location identified in the Remedial Investigation, according to the procedure listed below. Hotspots include soil boring SB-1 for VOCs and SVOCs and SB-8 for SVOCs. Endpoint samples will be analyzed for SCO trigger parameters.

For any hotspots identified during this remedial program, including any hotspots identified during the remedial action, hotspot removal actions will be performed to ensure that hotspots are fully removed and endpoint samples will be collected at the following frequency:

1. For excavations less than 20 feet in total perimeter, at least one bottom sample and one sidewall sample biased in the direction of surface runoff.
2. For excavations 20 to 300 feet in perimeter:
    - For surface removals, one sample from the top of each sidewall for every 30 linear feet of sidewall and one sample from the excavation bottom for every 900 square feet of bottom area.
    - For subsurface removals, one sample from each sidewall for every 30 linear feet of sidewall and one sample from the excavation bottom for every 900 square feet of bottom area.
3. For sampling of volatile organics, bottom samples should be taken within 24 hours of excavation and should be taken from the zero to six-inch interval at the excavation floor. Samples taken after 24 hours should be taken at six to twelve inches.
4. For contaminated soil removal, post remediation soil samples for laboratory analysis should be taken immediately after contaminated soil removal. If the excavation is enlarged horizontally, additional soil samples will be taken pursuant to bullets 1-3 above.

Post-remediation endpoint sample locations and depths will be biased towards the areas and depths of highest contamination identified during previous sampling episodes unless field indicators such as field instrument measurements or visual contamination identified during the remedial action indicate that other locations and depths may be more heavily contaminated. In all cases, post-remediation samples should be biased toward locations and depths of the highest expected contamination.

If either LNAPL and/or DNAPL are detected, appropriate samples will be collected for characterization and required regulatory reporting (i.e., spills hotline) will be performed. "Fingerprint analysis" may elect to be performed by the Applicant.

4.5 Soil Vapor Intrusion Investigation

As requested by NYSDEC in its email dated December 7, 2022, an SVI investigation will be conducted following the completion of construction to assess the potential for contaminated soil vapor to migrate into the building. The SVI investigation will be performed in accordance with the NYSDOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006. A SVI Investigation Workplan will be submitted to NYSDEC prior to the commencement of the investigation, pending building completion. The number and type of samples will be determined based on post-construction Site conditions and the analytical results of the soil vapor samples collected during the RI and the Supplemental RI.

The proposed building design features a basement with multiple slab elevations. A vented parking garage is located on the first floor above the proposed bicycle storage room, tenant storage room and locker changing room. The final building configuration will impact the location of the samples.

The SVI investigation will include soil vapor samples, indoor air samples and outdoor air samples. Soil vapor samples will be used in conjunction with the indoor and outdoor samples to evaluate the potential for future exposure to contaminated soil vapor.

4.6 Quality Assurance Project Plan

A Quality Assurance Project Plan (QAPP) was prepared for the Site to ensure data quality with respect to accuracy, precision, and sensitivity of analysis for laboratory analytical data. The Quality Assurance Project Plan is included as **Appendix F**.

Data Usability Summary Reports (DUSRs)

Data validation will be performed in general accordance with NYSDEC DUSR requirements for organic and inorganic data review.

Reporting of End-Point Data in FER

The FER will include a table of end-point data with highlights or a summary of exceedances of SCOs. A map showing all SCO exceedances will be presented in the FER. Chemical labs used for end-point sample results and contingency sampling will be NYSDOH ELAP certified.

4.7 Import of Soil and Gravel

Import of soils onto the property will be performed in conformance with the SMMP in **Section 4.10**. Imported soil will meet the lower of:

- Track 2 RR SCOs, and
- Groundwater Protection Standards in Part 375-6.8.

Approximately 1,200 CY of clean fill/topsoil and 124 CY of ¾-inch clean stone will be imported for backfilling of the hot spots, parking lot and for backfill around footings. A map of imported material placement locations is shown in **Figure 12**.

Import of clean bluestone and/or Recycled Concrete Aggregate (RCA) is proposed for this project; the bluestone and/or RCA or will contain minimal fines and consist of:

- Gravel, rock or stone, consisting of virgin material from a permitted mine or quarry; or
- Recycled concrete or brick from a NYSDEC registered construction and demolition debris processing facility, if the material conforms to the requirements of Section 304 of the New York State Department of Transportation Standard Specifications Construction and Materials Volume 1 (2002).

4.8 Vapor Barrier System

A vapor barrier system is proposed as a green remedial measure to mitigate potential impacts due to migration of soil vapor from onsite or offsite sources into the building. The vapor barrier will consist of the Stego® Wrap 20-Mil Vapor Barrier Membrane, manufactured by Stego Industries and W.R. Meadows PreCon 73-Mil waterproofing membrane manufactured by W.R. Meadows. The Stego® Wrap vapor barrier membrane will be installed beneath the first-floor slab on grade and along the exterior portions of the below grade foundation sidewalls. The W.R. Meadows PreCon vapor and waterproofing membrane will be installed along the exterior portions of the elevator pits. The vapor barrier membrane system will be installed in accordance with manufacturer specifications. Product specification sheets and installation details (penetrations, joints, etc.) with respect to the proposed building's slab and foundation components are provided in **Appendix G.** The FER will include as-built drawings and diagrams; manufacturer documentation; and photographs.

The remediation engineer, licensed by the State of New York, will have primary direct responsibility for overseeing the implementation of the vapor barrier. A plan view showing the location of the proposed vapor barrier system and typical design sections for the vapor barrier are provided on **Figure 13**.

4.9 Track 4 Contingent Engineering Controls

Track 2 RR SCOs are proposed for the Site. A cover system extending across the Site is required as a remedial element if Track 4 restricted residential cleanup is achieved to prevent exposure to residual soil/fill.

The Track 4 cover system for this site will consist of a combination of the foundation, pavement and clean soil cover in the landscaped area. Fill material brought to the Site will meet the requirements for the identified Site use as set forth in 6 NYCRR Part 375-6.7(d);

Figure 13 shows the typical cross-section design and location of the Track 4 cover proposed for the site.

4.10 Institutional Controls - Environmental Easement

An Institutional Control in the form of an environmental easement for the controlled property is required for the Track 2 or Track 4 remedy and will:

- Require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);
- Allow the use and development of the controlled property for restricted residential use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- Restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or NYCDOHMH; and
- Require compliance with the Department approved Site Management Plan which will be submitted with the FER;

4.11 Site Management Plan

A Site Management Plan is required for the Track 2 or Track 4 remedy and will include the following:

- A Plan that identifies all use restrictions for the site and details the steps and media-specific requirements necessary to ensure the following institutional and/or engineering controls remain in place and effective:
  - Institutional Controls: The Environmental Easement discussed in above.
- This Plan includes, but may not be limited to descriptions of the provisions of the environmental easement including any land use and groundwater use restrictions;
- Provisions for the management and inspection of the identified engineering controls;
- Maintaining site access controls and Department notification; and
- The steps necessary for the periodic reviews and certification of the institutional and/or engineering controls.

SMP inspections will be based on a calendar year and certification reports will be due for submission to NYSDEC by July 30 of the year following the reporting period, or schedule approved by NYSDEC. The SMP will be submitted to NYSDEC for approval with the FER.

4.12 Qualitative Human Health Exposure Assessment

The objective of the qualitative exposure assessment is to identify potential receptors and pathways for human exposure to the contaminants of concern (COC) that are present at, or migrating from, the Site. The identification of exposure pathways describes the route that the COC takes to travel from the source to the receptor. An identified pathway indicates that the potential for exposure exists; it does not imply that exposures actually occur.

Data and information reported in the RIR are sufficient to complete a Qualitative Human Health Exposure Assessment (QHHEA) for this project. As part of the NYSDEC BCP process, a QHHEA was performed to determine whether the Site poses an existing or future health hazard to the Site's exposed or potentially exposed population. The sampling data from the RI were evaluated to determine whether there is any health risk under current and future

conditions by characterizing the exposure setting, identifying exposure pathways, and evaluating contaminant fate and transport. This QHHEA was prepared in accordance with Appendix 3B and Section 3.3 (b) 8 of the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation.

Known and Potential Contaminant Sources

Based on the results of the RIR, the contaminants of concern are:

Soil:

- VOCs including Benzene, Toluene, Ethylbenzene, Total Xylenes, and 1,2,4-Trimethylbenzene were detected exceeding NYSDEC Restricted-Residential Use SCOs. VOCs including 1,4-Dichlorobenzene, Acetone, 2-Butanone, Naphthalene, N-propylbenzene, and 1,3,5-Trimethylbenzene were detected exceeding NYSDEC Unrestricted Use SCOs.
- SVOCs including Benzo(a)pyrene, Benzo(a)anthracene, Benzo(b)fluoranthene, Chrysene, Dibenzo(a,h)anthracene, and Ideno(1,2,3-cd)pyrene were detected exceeding NYSDEC Restricted-Residential Use SCOs. SVOCs including Naphthalene, Benzo(k)fluoranthene, 2-Methylphenol, and 3/4-MethylPhenol were detected exceeding NYSDEC Unrestricted Use SCOs.
- Several Pesticides including Dichlorodiphenyldichloroethane (4,4'DDD), Dichlorodiphenyldichloroethylene (4,4'DDE), and Dichlorodiphenyltrichloroethane (4,4'DDT), aldrin, and dieldrin were detected exceeding the NYSDEC Unrestricted Use SCOs;
- Metals including Lead, Mercury, and Nickel were detected exceeding NYSDEC Unrestricted Use SCOs.

Groundwater:

- VOCs including sec-Butylbenzene and 1,2,4,5-Tetramethylbenzene were detected exceeding the NYGQS;
- Dissolved Metals including Iron, Manganese, and Sodium were detected exceeding the NYGQS;
- Total Metals including Beryllium, Chromium, Iron, Lead, Magnesium, Manganese, Nickel, Selenium, Sodium, and Thallium were detected exceeding the NYGQS.

Soil Vapor:

- Chlorinated VOCs including Vinyl Chloride and Cis-1,2-dichloroethene were detected at concentrations above the NYSDOH mitigate threshold and at low concentrations below NYSDOH monitoring threshold. Methylene chloride was detected at concentrations above and below the NYSDOH monitoring thresholds. Trichloroethene and Tetrachloroethane were detected at concentrations below the NYSDOH monitoring thresholds.

Nature, Extent, Fate and Transport of Contaminants

Several pesticides, SVOCs, VOCs, and metals are present in the urban historic fill throughout the Site. The pesticides were detected in several shallow soil samples deep soil samples and are likely a result from the nature of the urban historic fill. Since no pesticides were detected in the groundwater, it is likely for the pesticides to remain immobile. Several petroleum related SVOCs were found in two (2) shallow soil samples at the Site and in one (1) deep sample at a single location. However, the petroleum-impacted soil appears to have not impacted on-Site groundwater since only groundwater at the soil boring location appears to have been impacted. It is believed that hotspot excavation of this material will remove a majority of the contamination. Since the groundwater table is confined within the native sand layer beneath the urban historic fill layer and the analytical results indicated no related contamination, it is likely for the on-Site petroleum-impacts to remain immobile and not have the potential to easily transport off Site. Several metals were found throughout the Site in shallow and deep samples within the urban historic fill. The majority of the metal compounds and concentrations are commonly and typically found in urban historic fill throughout the NYC Metropolitan Area.

Several metals were detected above the NYGQS, and the metal exceedances are commonly and typically found in groundwater throughout the NYC Metropolitan Area. Two (2) VOCs were also detected above the NYGQS in a single sampling location; however, these compounds were detected at relatively low concentrations and it is unlikely for the compounds to migrate off Site.

Soil vapor samples detected chlorinated compounds at an elevated concentration in a single location. Additional chlorinated compounds were detected below the NYSDEC monitoring thresholds in other sampling locations.

Receptor Populations

On-Site Receptors: The site is currently utilized as a self-storage facility and is accessed through a manned attendant room. A six-foot high chain-link perimeter fence provides access to the outdoor parking lot. Onsite receptors are limited to storage unit tenants, site representatives and visitors granted access to the property. During construction, potential on-site receptors include construction workers, site representatives, and visitors. Under proposed future conditions, potential on-site receptors include building residents, workers, and visitors.

Off-Site Receptors: Potential off-site receptors within a 500-foot radius of the Site include adult and child residents; commercial and construction workers; pedestrians; and trespassers based on the following land uses within 500 feet of the Site:

1. Commercial Businesses – existing and future
2. Residential Buildings – existing and future
3. Building Construction/ Renovation – existing and future
4. Pedestrians, Trespassers, Cyclists – existing and future

Potential Routes of Exposure

Three potential primary routes exist by which chemicals can enter the body: ingestion, inhalation, and dermal absorption. Exposure can occur based on the following potential media:

- Ingestion of groundwater or fill/ soil;
- Inhalation of vapors or particulates; and
- Dermal absorption of groundwater or fill/ soil.

Potential Exposure Points

Current Conditions: The Site currently contains one (1) multi-story building utilized as a self-storage facility and a gated asphalt-paved parking lot. The potential for exposure to surficial historic fill does not exist under current conditions since surficial historic fill is not exposed as the entirety of the Site is covered. Access to the Site is also limited to authorized building guests and employees by a secured entrance or parking lot gate. Groundwater is marginally contaminated but is not exposed at the Site and, because the Site is served by the public water supply and groundwater use for potable supply is prohibited, groundwater is not used at the Site and there is no potential for exposure. The potential for exposure to soil vapor exists since soil vapor may accumulate in the structure present on the Site but is limited by security present in the building granting access for authorized employees and guests only.

Construction/ Remediation Conditions: Once redevelopment activities begin, construction workers will come into direct contact with surface and subsurface soils as a result of on-Site construction and excavation activities. On-Site construction workers potentially could ingest, inhale, or have dermal contact with any exposed impacted soil and fill. Similarly, off-Site receptors could be exposed to dust and vapors from on-Site activities. During construction, on-Site and off-Site exposures to contaminated dust from on Site will be addressed through the site management plan, dust controls, and through the implementation of the CAMP and a CHASP.

Proposed Future Conditions: Under future remediated conditions, soils in excess of Track 2 RR SCOs will be removed. In the event that a Track 2 restricted residential use is not achieved, a contingent Track 4 cleanup will be implemented. The Track 4 remedy will require a cover system as a remedial element to allow for restricted residential use of the Site in areas where the upper two feet of exposed surface soil will exceed the applicable SCOs, and the remedy will achieve Track 4 restricted residential cleanup. The Track 4 cover system for this site will consist of a combination of the foundation, pavement and clean soil cover in the landscaped area. The site is served by the public water supply, and groundwater is not used at the site. There are no plausible off-site pathways for oral, inhalation, or dermal exposure to contaminants derived from the site.

Overall Human Health Exposure Assessment

There are potential complete exposure pathways for the current site condition. There are potential complete exposure pathways that require mitigation during implementation of the remedy. There are no complete exposure pathways under future conditions after the site is developed. This assessment takes into consideration the reasonably anticipated use of the

site, which includes a residential structure, and a subsurface vapor barrier system for the building as a green remedial measure.

Under current conditions, on-Site exposure pathways exist for those with access to the Site and trespassers. During remedial construction, on-Site and off-Site exposures to contaminated dust from historic fill material will be addressed through dust controls, and through the implementation of the CAMP, the SMMP, and a CHASP. After the remedial action is complete, there will be no remaining exposure pathways to on-site soil/fill, as all soil above Track 2 RR SCOs will have been removed and a vapor barrier system will have been installed as a green remedial measure. An environmental easement will serve as an institutional control. Potential post-construction use of groundwater is not considered an option because groundwater in this area of New York City is not used as a potable water source. There are no surface waters in close proximity to the Site that could be impacted or threatened.

4.13 Soil/Materials Management Plan

Soil/materials management activities specific to the handling as well as transportation/disposal materials generated during this RAWP are described in this section. A field engineer/scientist/geologist, under the supervision of the RE will monitor and document handling of material exported from the Site that is transported and disposed of in accordance with applicable laws and regulations. Excavated material will be screened by visual and olfactory methods and with a PID, to identify if soil is impacted with VOCs. Excavated materials, including temporarily stockpiling, will be segregated in accordance with defined material types and to prevent co-mingling of contaminated material and non-contaminated materials.

It is reasonably anticipated that historic fill impacted with SVOCs, pesticides, and metals above Unrestricted Use and/or Restricted-Residential Restricted Use SCOs will be encountered during remedial activities. Historic fill material and petroleum impacted material, if encountered, will be managed separately to avoid comingling.

4.13.1 Construction and Demolition Debris (C&D) Material Load Out

The Applicant , YYY Brooklyn NY LLC will manage the C&D materials handling, transposition and disposal in accordance with local, state (including 6 NYCRR Part 361-5.4) and federal regulations. Exported loads will be transported by licensed haulers in accordance with appropriate local, state, and federal regulations, including 6 NYCRR Part 364.

4.13.2 Soil Screening Methods

Visual, olfactory, and instrumental soil screening will be performed under the direction of the RE using a photoionization detector (PID) equipped and will be reported in the final engineering report. Soil screening will be performed during invasive work. Visibly impacted material will be segregated and placed on polyethylene sheeting for off-Site disposal.

4.13.3 Soil Stockpile Management

Excavated soil from suspected areas of contamination (e.g., hotspots, USTs, drains, etc.) will be stockpiled separately and will be segregated from clean soil and construction materials. Stockpiles will be used only when necessary and will be removed as soon as practicable. While stockpiles are in place, they will be inspected daily, and before and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC. Excavated soils will be stockpiled on, at minimum, double layers of 8-mil minimum sheeting, will be kept covered at all times with appropriately anchored plastic tarps, and will be routinely inspected. Broken or ripped tarps will be promptly replaced.

All stockpile activities will be compliant with applicable laws and regulations. Soil stockpile areas will be appropriately graded to control run-off in accordance with applicable laws and regulations. Stockpiles of excavated soils and other materials shall be located at least of 50 feet from the property boundaries, where possible. Hay bales or equivalent will surround soil stockpiles except for areas where access by equipment is required. Silt fencing and hay bales will be used as needed near catch basins, surface waters and other discharge points.

4.13.4 Characterization of Excavated Materials

Soil/fill or other excavated media that is transported off-Site for disposal will be sampled in a manner required by the receiving facility, and in compliance with applicable laws and regulations. Soils proposed for reuse on-Site will be managed as defined in this plan.

4.13.5 Material Excavation and Load-Out

The RE overseeing the implementation of the remedy will:

- oversee the excavation and load-out of excavated material during the remedial action;
- ensure that there is a party responsible for the safe execution of invasive and other work performed under this work plan;
- ensure that Site development activities and development-related grading cuts will not interfere with, or otherwise impair or compromise the remedial activities proposed in this RAWP;
- ensure that the presence of utilities and easements on the Site has been investigated and that any identified risks from work proposed under this plan are properly addressed by appropriate parties;
- ensure that all loaded outbound trucks are inspected and cleaned if necessary, before leaving the Site; and,
- ensure that egress points for truck and equipment transport from the Site will be kept clean of Site-derived materials during the remedial action.

Locations where vehicles exit the Site shall be inspected daily for evidence of soil tracking off premises. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site-derived materials.

Open and uncontrolled mechanical processing of historical fill and contaminated soil on-Site will not be performed without prior NYSDEC approval.

4.13.6 Off-Site Materials Transport

Loaded vehicles leaving the Site will comply with all applicable materials transportation requirements (including appropriate covering, manifests, and placards) in accordance with applicable laws and regulations, including use of licensed haulers in accordance with 6 NYCRR Part 364. If loads contain wet material capable of causing leakage from trucks, truck liners will be used. Queuing of trucks will be performed on-Site, when possible in order to minimize off Site disturbance. Off-Site queuing will be minimized.

Outbound truck transport routes are described in the remedial report. This routing takes into account the following factors: (a) limiting transport through residential areas and past sensitive sites; (b) use of mapped truck routes; (c) minimizing off-Site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport. To the extent possible, all trucks loaded with Site materials will travel from the Site using these truck routes. Trucks will not stop or idle in the neighborhood after leaving the project Site.

4.13.7 Materials Disposal Off-Site

The following documentation will be established and reported by the RE for each disposal destination used in this project to document that the disposal of regulated material exported from the Site conforms with applicable laws and regulations: (1) a letter from the RE or Enrollee to each disposal facility describing the material to be disposed and requesting written acceptance of the material. This letter will state that material to be disposed is regulated material generated at an environmental remediation Site in New York City under a governmental remediation program. The letter will provide the project identity and the name and phone number of the RE or Enrollee. The letter will include as an attachment a summary of all chemical data for the material being transported; and (2) a letter from each disposal facility stating it is in receipt of the correspondence (1, above) and is approved to accept the material. These documents will be included in the FER.

The FER will include an itemized account of the destination of all material removed from the Site during this remedial action. Documentation associated with disposal of all material will include records and approvals for receipt of the material. This information will be presented in the final remedial report.

All impacted soil/fill or other waste excavated and removed from the Site will be managed as regulated material and will be disposed in accordance with applicable laws and regulations. Historic fill and contaminated soils taken off-Site will be handled as solid waste and will not be disposed at a Part 360-16 Registration Facility (also known as a Soil Recycling Facility).

Waste characterization will be performed for off-Site disposal in a manner required by the receiving facility and in conformance with its applicable permits. Waste characterization sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported in the final remedial report. A manifest system for off-Site transportation of exported materials will be employed. Manifest information will be reported in the final remedial report. Hazardous wastes derived from on-Site will be stored, transported, and disposed of in compliance with applicable laws and regulations.

If disposal of soil/fill from this Site is proposed for unregulated disposal (i.e., clean soil removed for development purposes), including transport to a Part 360-16 Registration Facility, a formal request will be made for approval by NYSDEC with an associated plan compliant with 6NYCRR Part 360-16. This request and plan will include the location, volume and a description of the material to be recycled, including verification that the material is not impacted by site uses and that the material complies with receipt requirements for recycling under 6NYCRR Part 360. This material will be appropriately handled on-Site to prevent mixing with impacted material.

4.13.8 Materials Reuse On-Site

Soil and fill that is derived from the property that meets the SCOs established in this plan may be reused on-Site. The SCOs for on-Site reuse are listed in **Section 4.2** of this cleanup plan. 'Reuse on-Site' means material that is excavated during the remedy or development, does not leave the property, and is relocated within the same property and on land with comparable levels of contaminants in soil/fill material, compliant with applicable laws and regulations, and addressed pursuant to the NYSBCP agreement subject to Engineering and Institutional Controls. The RE will ensure that reused materials are segregated from other materials to be exported from the Site and that procedures defined for material reuse in this remedial plan are followed.

Soil reuse on-site is not proposed for this project.

Organic matter (wood, roots, stumps, etc.) or other waste derived from clearing and grubbing of the Site will not be buried on-Site. Soil or fill excavated from the site for grading or other purposes will not be reused within a cover soil layer or within landscaping berms.

4.13.9 Demarcation

After completion of hotspot removal and any other invasive remedial activities, and prior to backfilling, the top of the residual soil/fill will be defined by one of three methods: (1) placement of a demarcation layer. The demarcation layer will consist of geosynthetic fencing or equivalent material to be placed on the surface of residual soil/fill to provide an observable reference layer. A description or map of the approximate depth of the demarcation layer will be provided in the SMP; or (2) a land survey of the top elevation of residual soil/fill before the placement of cover soils, pavement and associated sub-soils, or other materials or structures or, (3) all materials beneath the approved cover will be considered impacted and subject to site management after the remedy is complete.

Demarcation may be established by one or any combination of these three methods. As appropriate, a map showing the method of demarcation for the Site and all associated documentation will be presented in the FER.

This demarcation will constitute the top of the site management horizon. Materials within this horizon require adherence to special conditions during future invasive activities as defined in the Site Management Plan.

4.13.10 Import of Backfill Soil From Off-Site Sources

Imported soil will meet the requirements for NYSDEC approved backfill and cover soil for this Site. Imported soil will meet the lower of:

- Track 2 RR SCOs; and
- Groundwater Protection Standards in Part 375-6.8.

Approximately 1,200 CY of clean fill/topsoil and 124 CY of ¾-inch clean stone will be imported for backfilling of the hot spot areas, parking lot and for backfill around footings.

A process will be established to evaluate sources of backfill and cover soil to be imported to the Site and will include an examination of source location, current and historical us(s) and any applicable documentation. Material from industrial sites, spill sites, environmental remediation sites or potentially contaminated sites will not be imported to the Site.

For each source of backfill that is imported to the Site, one of the following will be completed prior to importing material:

- Documentation will be provided to NYSDEC as to the source of the material and the consistency of the material in accordance with the exemption for no chemical testing listed in DER-10 Section 5.4(e)(5); or
- Chemical testing will be completed in accordance with DER-10, Table 5.4(e)10 and shown below:

DER-10, Table 5.4(e)10

Recommended Number of Soil samples for Soil Imported to or Exported from a Site

Contaminant	VOCs	SVOCs, Inorganics & PCBs/Pesticides	
Soil Quantity (Cubic Yards)	Discrete Samples	Composite	Discrete Samples/Composite
0-50	1	1	3-5 discrete samples from different locations in the fill being provided will comprise a composite sample for analysis
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1000	7	2	

1000	Add an additional 2 VOC and 1 composite for each additional 1000 Cubic Yards or consult with DER.

In the event that laboratory analyses are performed, the results for each new source of fill must meet the requirements for Restricted Residential Use Standards listed in DER-10, Appendix 5, *Allowable Constituent Levels for Imported Fill or Soil* and must receive approval from NYSDEC.

The FER will report the source of the fill, evidence that an inspection was performed on the source, chemical sampling results, frequency of testing, and a Site map indicating the locations where backfill or soil cover was placed.

4.13.11 Fluids Management

Dewatering will be performed in order to excavate soil and fill material below the water table (approximately 15 feet bgs). All liquids to be removed from the Site, including dewatering fluids, will be handled, transported and disposed in accordance with applicable laws and regulations. Liquids discharged into the New York City sewer system will receive prior approval by New York City Department of Environmental Protection (NYC DEP). The NYC DEP regulates discharges to the New York City sewers under Title 15, Rules of the City of New York Chapter 19. Discharge to the New York City sewer system will require an authorization and sampling data demonstrating that the groundwater meets the City's discharge criteria. The dewatering fluid will be pretreated as necessary to meet the NYC DEP discharge criteria. If discharge to the City sewer system is not appropriate, the dewatering fluids will be managed by transportation and disposal at an off-Site treatment facility.

Discharge of water generated during remedial construction to surface waters (i.e. a stream or river) is prohibited without a SPDES permit issued by New York State Department of Environmental Conservation.

4.13.12 Stormwater Pollution Prevention

Applicable laws and regulations pertaining to stormwater pollution prevention will be addressed during the remedial program. Erosion and sediment control measures identified in this remedial plan (silt fences and barriers, and hay bale checks) will be installed around the entire perimeter of the remedial construction area and inspected once a week and after every storm event to ensure that they are operating appropriately. Discharge locations will be inspected to determine whether erosion control measures are effective in preventing significant impacts to receptors. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC. All necessary repairs shall be made immediately. Accumulated sediments will be removed as required to keep the barrier and hay bale check functional. Undercutting or erosion of the silt fence toe anchor will be repaired immediately with appropriate backfill materials. Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

4.13.13 Contingent Work Plan Activities

The potential exists that unforeseen impacts that would require immediate action by the RE may be encountered during implementation of the remedy. In order to address this potential, the following section provides contingency measures for addressing petroleum impacted or otherwise similarly impacted material and USTs should they be encountered during implementation of the RAWP.

Petroleum and/or Similarly Impacted Soil Removal

Petroleum and/or similarly impacted material (i.e., areas of heavily stained and/or odorous soil observed during soil disturbance activities) identified as result of the above identified screening, will either be excavated to the extent necessary to remove the impacted material or, the location of any impacted material will be properly documented. Impacted soil that cannot be removed due to structural concerns or other impediments will be further investigated to document the area of contamination being left in place. Impacted materials will be segregated, stockpiled, and properly characterized prior to off-site disposal as detailed in the SMMP.

If required and to the extent possible, during removal of any petroleum and/or similarly impacted materials, the excavation areas will be screened and inspected for the presence of impacts to the surrounding soils using a photoionization detector (PID). The RE will determine when the extents of these impacts have been properly removed based on screening results and will complete documentation sampling in accordance with the requirements defined in SMMP. As groundwater was determined to be located between approximately 15 feet below sidewalk level, contingent measures for the remediation of petroleum impacted groundwater are provided SMMP.

Underground Storage Tank (UST) Removal Contingency Plan

While it is not anticipated that USTs will be encountered during RAWP activities, if they are encountered, removal of the tanks and impacted soil will be completed in accordance with NYSDEC CP-51 Soil Cleanup Guidance and other applicable NYSDEC UST closure requirements.

During UST removal, excavation areas will be screened and inspected for the presence of petroleum-impacts to the surrounding soils. Any petroleum-impacted materials encountered during UST removal activities will be addressed in accordance with the measures identified in SMMP.

Following removal of any UST(s), affidavits of closure will be submitted to the FDNY, and PBS registration/de-registration applications will be submitted to NYSDEC.

4.13.14 Odor, Duct and Nuisance Control Plan

Dust, odor, and nuisance control will be accomplished by the Remedial Contractor as described in this section.

Odor Control

All necessary means will be employed to prevent on- and off-Site odor nuisances. At a minimum, procedures will include: (a) limiting the area of open excavations; (b) shrouding open excavations with tarps and other covers; and (c) use of foams to cover exposed odorous soils. If odors develop and cannot otherwise be controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-Site disposal; and (e) use of chemical odorants in spray or misting systems and subsequent remediation of these residues if still present on the Site.

This odor control plan is capable of controlling emissions of nuisance odors. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until nuisance odors have been abated. NYSDEC will be notified of odor complaint events.

Dust Control

Dust management during invasive on-Site work will include, at a minimum:

- Use of a dedicated water spray methodology for roads, excavation areas and stockpiles.
- Use of properly anchored tarps to cover stockpiles.
- Exercise extra care during dry and high-wind periods.
- Use of gravel or recycled concrete aggregate on egress and other roadways to provide a clean and dust-free road surface.

This dust control plan is capable of controlling emissions of dust. If nuisance dust emissions are identified, work will be halted and the source of dusts will be identified and corrected. Work will not resume until nuisance dust emissions have been abated. NYSDEC will be notified of dust complaint events.

Other Nuisances

Noise control will be exercised during the remedial program. Remedial work will conform, at a minimum, to NYC noise control standards.

Rodent control will be provided during Site clearing and grubbing and during the remedial program, as necessary, to prevent nuisances.

5

Remedial Action Management

5.1 Construction Health and Safety Plan

The Site-specific CHASP is included as **Appendix B.** The CHASP provides a mechanism for establishing on-Site safe working conditions, safety organization, procedures, and personal protective equipment (PPE) requirements. The CHASP meets the requirements of 29 CFR 1910 and 29 CFR 1926 (which includes 29 CFR 1910.120 and 29 CFR 1926.65). The CHASP includes, but is not limited to, the following components listed below:

- Organization and Identification of key personnel;
- Training requirements;
- Medical surveillance requirements;
- List of site hazards;
- Excavation safety;
- Work zone descriptions and monitoring procedures;
- Personal safety equipment and protective clothing requirements;
- Decontamination requirements;
- Standard operating procedures;
- Contingency Plan; and
- Material Safety Data Sheets.

5.2 Project Organization and Oversight

Following are the principal personnel who will be assigned to the management, oversight, and completion of this project:

Environmental Consultant
VHB Engineering, Surveying, Landscape Architecture and Geology, P.C.
One Penn Plaza
Suite 715
New York, NY 1119-0800
Office 212.857.7350

- VHB Principal/Project Coordinator – Catherine Applegate

Will be responsible for the overall coordination and management of the project.

- VHB Remediation Engineer – Catherine Applegate, P.E.

Will be responsible for data review, evaluation, oversight, and final sign-off where applicable.

- NYSDEC Project Manager – Jane O'Connell

Will be responsible for day-to-day coordination, scheduling, data review, and evaluation and will be the principal contact for matters relating to the environmental assessment and remediation.

- VHB Quality Assurance Officer – Rachael Barr

Will review sampling procedures and certify that the data was collected and analyzed using the appropriate procedures.

Subcontractors

- Laboratory

Alpha Analytical Laboratory
320 Forbes Boulevard
Mansfield, Massachusetts
NYSDOH Certification No. MA015
Office: 508-822-9300

- Environmental Data Validator

New Environmental Horizons Inc.
2 Farmers Circle
Arlington, Massachusetts
Office 781-643-4294

› Remedial Party Contact

YYY Brooklyn NY LLC c/o Maddd Equities, LLC
15 Verbana Avenue
New York, New York 10029
Office 516-821-2065

5.3 Site Security

Site access will be controlled by a guarded gated entrance and an entirely fenced property.

5.4 Work Hours

The hours for operation of cleanup will comply with the NYC Department of Buildings construction code requirements or according to specific variances issued by that agency. The hours of operation will be conveyed to NYSDEC during the pre-construction meeting.

5.5 Community Air Monitoring Plan

› A Community Air Monitoring Plan will be conducted in accordance with DER-10, Appendix 1A, NYS Department of Health (DOH) Generic Community Air Monitoring Plan, as outlined below during excavation work that impacts soil.

› Real-time air monitoring for volatile organic compounds (VOCs) and particulate levels at the perimeter of the exclusion zone or work area will be performed. Continuous monitoring will be performed for all ground intrusive activities and during the handling of contaminated or potentially contaminated media. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pit excavation or trenching, and the installation of soil borings or monitoring wells.

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

› CAMP readings will be submitted to NYSDEC and NYDOH on a weekly basis. Exceedances of action levels will be reported to the NYSDEC and NYDOH the same day or next business day is after hours. Daily reports will include the reason for exceedance, what was done to correct it, and whether the corrective measure was effective.

VOC Monitoring, Response Levels, and Actions

› Volatile organic compounds (VOCs) will be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis during invasive work.

Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work will be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment will be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment will 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 will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will 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 will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the 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 will be shutdown.

All 15-minute readings must be recorded and reported to NYSDEC and NYSDOH on a weekly basis. Exceedances will be reported to NYSDEC and NYSDOH the same day or the next business day is after hours. The report will include the reason for the exceedance, what was done to correct it, and if the corrective measure was effective.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations will be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring will 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 will 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 (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

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

All 15-minute readings must be recorded and reported to NYSDEC and NYSDOH on a weekly basis. Exceedances will be reported to NYSDEC and NYSDOH the same day or the next business day is after hours. The report will include the reason for the exceedance, what was done to correct it, and if the corrective measure was effective. Agency Approvals

All permits or government approvals required for remedial construction have been or will be obtained prior to the start of remedial construction. Approval of this RAWP by NYSDEC does not constitute satisfaction of these requirements and will not be a substitute for any required permit.

5.6 Site Preparation

Pre-Construction Meeting

NYSDEC will be invited to attend the pre-construction meeting at the Site with all parties involved in the remedial process prior to the start of remedial construction activities.

Mobilization

Mobilization will be conducted as necessary for each phase of work at the Site. Mobilization includes field personnel orientation, equipment mobilization (including securing all sampling equipment needed for the field investigation), marking/staking sampling locations and utility mark-outs. Each field team member will attend an orientation meeting to become familiar with the general operation of the Site, health and safety requirements, and field procedures.

Utility Marker Layouts, Easement Layouts

The presence of utilities and easements on the Site will be fully investigated prior to the performance of invasive work such as excavation or drilling under this plan by using, at a minimum, the One-Call System (811). Underground utilities may pose an electrocution, explosion, or other hazard during excavation or drilling activities. All invasive activities will be performed incompliance with applicable laws and regulations including NYC Building Code to assure safety. Utility companies and other responsible authorities will be contacted to locate and mark the locations, and a copy of the Mark-Out Ticket will be retained by the contractor prior to the start of drilling, excavation, or other invasive subsurface operations. Overhead utilities may be present within the anticipated work zones. Electrical hazards associated with drilling in the vicinity of overhead utilities will be prevented by maintaining a safe distance between overhead power lines and drill rig masts.

Proper safety and protective measures pertaining to utilities and easements, and compliance with all laws and regulations will be employed during invasive and other work contemplated under this RAWP. The integrity and safety of on-Site and off-Site structures will be

maintained during all invasive, excavation or other remedial activity performed under the RAWP.

Dewatering

Dewatering is anticipated during remediation and construction.

Dewatering will be performed in order to excavate soil and fill material below the water table (ranging from 7 to 18 feet bgs). Dewatering for this site will utilize a pumping system, settling tanks, possibly a treatment system prior to discharge into the city sewer system. All required permits will be obtained from NYCDEP prior to any discharge of groundwater into the sewer system.

Equipment and Material Staging

Equipment and materials will be stored and staged in a manner that complies with applicable laws and regulations. Staging locations will be reported to NYSDEC prior to the start of the remedial action.

Stabilized Construction Entrance

Steps will be taken to ensure that trucks departing the site will not track soil, fill or debris off-Site. Such actions may include use of cleaned asphalt or concrete pads or use of stone or other aggregate-based egress paths between the truck inspection station and the property exit. Measures will be taken to ensure that adjacent roadways will be kept clean of project related soils, fill and debris.

Truck Inspection Station

An outbound-truck inspection station will be set up close to the Site exit. Before exiting the Site, trucks will be required to stop at the truck inspection station and will be examined for evidence of contaminated soil on the undercarriage, body, and wheels. Soil and debris will be removed. Brooms, shovels, and clean water will be utilized for the removal of soil from vehicles and equipment, as necessary.

Extreme Storm Preparedness and Response Contingency Plan

Damage from flooding or storm surge can include dislocation of soil and stockpiled materials, dislocation of site structures and construction materials and equipment, and dislocation of support of excavation structures. Damage from wind during an extreme storm event can create unsafe or unstable structures, damage safety structures and cause downed power lines creating dangerous site conditions and loss of power. In the event of emergency conditions caused by an extreme storm event, the enrollee will undertake the following steps for site preparedness prior to the event and response after the event.

Storm Preparedness

Preparations in advance of an extreme storm event will include the following: containerized hazardous materials and fuels will be removed from the property; loose materials will be secured to prevent dislocation and blowing by wind or water; heavy equipment such as excavators and generators will be removed from excavated areas, trenches and depressions on the property to high ground or removed from the property; an inventory of the property

with photographs will be performed to establish conditions for the site and equipment prior to the event; stockpile covers for soil and fill will be secured by adding weights such as sandbags for added security and worn or ripped stockpile covers will be replaced with competent covers; stockpiled hazardous wastes will be removed from the property; stormwater management systems will be inspected and fortified, including, as necessary: clean and reposition silt fences, hay bales; clean storm sewer filters and traps; and secure and protect pumps and hosing.

Storm Response

At the conclusion of an extreme storm event, as soon as it is safe to access the property, a complete inspection of the property will be performed. A site inspection report will be submitted to NYSDEC at the completion of site inspection and after the site security is assessed. Site conditions will be compared to the inventory of site conditions and material performed prior to the storm event and significant differences will be noted. Damage from storm conditions that result in acute public safety threats, such as downed power lines or imminent collapse of buildings, structures or equipment will be reported to public safety authorities via appropriate means such as calling 911. Petroleum spills will be reported to NYSDEC within 2 hours of identification and consistent with State regulations. Emergency and spill conditions will be reported to NYSDEC. Public safety structures, such as construction security fences will be repaired promptly to eliminate public safety threats. Debris will be collected and removed. Dewatering will be performed in compliance with existing laws and regulations and consistent with emergency notifications, if any, from proper authorities. Eroded areas of soil including unsafe slopes will be stabilized and fortified. Dislocated materials will be collected and appropriately managed. Support of excavation structure will be inspected and fortified as necessary. Impacted stockpiles will be contained and damaged stockpile covers will be replaced. Stormwater control systems and structures will be inspected and maintained as necessary. If soil or fill materials are discharged off site to adjacent properties, property owners and NYSDEC will be notified and corrective measure plan designed to remove and clean dislocated material will be submitted to NYSDEC and implemented following approval by NYSDEC and granting of site access by the property owner. Impacted offsite areas may require characterization based on site conditions, at the discretion of NYSDEC. If onsite petroleum spills are identified, a qualified environmental professional will determine the nature and extent of the spill and report to NYSDEC's spill hotline at 800-457-7362 within statutory defined timelines. If the source of the spill is ongoing and can be identified, it should be stopped if this can be done safely. Potential hazards will be addressed immediately, consistent with guidance issued by NYSDEC.

Storm Response Reporting

A site inspection report will be submitted to NYSDEC at the completion of the site inspection. Site conditions will be compared to the inventory of site conditions and material performed prior to the storm event and significant differences will be noted. Site conditions will be compared to the inventory of site conditions and material performed prior to the storm event and significant differences will be noted. The site inspection report will be sent to the NYSDEC project manager and will include the site name, address, tax block and lot, site primary and alternate contact name and phone number. Damage and soil release

assessment will include: whether the project had stockpiles; whether stockpiles were damaged; photographs of damage and notice of plan for repair; report of whether soil from the site was dislocated and whether any of the soil left the site; estimates of the volume of soil that left the site, nature of impact, and photographs; description of erosion damage; description of equipment damage; description of damage to the remedial program or the construction program, such as damage to the support of excavation; presence of onsite or offsite exposure pathways caused by the storm; presence of petroleum or other spills and status of spill reporting to NYSDEC; description of corrective actions; schedule for corrective actions. This report should be completed and submitted to NYSDEC project manager with photographs within 24 hours of the time of safe entry to the property after the storm event.

5.7 Traffic Control

Drivers of trucks leaving the Site with soil/fill will be instructed to proceed without stopping in the vicinity of the Site to prevent neighborhood impacts. The planned route on local roads for trucks leaving the site is shown on **Figure 14**.

5.8 Demobilization

Demobilization will include:

- As necessary, restoration of temporary access areas and areas that may have been disturbed to accommodate support areas (e.g., staging areas, decontamination areas, storage areas, temporary water management areas, and access area);
- Removal of sediment from erosion control measures and truck wash and disposal of materials in accordance with applicable laws and regulations;
- Equipment decontamination, and;
- General refuse disposal.

Equipment will be decontaminated and demobilized at the completion of all field activities. Investigation equipment and large equipment (e.g., soil excavators) will be washed at the truck inspection station as necessary. In addition, all investigation and remediation derived waste will be appropriately disposed.

5.9 Complaint Management

All complaints from citizens will be promptly reported to NYSDEC . Complaints will be addressed and outcomes will be reported to NYSDEC in daily reports. Notices to NYSDEC will include the nature of the complaint, the party providing the complaint, and the actions taken to resolve any problems.

5.10 Deviations From The Remedial Action Work Plan

All changes to the RAWP will be reported to, and approved by, the NYSDEC Project Manager and will be documented in daily reports and reported in the FER. The process to be followed

if there are any deviations from the RAWP will include a request for approval for the change from NYSDEC noting the following:

- Reasons for deviating from the approved RAWP;
- Effect of the deviations on overall remedy; and
- Determination with basis that the remedial action with the deviation(s) is protective of public health and the environment.

6

Reporting

6.1 Notification

The NYSDEC will be notified at least 10 days prior to commencement of RAWP-related work. A preconstruction meeting will be coordinated between the RE, the Remediation Contractor, and the NYSDEC. This meeting must be coordinated prior to the implementation of this RAWP.

6.2 Monthly & Daily Progress Reports

Monthly Progress Reports will be prepared for the project file and submitted to the NYSDEC for review. Progress reports will include:

An update of progress made during the reporting period;

- Discussion of project progress and significant activities during the reporting period, including permit status;
- Discussion of pending/planned activities during the next two months or other authorized timeframe;
- Approved schedule or modifications to schedule;
- Discussion of problems encountered or delays;
- Proposed actions to correct identified problems, including adverse schedule impacts;

- Locations of work and quantities of material imported and remediation waste exported from the site, with name of disposal facilities, transporters'' dates of disposal and if applicable, manifest numbers;
- References to map for site activities;
- A summary of any and all complaints with relevant details (names, phone numbers);
- A summary of CAMP results, including STEL exceedances; and
- An explanation of notable site conditions.

Monthly Progress reports are not intended to be the mode of communication for notification to the NYSDEC of emergencies (accident, spill), requests for changes to the RAWP or other sensitive or time critical information; however, such conditions will be included in the daily reports during active Site excavation activities. Emergency conditions and changes to the RAWP will be addressed directly to the NYSDEC Project Manager via personal communication. If Site conditions warrant, the RE may request to increase the frequency of progress reports to weekly or daily reporting periods that include the above information. As described in previous sections of this RAWP, daily reports will be provided to NYSDEC during active Site remedial excavation work as part of the CAMP monitoring.

6.3 Final Engineering Report (FER)

A FER will be prepared and signed by Applicant's RE for submittal to the NYSDEC. The FER will be prepared in accordance with 6 NYCRR Part 375 and DER-10 and will provide a narrative description of the work performed, including modifications to the original work plan if necessary, and appending supporting documentation.

The FER will include:

- Information required by this RAWP;
- Text description with thorough detail of all engineering and institutional controls (if Track 1 remedial action is not achieved)
- As-built drawings for all constructed remedial elements;
- Manifests for al soil or fill disposal;
- Photographic documentation of remedial work performed under this remedy;
- Site Management Plan (if Track 1 remedial action is not achieved);
- Description of any changes in the remedial action from the elements provided in this RAWP and associated design documents;
- Tabular summary of all end point sampling results (including all soil test results from the remedial investigation for soil that will remain on site) and all soil/fill waste characterization results, QA/QC results for endpoint sampling, and other sampling and chemical analysis performed as part of the remedial action;
- Test results or other evidence demonstrating that remedial systems are functioning properly;

- Account of the source area locations and characteristics of all soil or fill material removed from the Site including a map showing the location of these excavations and hotspots, tanks, or other contaminant source areas;
- Full accounting of the disposal destination of all contaminated material removed from the Site. Documentation associated with disposal of all material will include transportation and disposal records, and letters approving receipt of the material;
- Account of the origin and required chemical quality testing for material imported onto the Site;
- Continue registration of the property with an E-Designation by the NYCDOB (if Track 1 remedial action is not achieved);
- The RAWP and Remedial Investigation Report will be included as appendices to the FER;
- Reports and supporting material will be submitted in digital form and final PDF's will include bookmarks for each appendix.

6.4 Report Submittal

As specified in DER-10, Section 1.15, reports will be submitted to NYSDEC in accordance with the NYDEC Electronic Document Standards (EDS). Data generated will be submitted in an electronic data deliverable (EDD) that complies with the NYSDEC Electronic Data Warehouse Standards (EDWS). Data validation will be performed in general accordance with NYSDEC DUSR requirements for organic and inorganic data review.

7

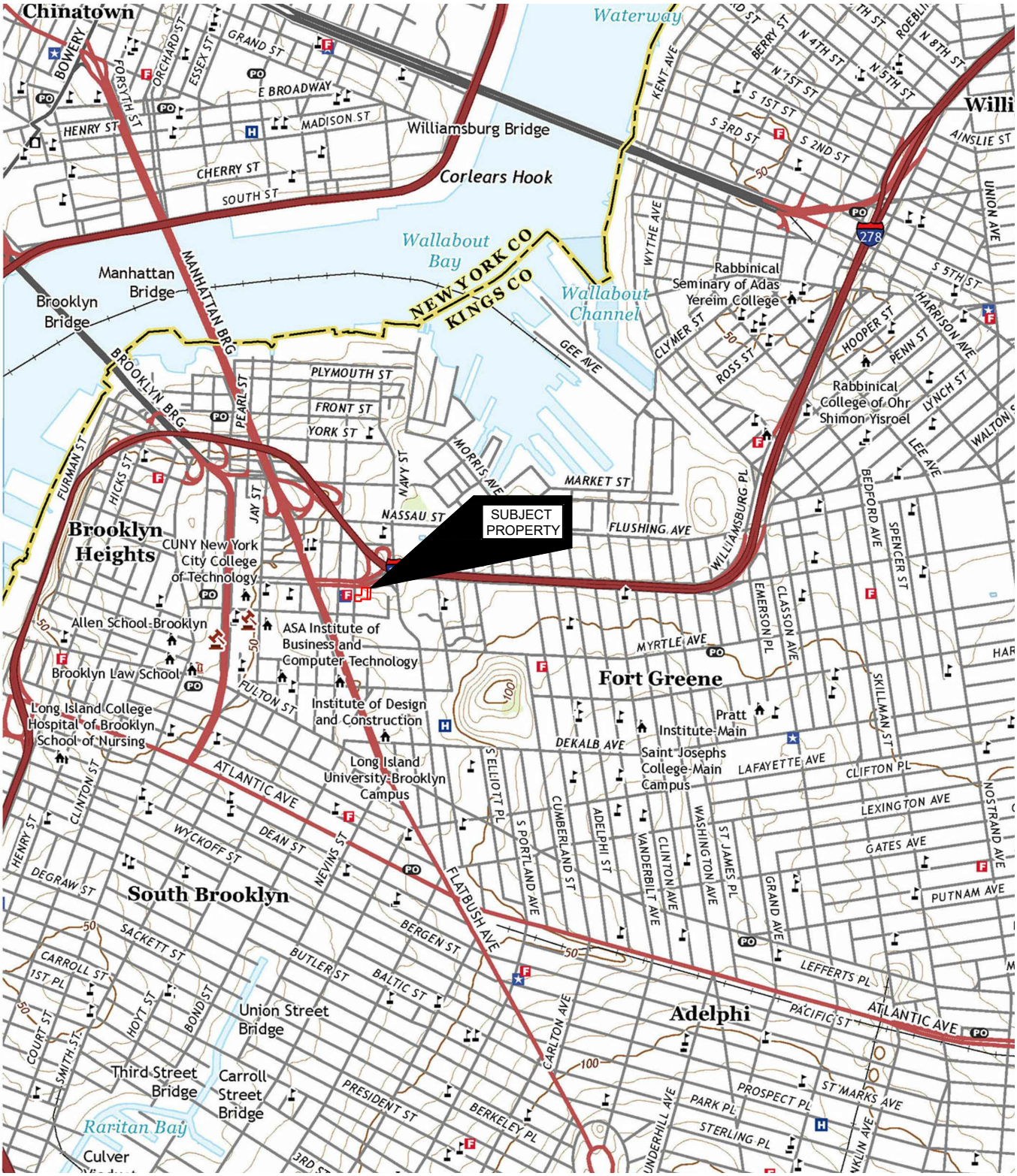
Schedule

The table below presents an estimated schedule for the proposed remedial work and reporting. If the schedule changes, it will be updated and submitted to NYSDEC.

Table 2. Proposed Schedule for Remedial Activities

Activity	Months (following approval of RAWP)							
	1	2	3	4	5	6	7	8
Site Preparation and Building Demolition (Demolition may commence before RAWP approval)								
Excavation of Contaminated Soil/Historic Fill Source Areas and Dewatering								
Preparation and Submission of FER								

Figures



SCALE: 1 : 24,000
PHOTO REVISED: 2019

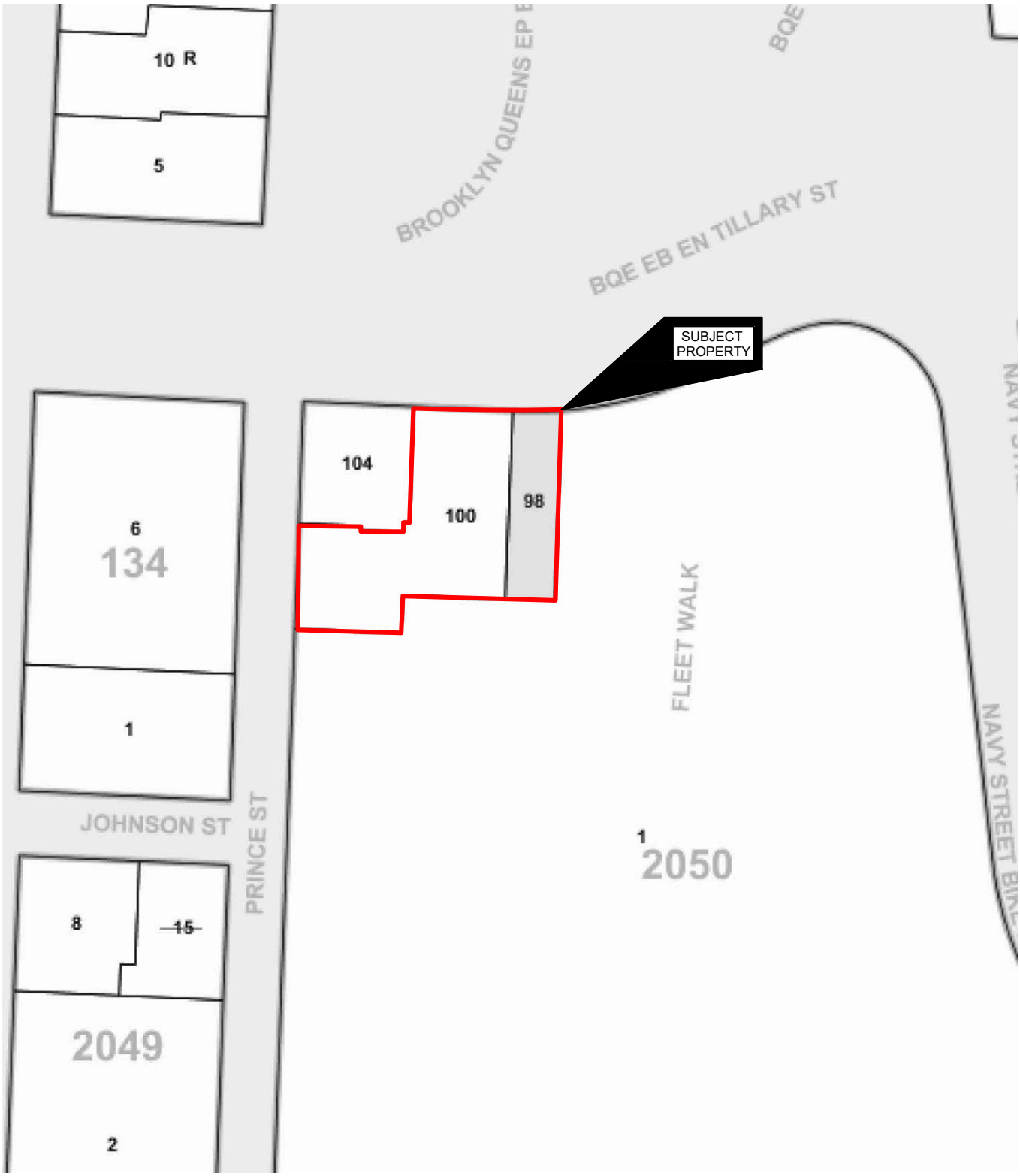
0′ 1000′ 2000′

SCALE: 1"=2000′

vhb

FIGURE 1 – SITE LOCATION MAP
U.S.G.S. TOPOGRAPHIC BROOKLYN, NY QUAD
67 PRINCE STREET (AKA 202 – 208 TILLARY STREET)
BLOCK 2050, LOTS 98 & 100
BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK

DATE: 12/16/2022	JOB NO.: 21183.01	SCALE: 1″ = 2000′



0′ 60′ 120′

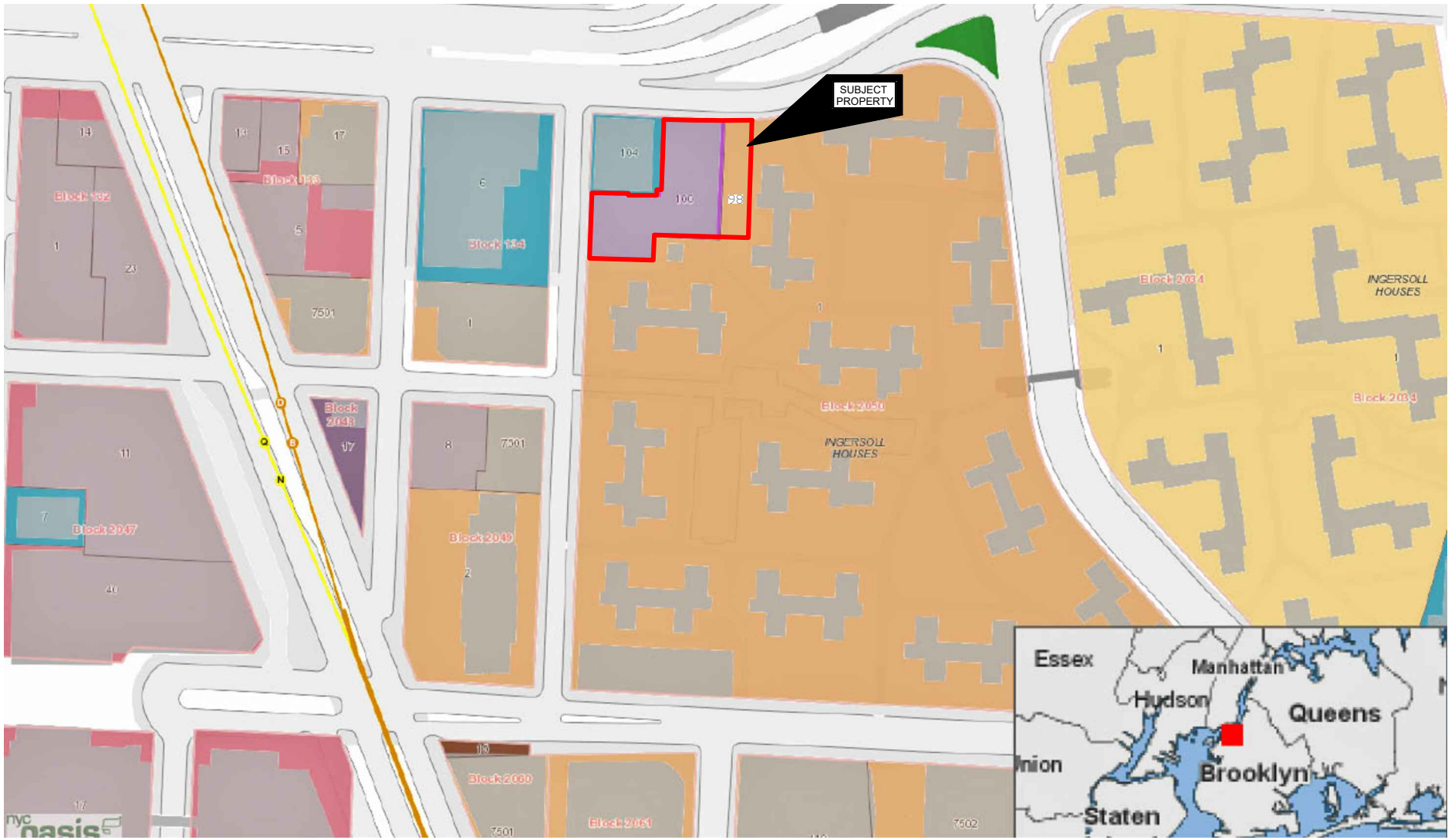
SCALE: 1"=120′

vhb

FIGURE 2 – SITE BOUNDARY MAP

67 PRINCE STREET (AKA 202 – 208 TILLARY STREET)
BLOCK 2050, LOTS 98 & 100
BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK

DATE: 12/16/2022	JOB NO.: 21183.01	SCALE: 1″ = 120′



Legend

- Parks, Playgrounds, & Open Space
  - Open Space (NYC Dept of City Planning)
  - Forested Areas (NJ)
  - Community Gardens
  - School property with garden
  - Playgrounds
  - Green Spaces Along Streets
  - Golf Courses
  - Baseball/Soccer/Football Fields
  - Tennis/Basketball/Handball Courts & Tracks
  - Cemeteries
- Land Use
  - Block/Lot Boundaries
  - (Building footprints in gray)
  - 1 & 2 Family Residential
  - Multi-family Residential
  - Mixed Use
  - Open space & outdoor recreation
  - Commercial
  - Institutions
  - Industrial
  - Parking
  - Transportation / Utilities
  - Vacant Lots

0′ 100′ 200′

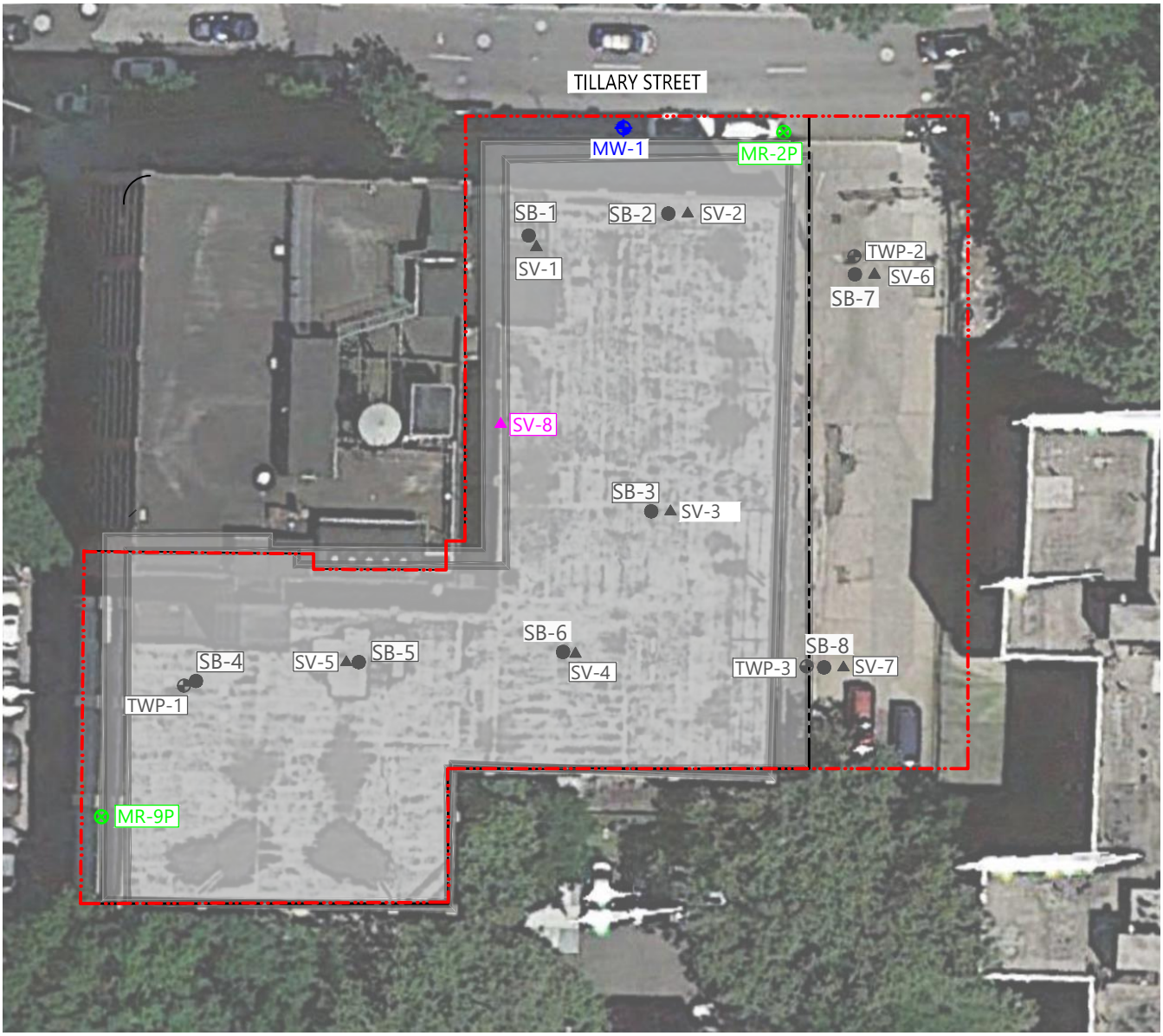
SCALE: 1"=200′

vhb

FIGURE 3 - SURROUNDING LAND USE MAP

67 PRINCE STREET (AKA 202 - 208 TILLARY STREET)
BLOCK 2050, LOTS 98 & 100
BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK

DATE:	JOB NO.:	SCALE:
12/16/2022	21183.01	1" = 200′



LEGEND

- SITE BOUNDARY
- LOT BOUNDARY
- EXISTING BUILDING FOOTPRINT
- MW-1 - MONITORING WELL - JULY 2022 SAMPLE
- SV-8 - SOIL VAPOR SAMPLE - JULY 2022
- MR-2P - PIZEOMETER WELL - JULY 2020 AND JULY 2022 GROUNDWATER SAMPLE
- MR-2P - SOIL VAPOR SAMPLE - OCTOBER 2020
- SB-1 - SOIL SAMPLE - OCTOBER 2020
- TWP-1 - GROUNDWATER SAMPLE - OCTOBER 2020

0' 20' 40'

SCALE: 1"= 40'

NOTE:
LOCATIONS OF MW-1 AND SV-8 ARE BASED ON COMMUNICATION FROM NYSDEC DATED 06/02/2022.

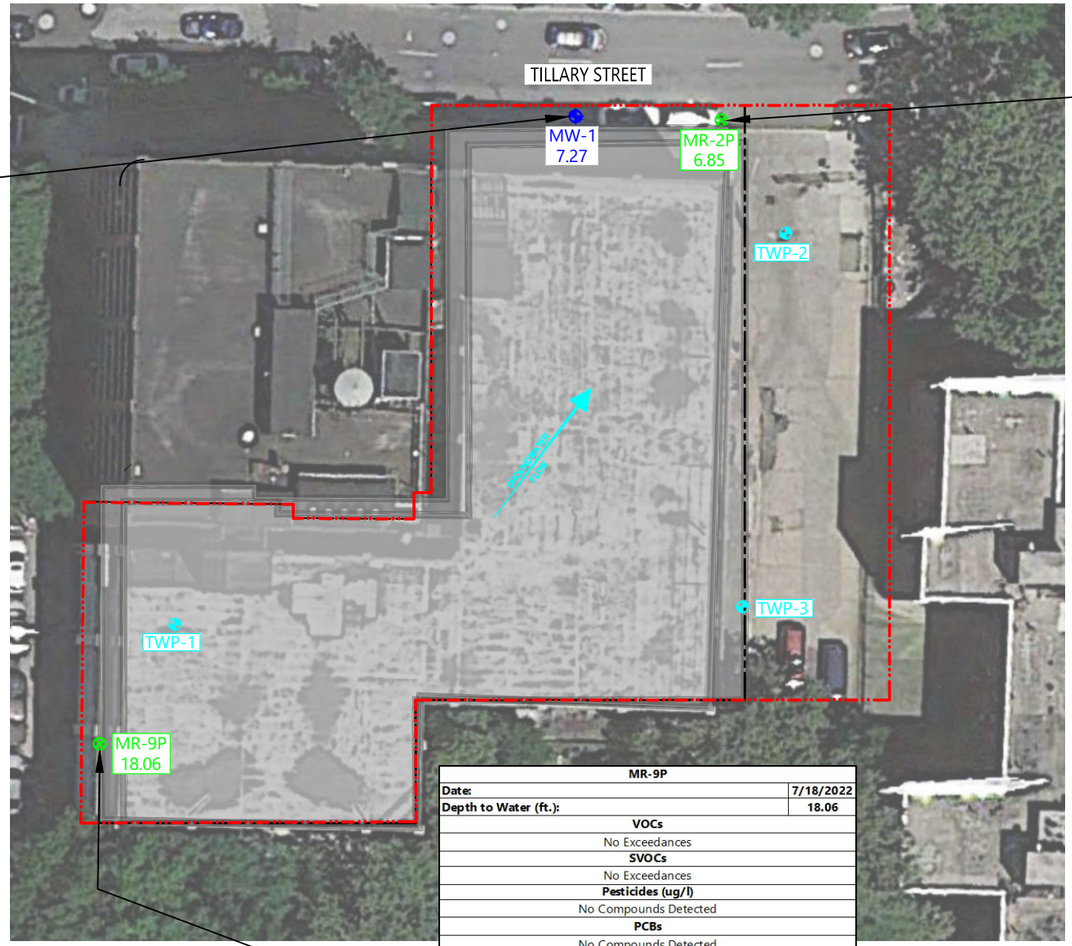
vhb

FIGURE 4 - SUPPLEMENTAL RI SAMPLE LOCATION MAP

67 PRINCE STREET (AKA 202-208 TILLARY STREET)
BLOCK 2050, LOTS 98 AND 100
BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK

DATE:	JOB NO.:	SCALE:
8/5/22	21183.01	AS SHOWN

MW-1	
Date:	**7/18/2022**
Depth to Water (ft.):	**7.27**
VOCs	
No Exceedances	
SVOCs	
No Exceedances	
Pesticides	
No Compounds Detected	
PCBs	
No Compounds Detected	
Metals (ug/l)	
Manganese	**3.26**
Sodium	**2450 J+**
Selenium	**12.1**
1,4-Dioxane by 88270D-SIM (ug/l)	
1,4-Dioxane	ND<40
Per- and Polyfluorinated Alkyl Substances (ng/l)	
Perfluorobutanoic Acid (PFBA)	**30.1**
Perfluoropentanoic Acid (PFPeA)	**44.2**
Perfluorobutanesulfonic Acid (PFBS)	**16.2**
Perfluorohexanoic Acid (PFHxA)	**32.6**
Perfluoroheptanoic Acid (PFHpA)	**26.2**
Perfluorohexanesulfonic Acid (PFHxS)	**13.1**
Perfluorooctanoic Acid (PFOA)	**120**
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND < 24
Perfluoroheptanesulfonic Acid (PFHpS)	ND < 9.62
Perfluorononanoic Acid (PFNA)	**24.1**
Perfluorooctanesulfonic Acid (PFOS)	**676**
Perfluorodecanoic Acid (PFDA)	ND < 9.62
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND < 9.62
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND < 9.62
Perfluoroundecanoic Acid (PFUnA)	ND < 9.62 UJ
Perfluorodecanesulfonic Acid (PFDS)	ND < 9.62 UJ
Perfluorooctanesulfonamide (FOSA)	ND < 9.62 UJ
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND < 9.62
Perfluorododecanoic Acid (PFDoA)	ND < 9.62
Perfluorotridecanoic Acid (PFTrDA)	ND < 9.62 UJ
Perfluorotetradecanoic Acid (PFTA)	ND < 9.62



MR-2P	
Date:	**7/18/2022**
Depth to Water (ft.):	**6.85**
VOCs	
No Exceedances	
SVOCs	
No Exceedances	
Pesticides (ug/l)	
No Compounds Detected	
PCBs	
No Compounds Detected	
Metals (ug/l)	
Manganese	**1.51**
Sodium	**2250 J+**
Selenium	**26.1**
1,4-Dioxane by 88270D-SIM (ug/l)	
1,4-Dioxane	ND<40
Per- and Polyfluorinated Alkyl Substances (ng/l)	
Perfluorobutanoic Acid (PFBA)	**33.7**
Perfluoropentanoic Acid (PFPeA)	**57**
Perfluorobutanesulfonic Acid (PFBS)	ND < 9.62
Perfluorohexanoic Acid (PFHxA)	**49.6**
Perfluoroheptanoic Acid (PFHpA)	**41.1**
Perfluorohexanesulfonic Acid (PFHxS)	**12.6**
Perfluorooctanoic Acid (PFOA)	**228**
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	**ND < 24**
Perfluoroheptanesulfonic Acid (PFHpS)	ND < 9.62
Perfluorononanoic Acid (PFNA)	**53.3**
Perfluorooctanesulfonic Acid (PFOS)	**295**
Perfluorodecanoic Acid (PFDA)	ND < 9.62
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND < 9.62
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND < 9.62
Perfluoroundecanoic Acid (PFUnA)	ND < 9.62
Perfluorodecanesulfonic Acid (PFDS)	ND < 9.62
Perfluorooctanesulfonamide (FOSA)	ND < 9.62
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND < 9.62
Perfluorododecanoic Acid (PFDoA)	ND < 9.62
Perfluorotridecanoic Acid (PFTrDA)	ND < 9.62 UJ
Perfluorotetradecanoic Acid (PFTA)	ND < 9.62

MR-9P	
Date:	**7/18/2022**
Depth to Water (ft.):	**18.06**
VOCs	
No Exceedances	
SVOCs	
No Exceedances	
Pesticides (ug/l)	
No Compounds Detected	
PCBs	
No Compounds Detected	
Metals (ug/l)	
Magnesium	**40.8**
Manganese	**0.6**
Selenium	**157 J+**
1,4-Dioxane by 88270D-SIM (ug/l)	
1,4-Dioxane	ND<40
Per- and Polyfluorinated Alkyl Substances (ng/l)	
Perfluorobutanoic Acid (PFBA)	**18.4**
Perfluoropentanoic Acid (PFPeA)	**18.7**
Perfluorobutanesulfonic Acid (PFBS)	**14.7**
Perfluorohexanoic Acid (PFHxA)	**20.8**
Perfluoroheptanoic Acid (PFHpA)	**14.4**
Perfluorohexanesulfonic Acid (PFHxS)	**5.45**
Perfluorooctanoic Acid (PFOA)	**148**
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	ND < 4.81
Perfluoroheptanesulfonic Acid (PFHpS)	ND < 1.92
Perfluorononanoic Acid (PFNA)	**3.17**
Perfluorooctanesulfonic Acid (PFOS)	**35**
Perfluorodecanoic Acid (PFDA)	ND < 1.92
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	ND < 1.92
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA)	ND < 1.92
Perfluoroundecanoic Acid (PFUnA)	ND < 1.92
Perfluorodecanesulfonic Acid (PFDS)	ND < 1.92
Perfluorooctanesulfonamide (FOSA)	ND < 1.92
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	ND < 1.92
Perfluorododecanoic Acid (PFDoA)	ND < 1.92
Perfluorotridecanoic Acid (PFTrDA)	ND < 1.92
Perfluorotetradecanoic Acid (PFTA)	ND < 1.92

Qualifiers:

J+ = Results is usable as an estimated value with possible high bias

UJ = Non-detect is usable as an estimated value with indeterminate bias

Notes:

1) NY-AWQS = New York TOGS 1.1.1. Ambient Water Quality Standards criteria reflects all addendum to criteria through June 2004.
2) **Bold** = Detected Compounds (For PFAS compounds)
3) **Bold & RED** = exceeds NY-AWQS.
4) Compounds that are highlighted gray were not detected but the RLs and/or MDLs are above the applicable standard.
5) -- = Compound not analyzed
6) NA = No applicable standard.
7) ND < ## = Analyte Not detected above Reporting Limit
8) RL = Reporting Limit.
9) Concentrations reported in micrograms per liter (ug/l) and nanograms per liter (ng/l) for PFAS compounds

New York TOGS 111 Ambient Water Quality Standards (ug/l)	
Compound	**NY-AWQS**
Metals	
Magnesium	35,000
Manganese	300
Selenium	10
Sodium	20,000

LEGEND

- SITE BOUNDARY
- LOT BOUNDARY
- EXISTING BUILDING FOOTPRINT
- MONITORING WELL (MW-1)
- PIZEOMETER WELL - JULY 2020 AND GROUNDWATER SAMPLE (MR-2P)
- GROUNDWATER SAMPLE LOCATION (TWP-1)

NOTE:
LOCATIONS OF MW-1 AND SV-8 ARE BASED ON COMMUNICATION FROM NYSDEC DATED 06/02/2022.

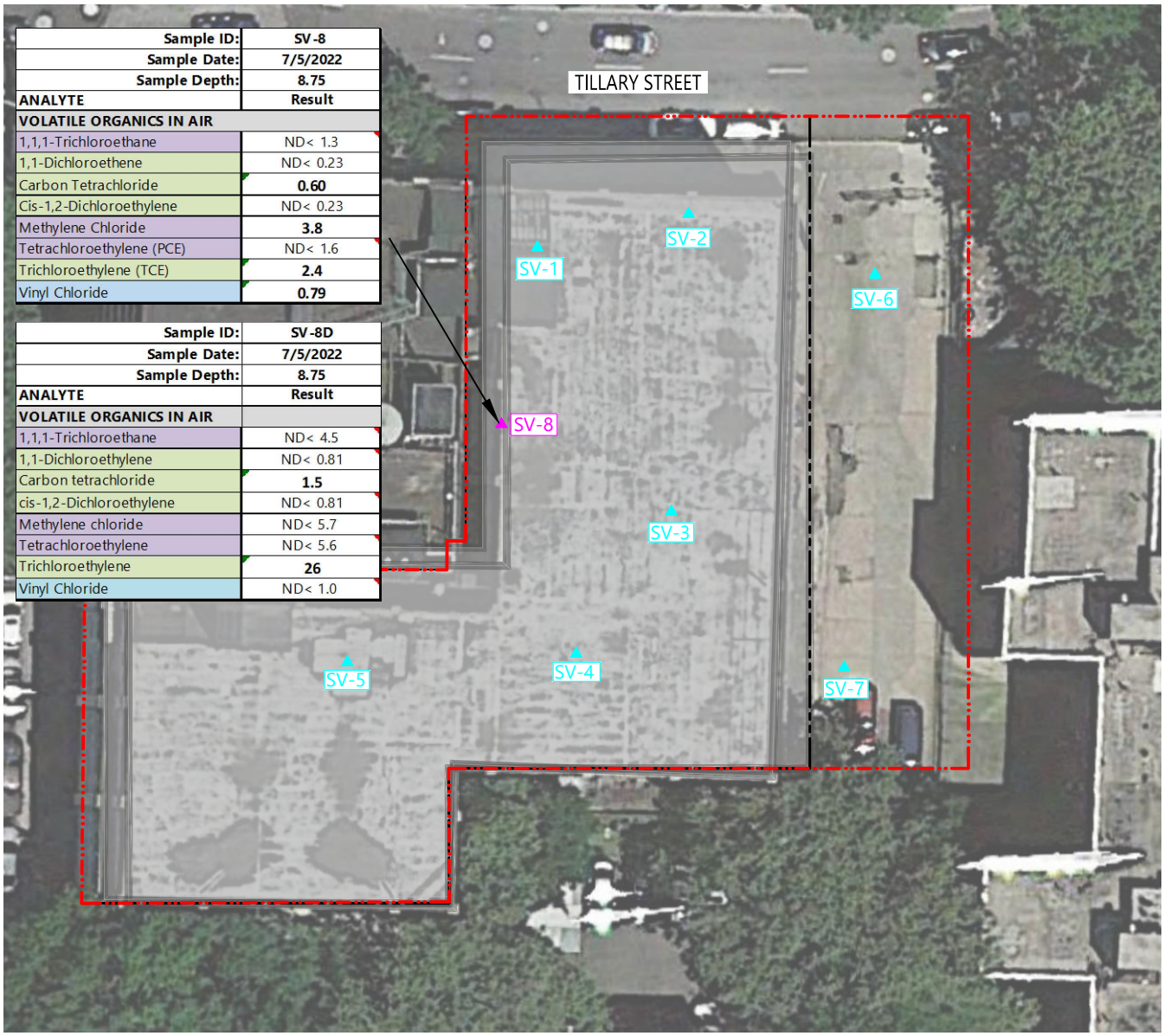
0' 20' 40'

SCALE: 1"= 40'

vhb

FIGURE 5 - SUPPLEMENTAL RI GROUNDWATER SAMPLE RESULTS MAP
67 PRINCE STREET (AKA 202 - 208 TILLARY STREET)
BLOCK 2050, LOTS 98 AND 100
BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK

DATE: 10/13/22 | JOB NO.: 21183.01 | SCALE: AS SHOWN



Sample ID:	SV-8
Sample Date:	7/5/2022
Sample Depth:	8.75
ANALYTE	**Result**
VOLATILE ORGANICS IN AIR	
1,1,1-Trichloroethane	ND< 1.3
1,1-Dichloroethene	ND< 0.23
Carbon Tetrachloride	**0.60**
Cis-1,2-Dichloroethylene	ND< 0.23
Methylene Chloride	**3.8**
Tetrachloroethylene (PCE)	ND< 1.6
Trichloroethylene (TCE)	**2.4**
Vinyl Chloride	**0.79**

Sample ID:	SV-8D
Sample Date:	7/5/2022
Sample Depth:	8.75
ANALYTE	**Result**
VOLATILE ORGANICS IN AIR	
1,1,1-Trichloroethane	ND< 4.5
1,1-Dichloroethylene	ND< 0.81
Carbon tetrachloride	**1.5**
cis-1,2-Dichloroethylene	ND< 0.81
Methylene chloride	ND< 5.7
Tetrachloroethylene	ND< 5.6
Trichloroethylene	**26**
Vinyl Chloride	ND< 1.0

1) Units in micrograms per cubic meter (µq/m^3)
2) Sample depths are reported in feet below ground surface (ft bgs)
3) NYSDOH = New York State Department of Health
4) ND = Compound Not Detected at or above the level indicated
5) Figure 6 revised on January 10, 2023 to report results in µg/m^3

Notes:
NYSDOH Matrix A
NYSDOH Matrix B
NYSDOH Matrix C

LEGEND

- SITE BOUNDARY
- LOT BOUNDARY
- EXISTING BUILDING FOOTPRINT
- SV-1 - FORMER SOIL VAPOR LOCATION - OCTOBER 2020
- SV-8 - SOIL VAPOR LOCATION - JULY 2022

0' 20' 40'

SCALE: 1"= 40'

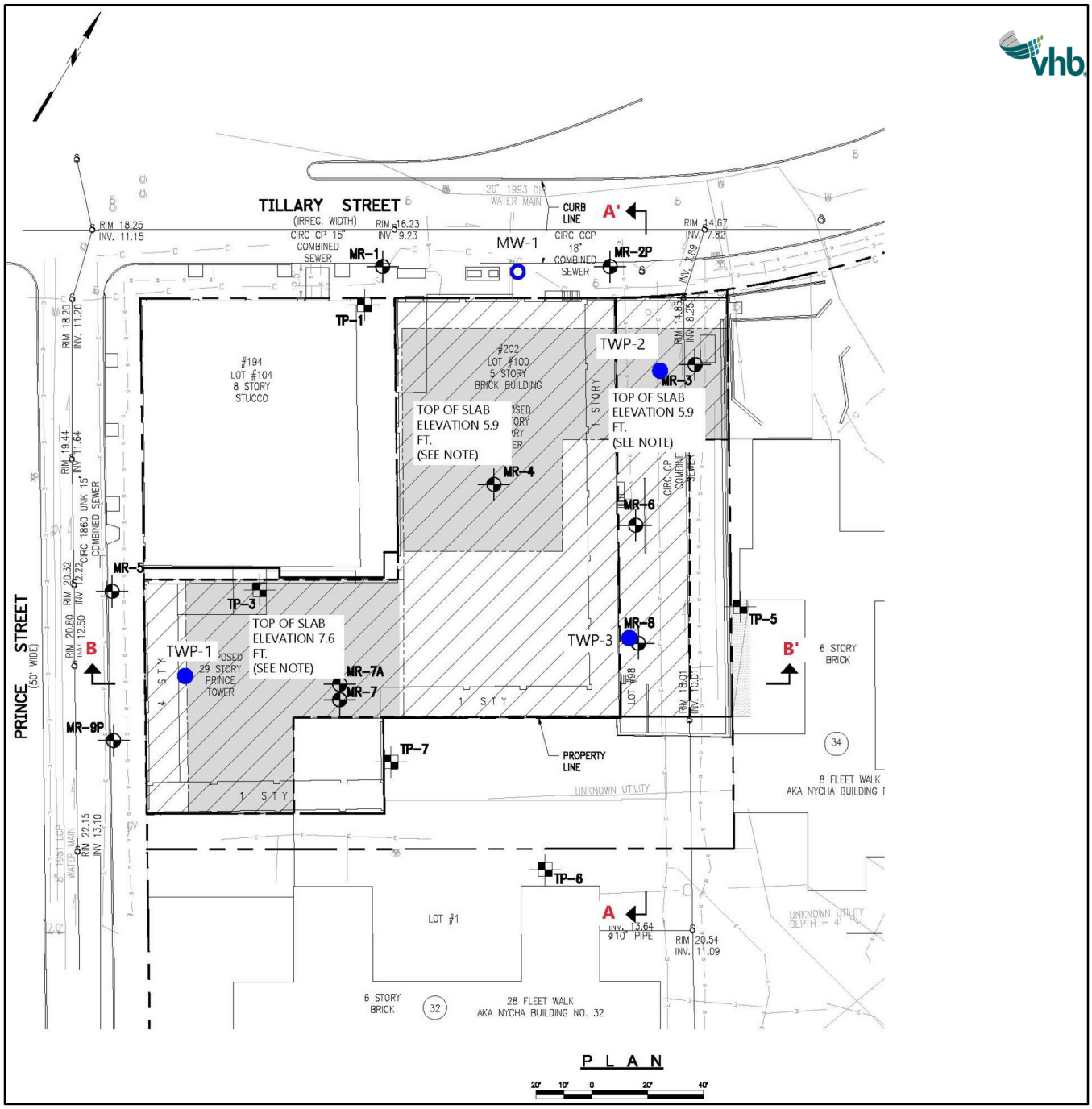
FIGURE 6 - SOIL VAPOR SAMPLE RESULTS MAP

67 PRINCE STREET (AKA 202 - 208 TILLARY STREET)
BLOCK 2050, LOTS 98 AND 100
BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK

DATE: 01/10/2023	JOB NO.: 21183.01	SCALE: AS SHOWN

Figure 7: Well Location Map

Remedial Action Work Plan | 67 Prince Street, Brooklyn, NY 11201



Path: \\vhb.com\gis\proj\Manasquan\21183.01 YYY Pl Tillary St\Project\RAWP\Figs\7-9\Figs7-9.aprx (imielczarek, 12/16/2022)

- APPROXIMATE LOCATION OF PERMANENT MONITORING WELL MW-1 (INSTALLED JULY 2022)
- APPROXIMATE LOCATION OF TEMPORARY WELL POINTS (INSTALLED OCTOBER 2020)

NOTE:

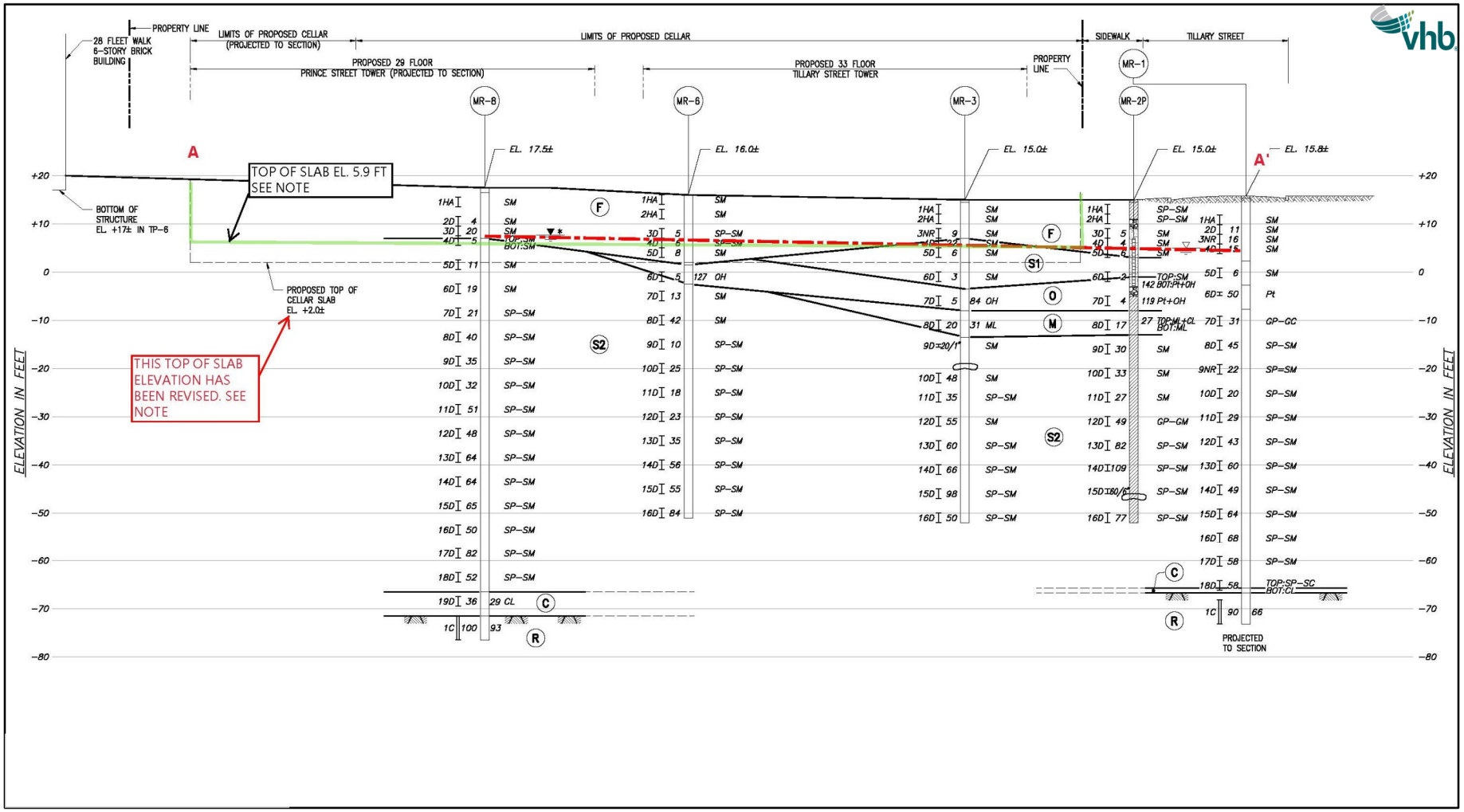
1. TOP OF SLAB ELEVATION FROM DWG ENTITLED BORING LOCATION PLAN (B-1) DATED 09-09-2020 BY MUESER RUTLEDGE CONSULTING ENGINEERS.

2. COLOR AND LOCATIONS OF MW-1 AND TWPS ADDED BY VHB 11-22-2022.

3. GEOLOGIC PROFILE FROM FIGURE GS-1, GEOTECHNICAL REPORT BY MUESER RUTLEDGE DATED 09/18/2020.

Figure 8: Geologic Cross Section Map A-A'

Remedial Action Work Plan | 67 Prince Street, Brooklyn, NY 11201



PROPOSED TOP OF CELLAR SLAB EL. 5.9 FT.

OBSERVED GROUNDWATER LEVEL EL. 4.9 FT.

1. TOP OF SLAB ELEVATION FROM DWG ENTITLED BORING LOCATION PLAN (B-1) DATED 09-09-2020 BY MUESER RUTLEDGE CONSULTING ENGINEERS.

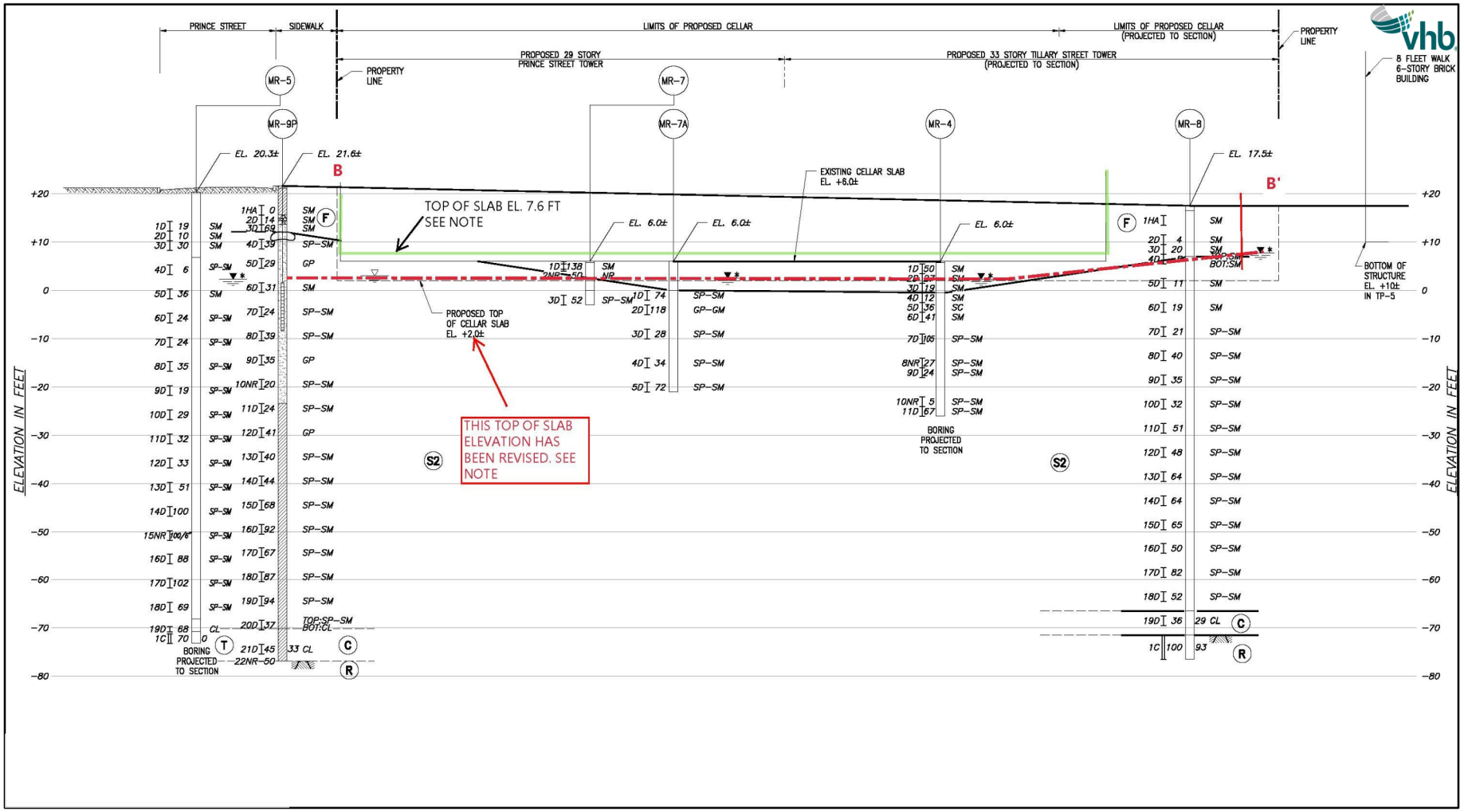
2. OBSERVED GROUNDWATER ELEVATIONS FROM 2020 GEOTECHNICAL INVESTIGATION BY MUESER RUTLEDGE.

3. COLOR ADDED BY VHB 11/22/2022.

4. GEOLOGIC PROFILE FROM FIGURE GS-1, GEOTECHNICAL REPORT BY MUESER RUTLEDGE DATED 09/18/2020.

Figure 9: Geologic Cross Section Map B-B'

Remedial Action Work Plan | 67 Prince Street, Brooklyn, NY 11201



PROPOSED TOP OF CELLAR SLAB EL. 7.6 FT.

OBSERVED GROUNDWATER LEVEL EL. 2.9 TO EL. 2.8 FT.

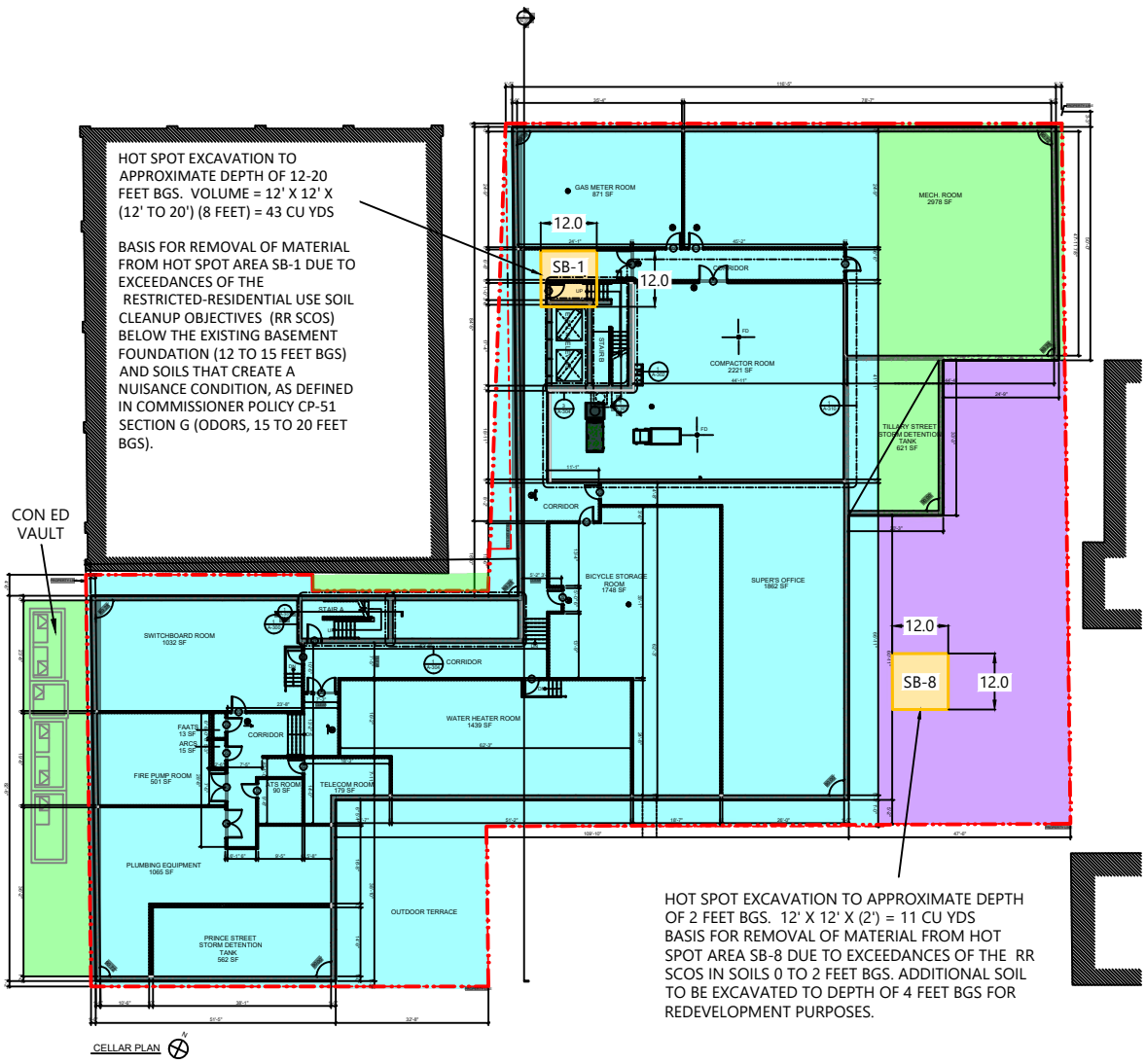
1. TOP OF SLAB ELEVATION FROM DWG ENTITLED BORING LOCATION PLAN (B-1) DATED 09-09-2020 BY MUESER RUTLEDGE CONSULTING ENGINEERS.

2. OBSERVED GROUNDWATER ELEVATIONS FROM 2020 GEOTECHNICAL INVESTIGATION BY MUESER RUTLEDGE.

3. COLOR ADDED BY VHB 11/22/2022.

4. GEOLOGIC PROFILE FROM FIGURE GS-2, GEOTECHNICAL REPORT BY MUESER RUTLEDGE DATED 09/18/2020.

Path: \\vhb.com\gis\proj\Manasquan\21183.01 YYY Pl Tillary St\Project\RAWP\Figs7-9\Figs7-9.aprx (imielczarek, 12/16/2022)



LEGEND

- SITE BOUNDARY
- LOT BOUNDARY
- PROPOSED DEVELOPMENTAL EXCAVATION AREA TO APPROXIMATELY 4 FEET BGS
- EXISTING CELLAR FOUNDATION SLAB AT 12 FEET BGS. NO EXCAVATION IS PROPOSED IN THIS AREA.
- PROPOSED HOT SPOT EXCAVATION
- PROPOSED DEVELOPMENTAL EXCAVATION AREA TO APPROXIMATELY 12 FEET BGS

NOTE:
1. RR SCO = RESTRICTED RESIDENTIAL SOIL CLEANUP OBJECTIVES.
2. TRACK 2 RR SCOS ARE PROPOSED.
3. A TRACK 4 RESTRICTED CLEANUP WOULD REQUIRE SOURCE REMOVAL OR TREATMENT (ODORS) AND REMOVAL OF RR SCO EXCEEDANCES IN THE UPPER 2 FEET OF THE SITE AND INCLUDE A SITE COVER AS A REMEDIAL ELEMENT.

0' 20' 40'

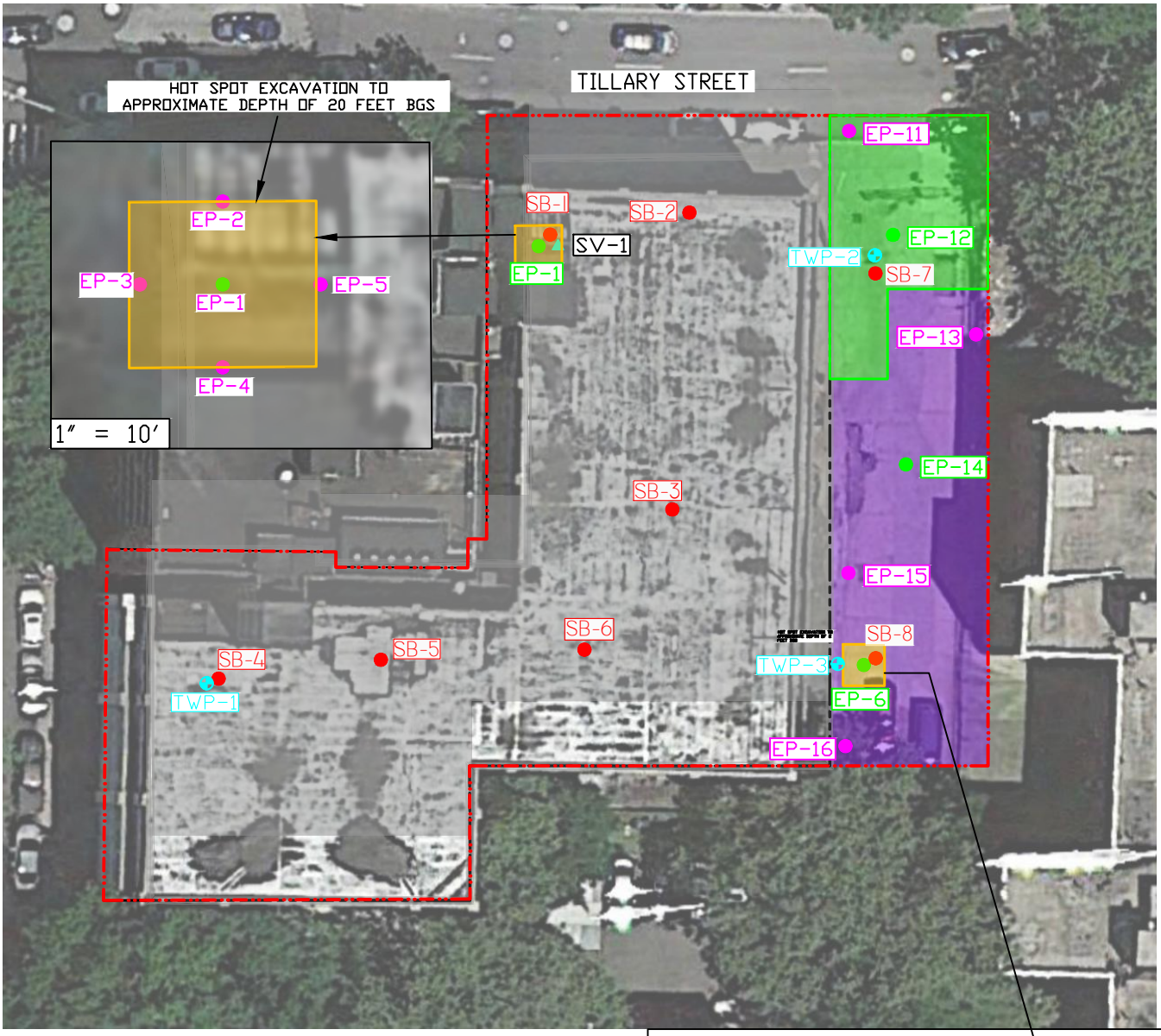
SCALE: 1"=40'

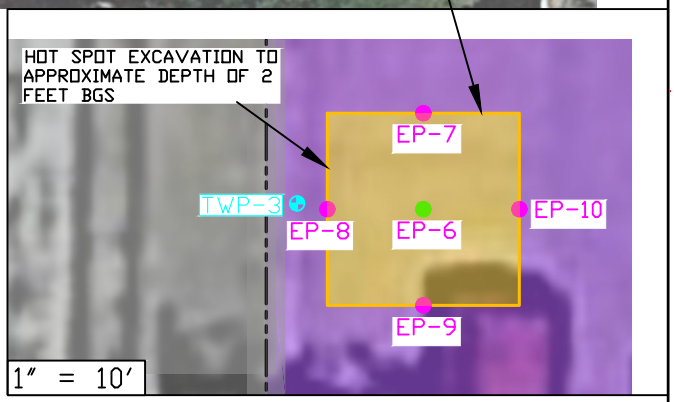
vhb

FIGURE 10 - PROPOSED EXCAVATION MAP

67 PRINCE STREET (202 - 208 TILLARY STREET)
BLOCK 2050, LOTS 98 & 100
BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK

DATE: 2/25/23	JOB NO.: 21183.01	SCALE: 1" = 40'





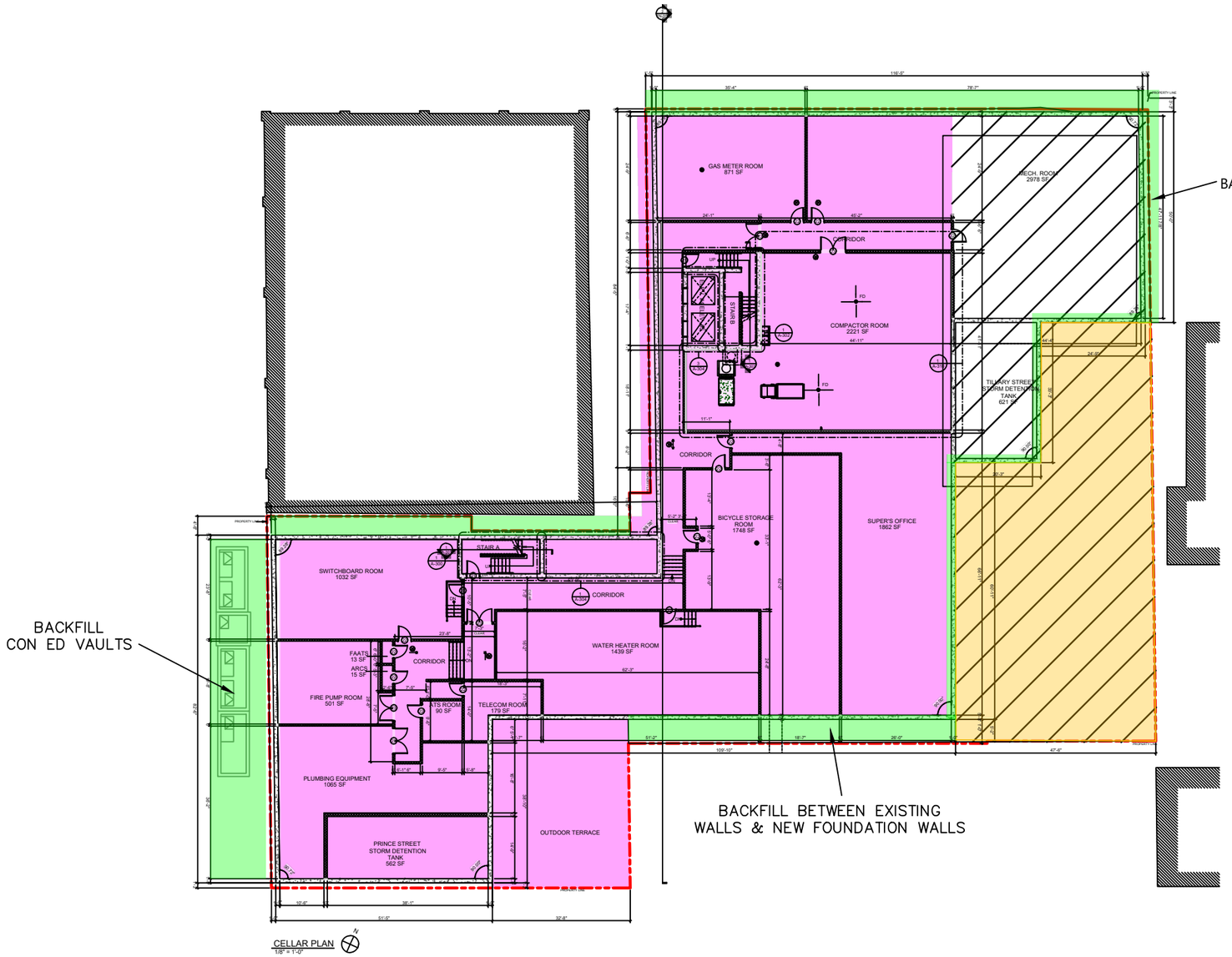
LEGEND

- SITE BOUNDARY
- LOT BOUNDARY
- PROPOSED DEVELOPMENTAL EXCAVATION TO ~4 FEET BGS
- PROPOSED DEVELOPMENTAL EXCAVATION TO ~12 FEET BGS
- PROPOSED HOT SPOT EXCAVATION
- EXISTING BUILDING FOOTPRINT
- SOIL VAPOR LOCATION - OCTOBER 2020
- EP-7 — PROPOSED SIDEWALL ENDPOINT SAMPLE
- EP-1 — PROPOSED BASE ENDPOINT SAMPLE
- SB-1 — IN-SITU PHASE II SOIL SAMPLE LOCATION OCTOBER 2020
- TWP-1 — TEMPORARY WELL POINT LOCATION

vhb

FIGURE 11 - PROPOSED ENDPOINT SAMPLE LOCATION MAP
67 PRINCE STREET (AKA 202 - 208 TILLARY STREET)
BLOCK 2050, LOTS 98 AND 100
BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK

DATE:	JOB NO.:	SCALE:
02/08/2023	21183.01	AS SHOWN



LEGEND

- 3/4- INCH STONE AND CLEAN SOIL BACKFILLED TO GRADE.
- NO BACKFILL PROPOSED IN THIS LOCATION.
- BACKFILL PROPOSED IN THIS LOCATION.
- PROPOSED LOCATION OF CLEAN 3/4-INCH STONE TO BE IMPORTED TO THE SITE.

REFERENCE DRAWING:
AUFGANG ARCHITECTS, SUFFERN, NY
A-100.00 PROPOSED DEVELOPMENT FOR 67 PRINCE STREET 11201
DATED: 1/30/19

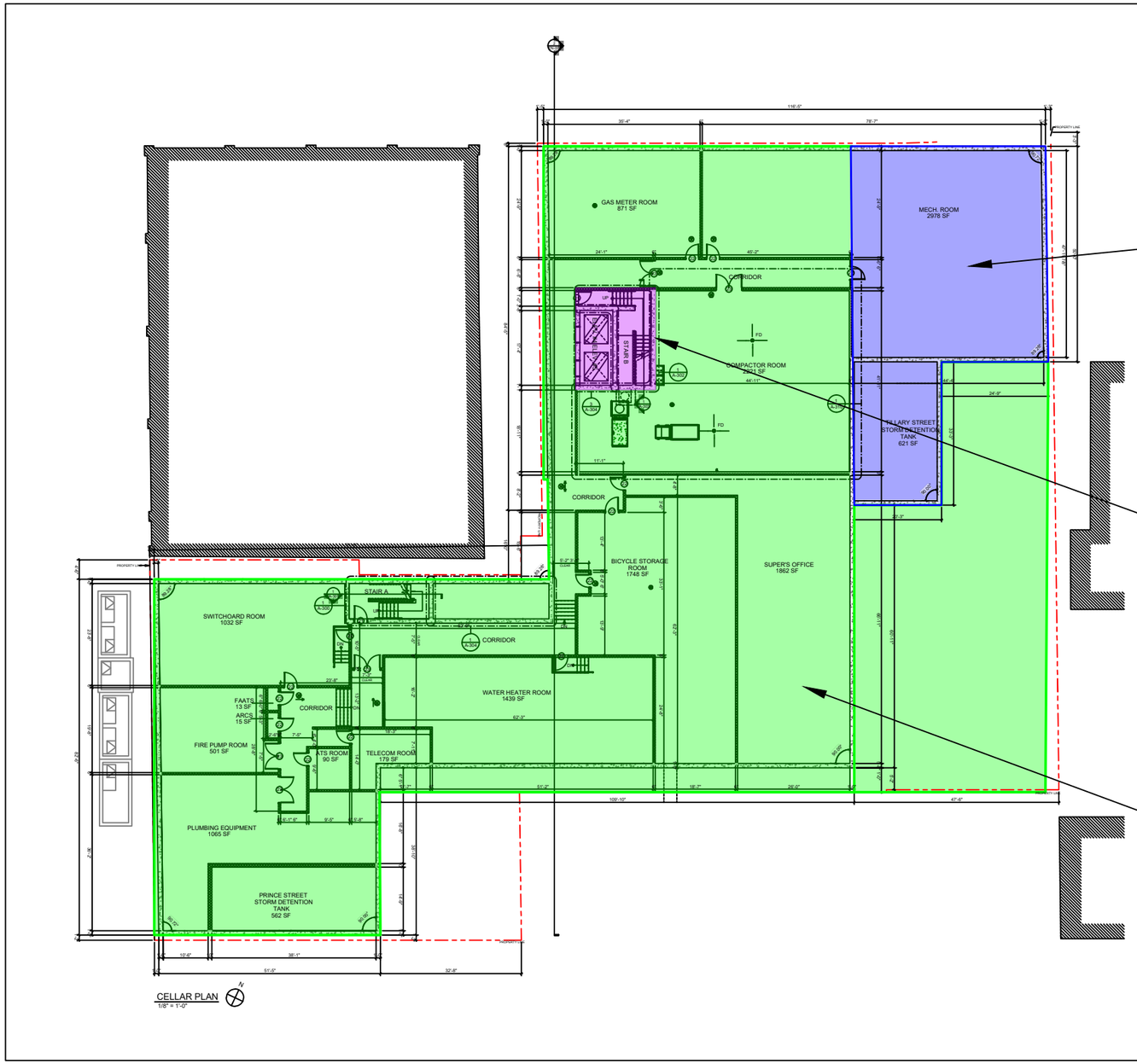
0' 15' 30'
SCALE: 1"= 30'

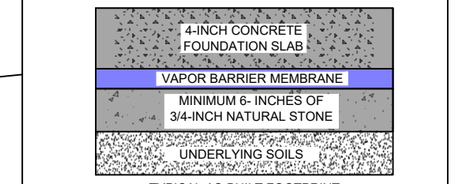
vhb

FIGURE 12 - PROPOSED BACKFILL LOCATION MAP

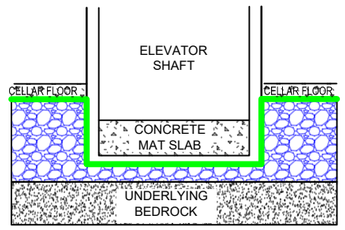
67 PRINCE STREET (AKA 202 - 208 TILLARY STREET)
BLOCK 2050, LOT 100 AND A PORTION OF LOT 1
BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK

DATE:	JOB NO.:	SCALE:
2/2/22	21183.01	1" = 30'

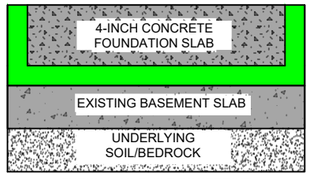




TYPICAL AS-BUILT FOOTPRINT
NTS



ELEVATOR PIT DETAIL
NTS



TYPICAL AS-BUILT FOOTPRINT
NTS

LEGEND
- VAPOR BARRIER
- VAPOR BARRIER/WATERPROOFING
- VAPOR BARRIER/WATERPROOFING

REFERENCE DRAWING:
AUFGANG ARCHITECTS, SUFFERN, NY
A-100.00 PROPOSED DEVELOPMENT FOR 67 PRINCE STREET 11201
DATED: 1/30/19

0' 15' 30'
SCALE: 1"= 30'

vhb

FIGURE 13 - COMPOSITE COVER SYSTEM LOCATION MAP
& CROSS SECTIONAL DETAIL MAP
67 PRINCE STREET (AKA 202 - 208 TILLARY STREET)
BLOCK 2050, LOTS 98 & 100
BOROUGH OF BROOKLYN, KINGS COUNTY, NEW YORK

DATE:	JOB NO.:	SCALE:
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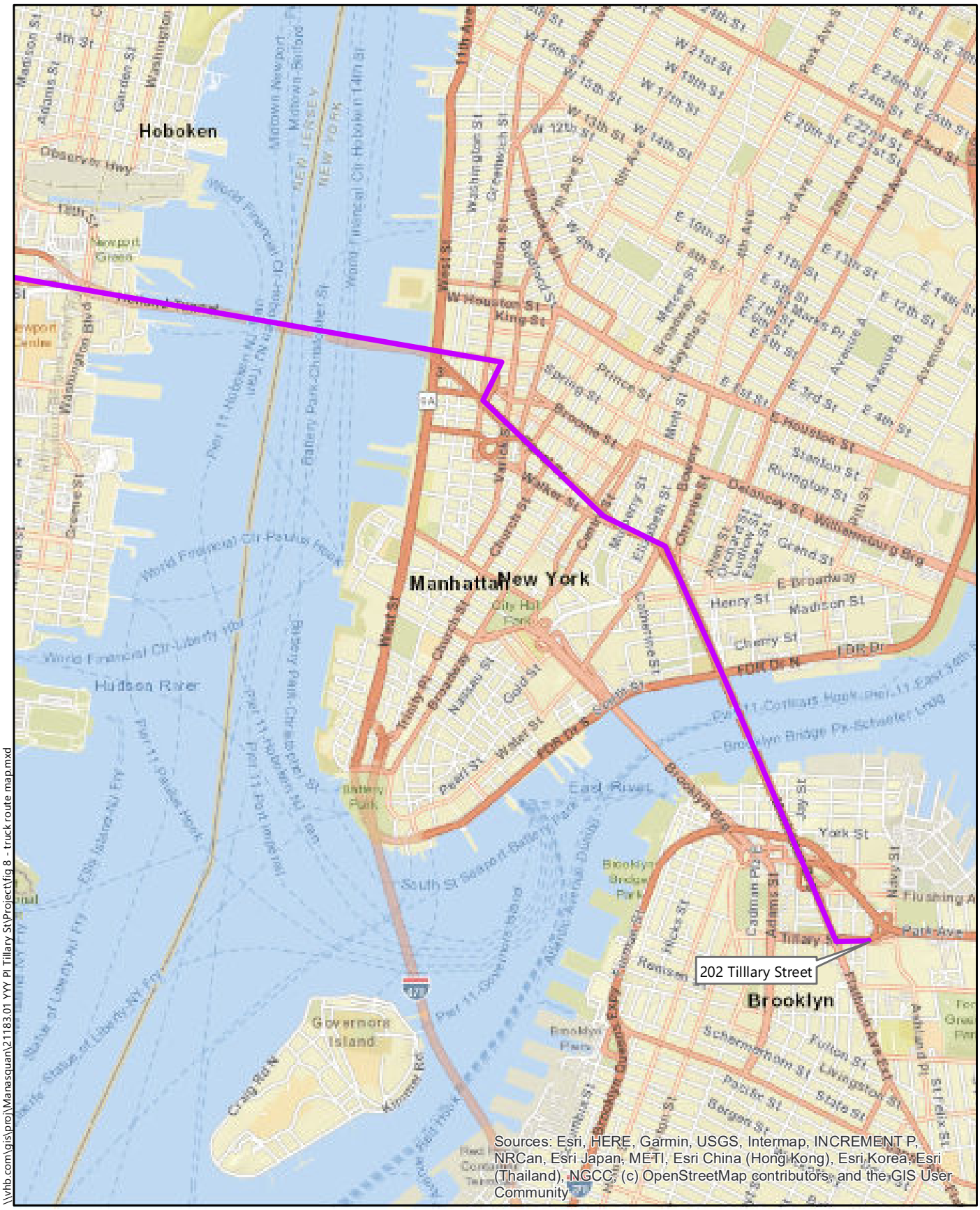

\\vhb.com\gis\proj\Manasquan\21183.01 YYY Pl Tillary St\Project\fig 8 - truck route map.mxd

0 1250 2500 5000 Feet

21183.01

Brooklyn, New York

Legend

Truck Route

67 Prince Street (aka 202-208 Tilllary Street)
Block 2050 , Lot 100 & Portion of Lot 1
Brooklyn, NY

Truck Route Map

Appendix A – Site Redevelopment Plans

PLANS PROVIDED IN SEPARATE PDF FILE

Appendix B – Previous Environmental Reports

DOCUMENTS PROVIDED IN SEPARATE PDF FILE

Appendix C – Construction Health and Safety Plan

SITE-SPECIFIC CONSTRUCTION HEALTH AND SAFETY PLAN

202-208 Tillary Street
Block 2050, Lots 100 and 98
Brooklyn, New York 11201

1.0 INTRODUCTION

This Site-Specific Construction Health and Safety Plan (CHASP) was prepared in accordance with the requirements and guidelines of the applicable Occupational Safety and Health Administration (OSHA) requirements in 29 Code of Federal Regulations (CFR) Part 1910.120. This CHASP has been prepared for the property located at 202-208 Tillary Street, Brooklyn, New York. The CHASP will be available for inspection and review by site workers and regulatory personnel during soil excavation and disposal activities. Site workers are required to comply with this CHASP when conducting the site activities listed in Section 2.0. Site workers will notify the Site Safety Officer of matters regarding health, safety, and security.

All personnel and subcontractors must familiarize themselves with the material contained herein, including special conditions and facilities located near each project as listed on the following pages. The information contained in this CHASP pertains to excavation and disposal of the urban historic fill.

2.0 ENTRY OBJECTIVES

The objective of entry to the Work Area is to conduct soil excavation and site grading associated with the development of a residential use building. Entrance will be gained to the property on Bruckner Boulevard. Work performed at the site will be completed in accordance with 29 CFR 1926, Subpart P, and all other appropriate federal and state regulations.

3.0 ON-SITE ORGANIZATION AND COORDINATION

Key project personnel and their responsibilities to carry out the stated job function at the site are discussed below.

VHB, Inc. (VHB) will provide health and safety support associated with environmental issues. The contact information for the designated person to provide Health and Safety support for this project is:

Catherine Applegate, Health and Safety Officer
VHB Engineering, Surveying, Landscape Architecture and Geology, P.C.
One Penn Plaza
Suite 715
New York, NY 1119-0800
Phone: (732) 223-2225, Fax: (732) 223-3666

The Construction Health and Safety Officer for overall administration of this CHASP during the soil excavation and removal activities, installation of piles and footings is designated below. The Construction Health and Safety Officer's responsibilities will include overall project safety and health monitoring for the work to be performed. The Construction Health and Safety Officer will enforce and audit the effectiveness of the CHASP on a continuing basis and make changes to ensure that the intent of the CHASP is maintained.

Contractor TBD

4.0 ON-SITE CONTROL

The Environmental Site Safety Officer is designated to coordinate access control and security on site during soil excavation operations. A safe perimeter will be established at the subject property. Unauthorized personnel will be excluded from this area. The Environmental Consultant will perform air monitoring and oversight during excavation operations and make determinations if dust control is required or if evidence of hazardous materials is present and/or the level of Personnel Protective Equipment (PPE) should be raised.

Excavating Precautions (Utilities)

1. A utility markout of all underground utilities will be completed prior to the inception of ground-intrusive work, in compliance with 29 CFR 1926.651. The utility markout will utilize the One Call system prior to the commencement of operations at the site. Work will commence less than 10 business days after contacting the One Call system.
2. Visually inspect all utility markout locations on site.
3. Operations in the vicinity of overhead power lines will be conducted in accordance with 29 CFR 1910.333 (c)(3).
4. Conduct all excavations and subsequent soil sampling in the vicinity of a utility with caution.
5. If a utility line is damaged, call the utility company immediately.
6. If unsure of the utility company, call NYC ONE CALL (1-800-272-4480).

Dust Prevention and Control (Track out onto Paved Public Roadways)

1. Vehicles leaving the site should be cleaned/decontaminated prior to exiting.
2. Promptly remove mud, dirt, or similar debris from the paved road.
3. Water flush and/or vacuum sweep the paved road.
4. Prepare unpaved site ingress and egress points by applying gravel to the surface to control track out and erosion.
5. The surface of the ingress and egress points must be kept adequately wet with water.

Dust Prevention and Control (General Procedures for Unpaved Areas)

1. Apply gravel to entrance, exit, and other areas of the site that are likely to see heavy vehicular traffic.
2. Limit vehicle traffic to required vehicles.
3. Limit vehicle speeds on unpaved areas of the site. Placement of signs near the site entrance that denote site speed restrictions is advised.
4. Apply sufficient water to unpaved surfaces that are likely to be disturbed to keep them adequately wet. According to 40 CFR Part 61, adequately wet means sufficiently mixed or penetrated with liquid to prevent the release of particulates. Visibly detectable dust emissions are the primary indication that the unpaved work area has not been kept adequately wet.

Dust Prevention and Control (Procedures for Grading and Excavation)

1. When soil is to be moved or stockpiled, the drop height of the soil should be reduced as much as possible.
2. Limit the height of soil stockpiles.
3. Limit the disturbance of soil stockpiles.
4. Keep the surface of stockpiles adequately wet.
5. All stockpiled soil shall be covered with plastic sheeting or other suitable cover material.
6. RECORD AND MONITOR ALL DUST PREVENTION/CONTROL ACTIVITIES. Recording this information will provide a superior method of monitoring and evaluating the success of the dust prevention and control plan.

In the event that visible dust is observed, associated work activities are to stop immediately and measures to mitigate commence as soon as possible (i.e., wetting down material with water).

5.0 HAZARD EVALUATION

The Environmental Site Safety Officer is responsible for administering the Contractor's Hazard Communication Program. OSHA HAZWOPER standards (29 CFR 1910.120 and 1926.65) require that site personnel, subcontractors, and visitors must be informed of hazards associated with the site. Additionally, the Site Safety Officer will be responsible for determining safety precautions, changes to the PPE program, or other modifications to this CHASP that would be appropriate in response to unanticipated chemical hazards.

5.1 Environmental Hazards

At present, suspected contaminants in the subsurface soil constitute an environmental hazard. Various chemical compounds have been identified in the soil. If encountered in the soil at higher concentrations than anticipated, exposure concerns could become a health issue. The following are known or suspected to be present at the site.

5.1.1 Volatile Organic Compounds (VOCs)

Several volatile organic compounds (VOCs) were detected in soil vapor samples. Should VOCs be detected during excavation, monitoring of the air using a photoionization detector (PID) will be performed. VOCs may cause chronic liver and kidney damage, and some are suspected human carcinogens. The primary route of exposure to VOCs is through inhalation; therefore, air monitoring and respiratory protection are the primary controls against exposure to VOCs.

5.1.2 Urban Historic Fill

Urban historic fill has been identified on the property. The urban historic fill is impacted with three (3) pesticides, several semi-volatile organic compounds (SVOCs), and several metals exceeding the New York State Department of Conservation (NYSDEC) Subpart 375-6 Unrestricted Use Soil Cleanup Objectives (SCO).

A complete list of Material Safety Data Sheets (MSDSs) for such compounds and analytes analyzed as part of the environmental investigations conducted at the site are provided as **Attachment I**.

5.2 Physical Hazards

The work to be completed at the site in conjunction with this CHASP consists of soil excavation and removal activities and installation of piles and footings. Additional physical hazards expected on site include: buried utilities; slip, trip, and fall hazards; and, hazards associated with heavy machinery.

6.0 HAZARD MONITORING

6.1 Air Monitoring Using a PID

Periodic air monitoring, visual, and olfactory inspection of soil during site-wide excavation, soil disposal, and well and pile installation will be conducted. A PID will be used to screen both the soil and ambient air for the presence of VOCs.

The following are the Short Term (ST) Exposure Limits on a 15-minute time weighted average and the Immediate Danger to Life and Health (IDLH) conditions for VOCs which may be present in the subsurface soil. The levels are presented in parts per million (ppm).

Compound	ST	IDLH
Benzene	5 ppm	500 ppm
Ethyl benzene	100 ppm	500 ppm
Toluene	150 ppm	500 ppm
Xylenes	150 ppm	900 ppm

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area exceeds five (5) ppm above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor

level readily decreases (per instantaneous readings) below five (5) ppm over background, work activities will 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 five (5) ppm over background, but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the 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 five (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 will be shut down.

All 15-minute readings will be recorded and be available for review. Instantaneous readings used for decision purposes, if any, will also be recorded.

6.2 Air Monitoring Using a Dust Trak Monitor

Particulate concentrations will be monitored periodically both in the upwind and downwind directions at temporary particulate monitoring stations. The particulate monitoring will be performed using real-time monitoring equipment such as the Dust Trak Aerosol Monitor, Model 8530, 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 will 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 (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work will be stopped and a reevaluation of activities initiated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

All readings will be recorded and will be available for review.

6.3 Personal Protective Equipment (PPE)

Based upon evaluation of potential hazards, the following levels of personal protection have been designated for the Work Area:

Location	Job Function	Level of Protection
Entire Site	Excavation	A B C D

If VOCs are detected which indicate a need to upgrade the PPE, the Health and Safety Officer will stop all work and evaluate the level of protection required to complete the project. A determination will be made regarding the safety of the situation and the type of PPE that will be required. *At no time will work be conducted in an environment where an IDLH condition could be present.*

The following is the monitoring level for which a change in the level of protection or evacuation of the work area would be implemented. If the work area is evacuated, procedures such as the use of ventilation would be utilized if possible to lower monitoring levels to below the threshold for raising the level of protection.

PID 150 ppm

It should be noted that the work proposed will not be performed in a level of PPE other than Level D. Procedures would have to be put in place to lower the PPE requirement to Level D should conditions suggest an increase in the level of PPE required.

Precautions will be implemented to limit direct contact with the soil or inhalation of dust. At a minimum, nitrile gloves are to be worn when handling soil, dust control procedures used if necessary, and thorough hand washing prior to handing food.

Specific protective equipment for potential levels of protection is as follows:

6.3.1 Levels A and B

Since levels A and B are for IDLH environments, they are not applicable to this project.

6.3.2 Level C

The concentration(s) and type(s) of airborne substance(s) is (are) known and the criteria for using air-purifying respirators are met. The following constitute Level C equipment:

- National Institute for Occupational Safety and Health (NIOSH)-approved full-face or half-face air purifying respirators;
- Chemical-resistant clothing (overalls, chemical-splash suit, disposable chemical-resistant overalls);
- Gloves, outer and inner, chemical-resistant;

- Boots, outer, chemical-resistant, with steel toe and shank;
- Optional chemical resistant boot covers;
- Hard hat;
- Safety glasses with side shields;
- Face shield and safety glasses when not wearing a full face respirator; and,
- Hearing protection when working in noise hazardous areas or near operating heavy equipment.

6.3.3 Level D

A work uniform providing no respiratory protection is used only for prevention of skin contamination. The following constitute Level D equipment:

- Coveralls or other skin-protective clothing (long-sleeve shirts and long pants);
- Gloves;
- Boots or shoes, chemical-resistant, steel toe and shank;
- Optional chemical resistant boot covers;
- Safety glasses or chemical splash goggles;
- Hard hat;
- Hearing protection when working in noise-hazardous areas or near operating heavy equipment; and,
- High-visibility safety vest.

NO CHANGES TO THE SPECIFIED LEVELS OF PROTECTION SHALL BE MADE WITHOUT THE APPROVAL OF THE CONSTRUCTION SITE SAFETY OFFICER.

7.0 COMMUNICATION PROCEDURES

The following standard hand signals will be used in case of emergency:

Message	**Interpretation(s)**
Hands gripping throat	Out of air; can't breathe.
Grip partner's wrist	Leave area immediately.
Hands on top of head	Need assistance.
Thumbs up	OK; I am all right; I understand.
Thumbs down	No; Negative.

8.0 DECONTAMINATION PROCEDURES

Should hazardous materials be encountered, a decontamination procedure will be implemented. Generated waste, such as disposable PPE, will be disposed of in accordance with applicable local, state, and federal regulations. The decontamination protocol shall be used with the following decontamination stations:

(1) Equipment drop;

(2) Detergent and Water Rinse (optional); and,

(3) Remove PPE (if utilized) and place in waste container

Decontamination of equipment is not anticipated to be required for this project.

9.0 MEDICAL MONITORING

As per 29 CFR 1910.120 (b)(4)(ii)(D) and in accordance with 29 CFR 1910.120 (f), persons engaging in on-site activities during which they are or may be exposed to hazardous substances or health hazards at or above the permissible exposure limits or published exposure levels for 30 days or more a year are included in a Medical Surveillance Program.

The timing and location of this project may be such that heat/cold stress could pose a threat to the health and safety of site personnel. Work/rest regimens will be employed as deemed necessary by the Site Safety Officer so site workers do not suffer adverse effects from heat/cold stress. Special clothing and an appropriate diet and fluid intake will be recommended to all on-site personnel to further reduce these temperature-related hazards. Site workers should stop work and notify the Site Safety Officer when they observe symptoms of heat/cold stress in themselves or co-workers.

9.1 Heat Stress Monitoring

Heat stress monitoring of personnel wearing protective clothing (i.e., impermeable fabric) should be considered when the ambient temperature is 70 degrees Fahrenheit or above. To monitor the worker, one of the following methods should be employed:

- Heart rate should be measured by the radial pulse for a 30-second period as early as possible in the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work cycle by one-third (0.3) and keep the rest period the same. If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following cycle by one-third (0.3).
- Oral temperature should be measured at the end of the work period (before drinking). If oral temperature exceeds 99.6 degrees Fahrenheit, shorten the next work cycle by one-third (0.3) without changing the rest period. If the oral temperature still exceeds 99.6 degrees Fahrenheit at the beginning of the next rest period, shorten the next work cycle by one-third (0.3). Do not permit a worker to wear a semipermeable or impermeable garment when his/her oral temperature exceeds 100.6 degrees Fahrenheit.

9.2 Cold Stress Monitoring

Work/rest schedules must be altered to minimize the potential for cold stress. Cold stress is defined as a decrease in core body temperature to 96.8 degrees Fahrenheit and/or cold injury to body extremities. Decreases in core body temperature are associated with reduced mental alertness, reduction in rational decision-making, or loss of consciousness in severe cases. Symptoms of cold stress include pain in extremities (i.e., hands and feet) and severe shivering.

10.0 MEDICAL EMERGENCIES

10.1 Emergency Medical Care

- First Aid & Rescue Squad (Call 911).
- Emergency Department, Brooklyn Hospital Center (718) 250-8000

10.2 Directions to The Brooklyn Hospital Center

The Brooklyn Hospital Center is located at 121 Dekalb Avenue, Brooklyn, New York, and is 0.8 miles south of the Site. See **Attachment II** for turn by turn driving directions and map.

10.3 List of Emergency Phone Numbers

Agency/Facility	Phone Number
All Services	911
Police	911
Fire Emergency	911
Brooklyn Hospital Center	(718) 250-8000

10.4 First Aid Equipment

First aid equipment is available on site at the following locations:

Equipment	Location
First Aid Kit	Field Vehicle
Fire Extinguisher	Field Vehicle

11.0 EMERGENCY PROCEDURES

On-site personnel will use the following standard emergency procedures. The Construction Health and Safety Officer shall be notified of on-site emergencies and be responsible for ensuring that the appropriate procedures are followed.

11.1 Personnel Injury in the Work Area

Upon notification of an injury in the Work Area, the Construction Health and Site Safety Officer will assess the nature of the injury. For a true emergency, 911 shall be called and local emergency services personnel shall initiate the appropriate first aid and contact the designated medical facility, if required.

If the cause of the injury or loss of the injured person does not affect the performance of site personnel, operations may continue with the local emergency services personnel initiating the appropriate first aid and necessary follow-up, as stated above. If the injury increases the risk to others, the designated emergency signal shall be sounded and all site personnel shall move to the site entrance for further instructions. Activities on site will stop until the added risk is removed or minimized. No persons shall reenter the Work Area until the cause of the symptoms or injury is determined by the Construction Health and Safety Officer.

11.2 Fire/Explosion

Upon notification of a fire or explosion on site, the designated emergency signal (three [3] horn blasts) shall be sounded, and all site personnel shall be assembled at the site entrance. The fire department shall be alerted, and all personnel shall be moved to a safe distance from the involved area.

11.3 PPE Failure

If utilization of PPE is necessitated by conditions in the Work Area and a site worker experiences a failure or alteration of protective equipment which affects the protection factor, that person shall immediately leave the Work Area. Reentry shall not be permitted until the equipment has been repaired or replaced.

11.4 Other Equipment Failure

If other equipment on site fails to operate properly, the Construction Health and Safety Officer shall be notified and then determine the effect of this failure on continuing operations. If the failure affects the safety of personnel or prevents completion of the planned tasks, all personnel shall leave the Work Area until the situation is evaluated and appropriate actions taken.

In all situations, when an on-site emergency results in evacuation of the Work Area, personnel shall not reenter until:

1. The conditions resulting in the emergency have been corrected.
2. The hazards have been reassessed.
3. The CHASP has been revised.
4. Site personnel have been briefed regarding changes in the CHASP.

12.0 SITE PERSONNEL SIGNATURE PAGE

ALL SITE PERSONNEL HAVE READ THE ABOVE HEALTH AND SAFETY PLAN AND ARE FAMILIAR AND WILL COMPLY WITH ITS PROVISIONS, AS EVIDENCED BY SIGNATURE BELOW.

Name	Signature	Date

Attachment I - Safety Sheets
Volatile Organic Compounds (VOCs)

Minnesota Department of Health Fact Sheet April 2010

Volatile Organic Compounds (VOCs) in Your Home

What are VOCs?

Volatile Organic Compounds (VOCs) are a large group of carbon-based chemicals that easily evaporate at room temperature. While most people can smell high levels of some VOCs, other VOCs have no odor. Odor does not indicate the level of risk from inhalation of this group of chemicals. There are thousands of different VOCs produced and used in our daily lives. Some common examples include:

- Acetone
- Benzene
- Ethylene glycol
- Formaldehyde
- Methylene chloride
- Perchloroethylene
- Toluene
- Xylene
- 1,3-butadiene

Where do VOCs come from?

Many products we have in our homes release or "off-gas" VOCs. Some examples of sources of VOCs are:

- Building Materials
  - Carpets and adhesives
  - Composite wood products
  - Paints
  - Sealing caulks
  - Solvents
  - Upholstery fabrics
  - Varnishes
  - Vinyl Floors
- Home and Personal Care Products
  - Air fresheners
  - Air cleaners that produce ozone
  - Cleaning and disinfecting chemicals
  - Cosmetics
  - Fuel oil, gasoline
  - Moth balls
  - Vehicle exhaust running a car in an attached garage
- Behaviors
  - Cooking
  - Drycleaning
  - Hobbies
  - Newspapers
  - Non-electric space heaters
  - Photocopiers
  - Smoking
  - Stored paints and chemicals
  - Wood burning stoves

Studies have shown that the level of VOCs indoors is generally two to five times higher than the level of VOC's outdoors. VOC concentrations in indoor air depend on many factors, including the:

- Amount of VOCs in a product;
- Rate at which the VOCs are released;
- Volume of the air in the room/building;
- Ventilation rate or the area; and
- Outdoor concentrations of VOCs.

What are the health effects of VOC exposure?

The risk of health effects from inhaling any chemical depends on how much is in the air, how long and how often a person breathes it in. Scientists look at short-term (acute) exposures as hours to days or long-term (chronic) exposures as years to even lifetime.

Breathing low levels of VOCs for long periods of time may increase some people's risk of health problems. Several studies suggest that exposure to VOCs may make symptoms worse in people who have asthma or are particularly sensitive to chemicals. *These are much different exposures than occupational exposures to VOCs.*

VOCs refer to a group of chemicals. Each chemical has its own toxicity and potential for causing different health effects. Common symptoms of exposure to VOCs include:

MINNESOTA MDH DEPARTMENT OF HEALTH

Indoor Air Unit
P.O. Box 64975
St, Paul, MN, 55164-0975
651-201-4601 or 800-798-9050
www.health.state.mn.us/divs/eh/air

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Short-Term (Acute) to high levels of VOCs

- Eye, nose and throat irritation
- Headaches
- Nausea / Vomiting
- Dizziness
- Worsening of asthma symptoms

Long-Term (Chronic) to high levels of VOCs
Increased risk of:

- Cancer
- Liver damage
- Kidney damage
- Central Nervous System damage

What level of VOCs is safe?

The best health protection measure is to limit your exposure to products and materials that contain VOCs when possible. If you think you may be having health problems caused by VOCs, try reducing levels in your home. If symptoms persist, consult with your doctor to rule out other serious health conditions that may have similar symptoms.

MDH has established Health Risk Values (HRVs) for some individual VOCs. HRVs are "concentrations of chemicals or defined mixtures of chemicals emitted to air that are unlikely to pose a significant risk of harmful effects when humans are exposed to those concentrations over a specified time."

For more information on these HRVs go to the MDH Health Risk Values Website at: http://www.health.state.mn.us/divs/eh/risk/rules/air/index.html

Also check the Household Products Database at: http://householdproducts.nlm.nih.gov/cgi-bin/household/list?tbl=TblChemicals&alpha=A

Most health related studies have been conducted on single chemicals. Less is known about the health effects of exposure to combinations of chemicals. Because the toxicity of a VOC varies for each individual chemical, there are no Minnesota or federal health-based standards for VOCs as a group.

Are some people at greater risk from VOC exposure than others?

Persons with respiratory problems such as asthma, young children, elderly, and persons with heightened sensitivity to chemicals may be more susceptible to irritation and illness from VOCs.

What can I do about VOCs that are in my home?

Although home screening kits (devices) are available to measure total volatile organic compound (TVOC) levels they are of limited use and won't correct a VOC problem. Instead of testing, the first step is to conduct an inspection of your home for the common sources of VOCs. Sources that may be problematic include household furnishings which tend to off-gas more VOC's when they are new. Possible sources include carpet, furniture, paint, plastics or electronic devices.

Once you determine the probable source(s) of VOCs, steps can be taken to reduce your exposure. If you are unable to determine probable sources, a professional indoor air quality investigator or an industrial hygienist can be consulted. MDH has developed a guidance document on how to select an indoor air quality consultant. http://www.health.state.mn.us/divs/eh/indoorair/iaqserviceprovider.pdf

How do I reduce the levels of VOCs in my home?

The most effective action is to remove the product that gives off VOCs. Most products containing VOCs will off-gas within a short period of time, although some will continue to give off VOCs for a longer period of time.

Some steps you can take to reduce your exposure to VOCs in the home are:

1. Source control: Remove or reduce the number of products in your home that give off VOCs. Only purchase amounts of chemicals that you know you will use and carefully follow directions on product labels. Remove unused chemicals from the home because stored chemicals in closed containers can sometimes "leak" and release VOCs into indoor air. Check with the city or county for household hazardous waste collection sites. http://www.pca.state.mn.us/waste/hhw/index.html

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For new items consider purchasing:

- floor models that have been allowed to off-gas in the store
- solid wood items with low emitting finishes
- new products that contain low or no VOCs (environmentally preferable products)

As a last resort, airtight sealers have been used to minimize VOC emissions. Check with vendors of composite wood products to choose a non-toxic sealant to reduce exposure to VOCs.

2. Ventilation and climate control can be used to reduce exposure to VOCs.
   - Increase ventilation by opening doors and windows, use fans, maximize air brought in from outside;
   - Keep both the temperature and relative humidity as low as possible or comfortable. Chemicals will off-gas more under warmer conditions with high humidity; and
   - If you have a choice, perform renovations when home is unoccupied or during seasons that will allow for additional ventilation.

In summary, the most effective way to limit VOCs indoors is to limit the potential sources of VOCs. Increasing the amount of outdoor “fresh air” into a space can also dilute and reduce VOC levels.

For site specific vapor intrusion issues, call
Minnesota Department of Health,
Site Assessment & Consultation Unit at:
(651) 201-4899.

IC#141-1381

Semi-Volatile Organic Compounds (SVOCs)

Semi-Volitile Organic Compounds

This Fact Sheet is presented by the U. S. Environmental Protection Agency, Region III (EPA) to assist in the selection of analytical parameters and the associated Quality Assurance and Quality Control (QA/QC) procedures to be utilized in Phase II Environmental Assessments under the U.S. Environmental Protection Agency (EPA) Brownfields initiative. This fact sheet is presented for informational purposes only, and should not be construed as a federal policy or directive. The Brownfields Coordinator for this region may be reached at 215-814-5000.

A semivolatile organic compound is an organic compound which has a boiling point higher than water and which may vaporize when exposed to temperatures above room temperature. Semivolatile organic compounds include phenols and polynuclear aromatic hydrocarbons (PAH).

LIST OF SEMIVOLATILE ORGANIC COMPOUNDS *

- Phenol
- Bis(2-chloroethyl)ether
- 2-Chlorophenol
- 1,3-Dichlorobenzene
- 1,4-Dichlorobenzene
- 1,2-Dichlorobenzene
- 2-Methylphenol
- Bis(2-chloroisopropyl)ether
- 4-Methylphenol
- n-Nitroso-di-n-propylamine
- Hexachloroethane
- Nitrobenzene
- Isophorone
- 2-Nitrophenol
- 2,4-Dimethlyphenol
- Bis(2-chloroethoxy)methane
- 2,4-Dichlorophenol
- 1,2,4-Trichlorobenzene
- Naphthalene
- 4-Chloroaniline
- Hexachlorobutadiene
- 4-Chloro-3-methylphenol
- 2-Methlynaphthalene
- Hexachlorocyclopentadiene
- 2,4,6-Trichlorophenol
- 2,4,5-Trichlorophenol
- 2-Chloronaphthalene
- 2-Nitroaniline
- Dimethylphthalate
- Acenaphthylene
- 2,6-Dinitrotoluene

- 3-Nitroaniline
- Acenaphthene
- 2,4-Dinitrophenol
- 4-Nitrophenol
- 4-Bromophenyl-phenylether
- Hexachlorobenzene
- Pentachlorophenol
- Phenanthrene
- Anthracene
- Carbazole
- Di-n-butylphthalate
- Fluoranthene
- Pyrene
- Butylbenzylphthalate
- 3,3'-Dichlorobenzidine
- Benzo(a)anthracene
- Chrysene
- Bis(2-ethylhexyl)phthalate
- Di-n-octylphthalate
- Benzo(b)fluoranthene
- Benzo(k)fluoranthene
- Benzo(a)pyrene
- Indeno(1,2,3-cd)pyrene
- Dibenz(a,h)anthracene
- Benzo(g,h,i)perylene

* Please note: The list above corresponds to the EPA Contract Laboratory Program (CLP) semivolatile organic list, and is not a complete list of all toxic semivolatile organic compounds. If the site history suggests a semivolatile organic compound may be present which is not on this list, the compound should be included in the requested analysis.

ANALYSIS METHODS

Please note that the methods listed below are EPA approved and the most commonly used by EPA and their contractors. However, they are not the only methods for the analysis of semivolatile organic compounds. In addition, these are not drinking water test methods.

METHOD	APPLICABLE MATRICES
EPA 625 or 1625 (1)	Aqueous
EPA SW-846 3010 or 3020/8250 or 8270 (2)	Aqueous
EPA SW-846 3500 or 3550/8250 or 8270 (2)	Soil/Sediment & Waste
EPA CLP Statement of Work 3/90	Aqueous & Soil/Sediment
EPA SW-846 8100 or 8310 (2) 610 (1)	Water and Soil/Sediment for PAH
EPA SW-846 8040 (2) or 604 (1)	Water and Soil/Sediment for Phenols

1. U.S. Environmental Protection Agency (EPA). 1992. *Test Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater.* Washington, D.C. July.
2. EPA. 1986. *Test Methods for Evaluating Solid Waste.* SW-846. Washington, D.C. September.

COLLECTION MEDIA/VOLUME

Listed below are the EPA-recommended preservation and holding times as well as suggested glassware.

MATRIX	GLASSWARE	VOLUME	PRESERVATIVE	HOLDING TIME
Soil/Sediment	8-oz wide mouthed jar	1 8-oz jar	ice to 4° C	14 days
Aqueous	32-oz amber bottle	2 amber bottles	ice to 4° C	7 days
Waste	8-oz wide mouth jar	1 8-oz jar	none required (ice preferred)	none (try not to exceed 14 days)

MINIMUM LABORATORY QUALITY CONTROL MEASURES

The laboratory should have Standard Operating Procedures available for review for the semivolatile organic compound analyses and for all associated methods needed to complete the semivolatile analysis, such as total solids, instrument maintenance, sample handling, and sample documentation procedures. In addition, the laboratory should have a Laboratory Quality Assurance/Quality Control Statement available for review which includes all key personnel qualifications.

QC TYPE	FREQUENCY OF ANALYSIS	ACCEPTABLE LIMITS
Gas Chromatograph/Mass Spectrometer (GC/MS) Tuning	Once per day or more frequently if required by method	See method criteria for acceptable limits
Initial Calibration	Prior to analysis of samples (minimum three concentration levels for every compound and an instrument blank)	% Relative Standard Deviation of Response Factors of $\leq$ 30 (see method for any allowable variations), and a minimum Response Factor of $\geq$ 0.05 (see method for calculation)
Continuing Calibration	Once per day (mid-level standard containing all compounds) or more frequently if required by method	% Difference for Response Factor of $\leq$ 25 (see method for any allowable variations), and a minimum Response Factor of $\geq$ 0.05 (see method for calculation)
Method Blank	Once per extraction batch	See method for allowable limits
Internal Standards	Six per sample (see method for suggested internal standard compounds)	-50% to + 100% of Daily standard area and retention time shift (limits depend if packed or capillary column, see method)

Matrix Spike/Matrix Spike Duplicate	One set of MS/MSD per 20 samples or analysis set	See method for allowable limits
Surrogate Spikes	Added to each sample (see method for suggested surrogate compounds)	Report recovery

MINIMUM DATA PACKAGE REQUIREMENTS

- Sample results in a tabular form (if soil or sediment) reported on a dry weight basis.
- Report % moisture or % solids for all soil and sediment samples.
- Report sample volumes or weights, as well as any dilution factors, for each sample analysis.
- Return copy of the chain of custody form sent with the samples with laboratory receipt acknowledgment, and the internal or laboratory chain of custody forms.
- Method blank results.
- GC/MS tuning data summary.
- GC/MS initial and continuing calibration data summary forms.
- GC/MS internal standard data for samples and associated daily standard.
- Surrogate spike recoveries, either on a separate table or with the results, including laboratory QC limits.
- Matrix spike recovery tables, including laboratory recovery and relative percent difference QC limits.
- Date samples were analyzed, on a separate sheet, tune sheet, or results page.
- Optional: sample, standard and blank chromatograms, quantitation sheets, mass spectra, instrument run logs, and total solids logs.

Note: The optional QC must be maintained by laboratory for at least one year for possible future QC audits.

[Region 3 HSCD | Region 3 | EPA Superfund]

United States Environmental Protection Agency, 1650 Arch Street, Philadelphia, PA 19103-2029
Phone: (800) 438-2474

Polycyclic Aromatic Hydrocarbons (PAHs) - ToxFAQs™

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

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

What are polycyclic aromatic hydrocarbons?

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

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

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

What happens to PAHs when they enter the environment?

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

How might I be exposed to PAHs?

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

Polycyclic Aromatic Hydrocarbons

How can PAHs affect my health?

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

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

How likely are PAHs to cause cancer?

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

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

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

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

Has the federal government made recommendations to protect human health?

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

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

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

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

Where can I get more information?

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

Phone: 1-800-232-4636.

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

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

SAFETY DATA SHEET
according to the (US) Hazard Communication Standard (29 CFR 1910.1200)

Revision Date 02/12/2019 Version 3.0

SECTION 1.Identification

Product identifier

Product number	821051
Product name	Pyrene for synthesis
CAS-No.	129-00-0

Relevant identified uses of the substance or mixture and uses advised against

Identified uses	Chemical for synthesis

Details of the supplier of the safety data sheet

Company	EMD Millipore Corporation | 400 Summit Drive | Burlington | Massachusetts 01803 | United States of America | General Inquiries: +1 800-645-5476 | Monday to Friday, 9:00 AM to 4:00 PM Eastern Time (GMT-5) MilliporeSigma is a business of Merck KGaA, Darmstadt, Germany.
Emergency telephone	800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2. Hazards identification

GHS-Labeling
Not a dangerous substance according to GHS.

Other hazards
None known.

SECTION 3. Composition/information on ingredients

Formula	$C_{16}H_{10}$ (Hill)
Molar mass	202.26 g/mol

Remarks	No hazardous ingredients according to the OSHA Hazard Communication Standard 29 CFR 1910.1200.

SECTION 4. First aid measures

Description of first-aid measures

Inhalation
After inhalation: fresh air.

Skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower.

Eye contact
After eye contact: rinse out with plenty of water. Remove contact lenses.

Ingestion
After swallowing: make victim drink water (two glasses at most). Consult doctor if feeling unwell.

Never give anything by mouth to an unconscious person.

Most important symptoms and effects, both acute and delayed

We have no description of any toxic symptoms.

Indication of any immediate medical attention and special treatment needed

No information available.

SECTION 5. Fire-fighting measures

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.

Special hazards arising from the substance or mixture

Combustible.
Risk of dust explosion.
Vapors are heavier than air and may spread along floors.
Forms explosive mixtures with air on intense heating.
Development of hazardous combustion gases or vapors possible in the event of fire.

Advice for firefighters

Special protective equipment for fire-fighters
In the event of fire, wear self-contained breathing apparatus.

Further information
Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid inhalation of dusts. Evacuate the danger area, observe emergency procedures, consult an expert.

Advice for emergency responders:

Protective equipment see section 8.

Environmental precautions

Do not let product enter drains.

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.

SECTION 7. Handling and storage

Precautions for safe handling

Observe label precautions.

Conditions for safe storage, including any incompatibilities

Tightly closed. Dry.

Storage temperature: no restrictions.

SECTION 8. Exposure controls/personal protection

Exposure limit(s)

Contains no substances with occupational exposure limit values.

Engineering measures

Technical measures and appropriate working operations should be given priority over the use of personal protective equipment.

Individual protection measures

Protective clothing should be selected specifically for the workplace, depending on concentration and quantity of the hazardous substances handled. The chemical resistance of the protective equipment should be inquired at the respective supplier.

Hygiene measures
Change contaminated clothing. Wash hands after working with substance.

Eye/face protection
Safety glasses

Hand protection

full contact:

Glove material:	Nitrile rubber
Glove thickness:	0.11 mm
Break through time:	480 min

splash contact:

Glove material:	Nitrile rubber
Glove thickness:	0.11 mm
Break through time:	480 min

The protective gloves to be used must comply with the specifications of EC Directive 89/686/EEC and the related standard EN374, for example KCL 741 Dermatril® L (full contact), KCL 741 Dermatril® L (splash contact).
The breakthrough times stated above were determined by KCL in laboratory tests acc. to EN374 with samples of the recommended glove types.
This recommendation applies only to the product stated in the safety data sheet and supplied by us as well as to the purpose specified by us. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Respiratory protection
required when dusts are generated.
Recommended Filter type: Filter P 1 (acc. to DIN 3181) for solid particles of inert substances
The entrepeneur has to ensure that maintenance, cleaning and testing of respiratory protective devices are performed according to the instructions of the producer.
These measures have to be properly documented.

SECTION 9. Physical and chemical properties

Physical state	powder, finecrystalline
Color	colorless
Odor	odorless
Odor Threshold	Not applicable
pH	No information available.

Melting point	298 - 302 °F (148 - 150 °C)
Boiling point/boiling range	739 °F (393 °C) at 1,013 hPa
Flash point	392 - 428 °F (200 - 220 °C)
Evaporation rate	No information available.
Flammability (solid, gas)	No information available.
Lower explosion limit	No information available.
Upper explosion limit	No information available.
Vapor pressure	No information available.
Relative vapor density	No information available.
Density	1.21 g/cm3 at 68 °F (20 °C)
Relative density	No information available.
Water solubility	ca.0.134 g/l at 77 °F (25 °C) Method: OECD Test Guideline 105
Partition coefficient: n-octanol/water	log Pow: 5.43 (30 °C) OECD Test Guideline 117 Potential bioaccumulation
Autoignition temperature	No information available.
Decomposition temperature	No information available.
Viscosity, dynamic	No information available.
Explosive properties	Not classified as explosive.
Oxidizing properties	none
Bulk density	650 kg/m3

SECTION 10. Stability and reactivity

Reactivity
Risk of dust explosion.
Forms explosive mixtures with air on intense heating.
A range from approx. 15 Kelvin below the flash point is to be rated as critical.

Chemical stability
The product is chemically stable under standard ambient conditions (room temperature) .

Possibility of hazardous reactions
increased reactivity with:

Strong oxidizing agents

Conditions to avoid
Strong heating.

Incompatible materials
no information available

Hazardous decomposition products
no information available

SECTION 11. Toxicological information

Information on toxicological effects

Likely route of exposure
Eye contact, Skin contact, Ingestion

Acute oral toxicity
LD50 Rat: 2,700 mg/kg (RTECS)

Skin irritation
Rabbit
Result: slight irritation
(External MSDS)

Eye irritation
Rabbit
Result: No eye irritation
(External MSDS)

Genotoxicity in vivo
Mutagenicity (mammal cell test):
Result: negative
(National Toxicology Program)

Mutagenicity (mammal cell test): chromosome aberration.
Result: negative
(National Toxicology Program)

Specific target organ systemic toxicity - single exposure
The substance or mixture is not classified as specific target organ toxicant, single exposure.

Specific target organ systemic toxicity - repeated exposure
The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Aspiration hazard
Regarding the available data the classification criteria are not fulfilled.

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.
OSHA	No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.
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.
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.

Further information
Hazardous properties cannot be excluded but are unlikely when the product is handled appropriately.
Handle in accordance with good industrial hygiene and safety practice.

SECTION 12. Ecological information

Ecotoxicity

Toxicity to fish
LC50 Oncorhynchus mykiss (rainbow trout): > 2 mg/l; 96 h (External MSDS)

Toxicity to daphnia and other aquatic invertebrates
EC50 Daphnia magna (Water flea): 0.002 - 0.003 mg/l; 48 h (External MSDS)

Persistence and degradability

Biodegradability
13 %; 28 d
(HSDB)
Not readily biodegradable.

Bioaccumulative potential
Partition coefficient: n-octanol/water
log Pow: 5.43 (30 °C)
OECD Test Guideline 117
Potential bioaccumulation

Bioaccumulation
Bioconcentration factor (BCF): 4,810
Fish 0.056 mg/l; 2 d
((External MSDS))

Mobility in soil
No information available.

SECTION 13. Disposal considerations

The information presented only applies to the material as supplied. The identification based on characteristic(s) or listing may not apply if the material has been used or otherwise contaminated. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste identification and disposal methods in compliance with applicable regulations. Disposal should be in accordance with applicable regional, national and local laws and regulations.

SECTION 14. Transport information

Land transport (DOT)

UN number	UN 3077
Proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (PYRENE)
Class	9
Packing group	III
Environmentally hazardous	--

Air transport (IATA)

UN number	UN 3077
Proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (PYRENE)
Class	9
Packing group	III
Environmentally hazardous	--
Special precautions for user	no

Sea transport (IMDG)

UN number	UN 3077
Proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (PYRENE)
Class	9
Packing group	III
Environmentally hazardous	--
Special precautions for user	yes
EmS	F-A S-F

SECTION 15. Regulatory information

United States of America

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 302

The following components are subject to reporting levels established by SARA Title III, Section 302:

Components

Pyrene 129-00-0

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.

DEA List I
Not listed

DEA List II
Not listed

US State Regulations

Massachusetts Right To Know
Components
Pyrene

Pennsylvania Right To Know
Components
Pyrene

New Jersey Right To Know
Components
Pyrene

California Prop 65 Components
This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

Notification status

TSCA:	All components of the product are listed in the TSCA-inventory.
DSL:	All components of this product are on the Canadian DSL

SECTION 16. Other information

Training advice
Provide adequate information, instruction and training for operators.

Labeling
Hazard pictograms

Signal Word
Warning

Hazard Statements
H410 Very toxic to aquatic life with long lasting effects.

Precautionary Statements
Prevention
P273 Avoid release to the environment.

Key or legend to abbreviations and acronyms used in the safety data sheet
Used abbreviations and acronyms can be looked up at www.wikipedia.org.

Revision Date02/12/2019

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.

SAFETY DATA SHEET

Creation Date 03-May-2012 **Revision Date** 05-Mar-2019 **Revision Number** 5

1. Identification

Product Name **Anthracene**

Cat No. : **AC104860000; AC104860025; AC104860050; AC104860100; AC104861000; AC104865000**

CAS-No 120-12-7
Synonyms Green oil; Paranaphtalene

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company

Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/Irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Combustible dust	Yes

Label Elements

Signal Word
Warning

Hazard Statements
May form combustible dust concentrations in air
Causes skin irritation
Causes serious eye irritation

Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves/protective clothing/eye protection/face protection
Skin
IF ON SKIN: Wash with plenty of soap and water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store in a well-ventilated place. Keep container tightly closed
Hazards not otherwise classified (HNOC)
Very toxic to aquatic life with long lasting effects

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Anthracene	120-12-7	>95

4. First-aid measures

General Advice If symptoms persist, call a physician.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Get medical attention.

Inhalation Remove to fresh air. Get medical attention if symptoms occur. If not breathing, give artificial respiration.

Ingestion Do NOT induce vomiting. Get medical attention.

Most important symptoms and effects None reasonably foreseeable.

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Water spray, carbon dioxide (CO2), dry chemical, alcohol-resistant foam.

Unsuitable Extinguishing Media No information available

Flash Point 121 °C / 249.8 °F

Method - No information available

Autoignition Temperature 540 °C / 1004 °F

Explosion Limits

Upper	No data available
Lower	0.6 vol %
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Fine dust dispersed in air may ignite. Dust can form an explosive mixture with air. Thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition. Do not allow run-off from fire-fighting to enter drains or water courses.

Hazardous Combustion Products
Carbon monoxide (CO). Carbon dioxide (CO_2).
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	1	1	N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment as required. Ensure adequate ventilation. Avoid dust formation. Avoid contact with skin, eyes or clothing.

Environmental Precautions Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system. Prevent product from entering drains. Local authorities should be advised if significant spillages cannot be contained.

Methods for Containment and Clean Up Sweep up and shovel into suitable containers for disposal. Avoid dust formation.

7. Handling and storage

Handling Wear personal protective equipment/face protection. Ensure adequate ventilation. Avoid dust formation. Avoid contact with skin, eyes or clothing. Avoid ingestion and inhalation.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from direct sunlight.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Anthracene		TWA: 0.2 mg/m³		

Legend

OSHA - Occupational Safety and Health Administration

Engineering Measures Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard

EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Powder Solid
Appearance	Yellow
Odor	aromatic
Odor Threshold	No information available
pH	No information available
Melting Point/Range	215 - 218 °C / 419 - 424.4 °F
Boiling Point/Range	340 °C / 644 °F @ 760 mmHg
Flash Point	121 °C / 249.8 °F
Evaporation Rate	Not applicable
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	0.6 vol %
Vapor Pressure	1.3 mbar @ 145 °C
Vapor Density	Not applicable
Specific Gravity	No information available
Solubility	insoluble
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	540 °C / 1004 °F
Decomposition Temperature	No information available
Viscosity	Not applicable
Molecular Formula	C14 H10
Molecular Weight	178.23

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions. Sensitivity to light.

Conditions to Avoid Avoid dust formation. Incompatible products. Excess heat. Exposure to light.

Incompatible Materials Acids, Strong oxidizing agents, Fluorine

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Anthracene	LD50 > 16 g/kg (Rat)	>1320 mg/kg (Rat)	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Anthracene	120-12-7	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed No information available

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

The product contains following substances which are hazardous for the environment. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Anthracene	EC50: 0.0039 - 0.0374 mg/L, 22h (Pseudokirchneriella subcapitata)	LC50: = 0.00278 mg/L, 96h static (Lepomis macrochirus) LC50: 0 - 0.00318 mg/L, 96h flow-through (Lepomis macrochirus)	Not listed	EC50: 0.081 - 0.112 mg/L, 48h (Daphnia magna)

Persistence and Degradability Insoluble in water May persist

Bioaccumulation/ Accumulation No information available.

Mobility . Is not likely mobile in the environment due its low water solubility.

Component	log Pow
Anthracene	4.54

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substances, solid, n.o.s.
Technical Name	Anthracene
Hazard Class	9
Packing Group	III

TDG

UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substances, solid, n.o.s.
Hazard Class	9
Packing Group	III

IATA

UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substances, solid, n.o.s.
Hazard Class	9
Packing Group	III

IMDG/IMO

UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substances, solid, n.o.s.
Hazard Class	9
Packing Group	III

15. Regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags
Anthracene	120-12-7	X	ACTIVE	-

Legend:
TSCA - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories
Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Australia (AICS), China (IECSC), Korea (ECL).

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
Anthracene	120-12-7	X	-	204-371-1	X	X	X	X	KE-01825

U.S. Federal Regulations

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Anthracene	120-12-7	>95	1.0 0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Anthracene	-	-	-	X

Clean Air Act Not applicable

OSHA - Occupational Safety and Not applicable

Health Administration

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Anthracene	5000 lb	-

California Proposition 65 This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Anthracene	X	X	X	-	-

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade Slight risk, Grade 1

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 03-May-2012
Revision Date 05-Mar-2019
Print Date 05-Mar-2019
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

Safety Data Sheet

Revision Date: 07/11/19
www.restek.com

2 Letter ISO country code/language code: US/EN

1. IDENTIFICATION

Catalog Number / Product Name:	**31271 / Benzo(a)pyrene Standard**
Company:	Restek Corporation
Address:	110 Benner Circle Bellefonte, Pa. 16823
Phone#:	814-353-1300
Fax#:	814-353-1309
Emergency#:	800-424-9300 (CHEMTREC) 703-527-3887 (Outside the US)
Email:	www.restek.com
Revision Number:	11
Intended use:	For Laboratory use only

2. HAZARD(S)IDENTIFICATION

Emergency Overview:

GHS Hazard Symbols:

GHS Classification:	Skin Sensitisation Category 1 Germ Cell Mutagenicity Category 1B Carcinogenicity Category 1B Flammable Liquid Category 2 Serious Eye Damage/Eye Irritation Category 2 Specific Target Organ Systemic Toxicity (STOT) - Single Exposure Category 3
GHS Signal Word:	Danger
GHS Hazard:	Highly flammable liquid and vapour. May cause an allergic skin reaction. Causes serious eye irritation. May cause drowsiness or dizziness. May cause genetic defects. May cause cancer.
GHS Precautions:	
Safety Precautions:	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep away from heat/sparks/open flames/hot surfaces. – No smoking. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilation and lighting equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Avoid breathing dust/fume/gas/mist/vapours/spray. Wash hands and skin thoroughly after handling. Use only outdoors or in a well-ventilated area. Contaminated work clothing should not be allowed out of the workplace. Wear protective gloves/protective clothing/eye protection/face protection.
First Aid Measures:	IF ON SKIN: Wash with plenty of soap and water. IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do.

Continue rinsing.
IF exposed or concerned: Get medical advice/attention.
Call a POISON CENTER or doctor/physician if you feel unwell.
Specific treatment see section 4.
If skin irritation or rash occurs: Get medical advice/attention.
If eye irritation persists: Get medical advice/attention.
Wash contaminated clothing before reuse.
In case of fire: Use extinguishing media in section 5 for extinction.

Storage: Store in a well-ventilated place. Keep container tightly closed.
Store in a well-ventilated place. Keep cool.
Store locked up.

Disposal: Dispose of contents/container according to section 13 of the SDS.

Single Exposure Target Organs: Specific target organ toxicity - Single exposure - STOT SE 3: H336 May cause drowsiness or dizziness.

Repeated Exposure Target Organs: No data available

3. COMPOSITION / INFORMATION ON INGREDIENT

Chemical Name	CAS #	EINEC #	% Composition
Acetone	67-64-1	200-662-2	99.9
benzo (a) pyrene	50-32-8	200-028-5	0.1

4. FIRST-AID MEASURES

Inhalation: Remove to fresh air. If breathing is difficult, have a trained individual administer oxygen. If not breathing, give artificial respiration and have a trained individual administer oxygen. Get medical attention immediately

Eyes: Flush eyes with plenty of water for at least 20 minutes retracting eyelids often. Tilt the head to prevent chemical from transferring to the uncontaminated eye. Get immediate medical attention.

Skin Contact: Wash with soap and water. Remove contaminated clothing and launder. Get medical attention if irritation develops or persists.

Ingestion: Do not induce vomiting and seek medical attention immediately. Drink two glasses of water or milk to dilute. Provide medical care provider with this SDS.

5. FIRE- FIGHTING MEASURES

Extinguishing Media: Use alcohol resistant foam, carbon dioxide, or dry chemical extinguishing agents. Water spray or fog may also be effective for extinguishing if swept across the base of the fire. Water can also be used to absorb heat and keep exposed material from being damaged by fire. Flammable component(s) of this material may be lighter than water and burn while floating on the surface.

Fire and/or Explosion Hazards: Vapors may be ignited by heat, sparks, flames or other sources of ignition at or above the low flash point giving rise to a Class B fire. Vapors are heavier than air and may travel to a source of ignition and flash back

Fire Fighting Methods and Protection: Do not enter fire area without proper protection including self-contained toxic breathing apparatus and full protective equipment. Fight fire from a safe distance and a protected location due to the potential of hazardous vapors and decomposition products. Flammable component(s) of this material may be lighter than water and burn while floating on the surface. Use water spray/fog for cooling. Flammable component(s) of this material may be lighter than water and burn while floating on the surface.

Hazardous Combustion Products: Carbon dioxide, Carbon monoxide

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions and Equipment: Exposure to the spilled material may be irritating or harmful. Follow personal protective equipment recommendations found in Section 8 of

this SDS. Additional precautions may be necessary based on special circumstances created by the spill including; the material spilled, the quantity of the spill, the area in which the spill occurred. Also consider the expertise of employees in the area responding to the spill.

Methods for Clean-up: Prevent the spread of any spill to minimize harm to human health and the environment if safe to do so. Wear complete and proper personal protective equipment following the recommendation of Section 8 at a minimum. Dike with suitable absorbent material like granulated clay. Gather and store in a sealed container pending a waste disposal evaluation.

7. HANDLING AND STORAGE

Handling Technical Measures and Precautions: Harmful or irritating material. Avoid contacting and avoid breathing the material. Use only in a well ventilated area. Use spark-proof tools and explosion-proof equipment

Storage Technical Measures and Conditions: Store in a cool dry ventilated location. Isolate from incompatible materials and conditions. Keep container(s) closed. Keep away from sources of ignition

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

United States:

Chemical Name	CAS No.	IDLH	ACGIH STEL	ACGIH TLV-TWA	OSHA Exposure Limit
Acetone	67-64-1	2500 ppm IDLH (10% LEL)	750 ppm STEL; 1782 mg/m3 STEL	500 ppm TWA; 1188 mg/m3 TWA	1000 ppm TWA; 2400 mg/m3 TWA
benzo (a) pyrene	50-32-8	Not established	None Known	Not established	0.2 mg/m3 TWA (listed under Coal tar pitch volatiles)

Personal Protection:

Engineering Measures: Local exhaust ventilation is recommended when generating excessive levels of vapours from handling or thermal processing.

Respiratory Protection: No respiratory protection required under normal conditions of use. Provide general room exhaust ventilation if symptoms of overexposure occur as explained Section 3. A respirator is not normally required.

Eye Protection: Wear chemically resistant safety glasses with side shields when handling this product. Do not wear contact lenses.

Skin Protection: Wear protective gloves. Inspect gloves for chemical break-through and replace at regular intervals. Clean protective equipment regularly. Wash hands and other exposed areas with mild soap and water before eating, drinking, and when leaving work

Medical Conditions Aggravated By Exposure: Respiratory disease including asthma and bronchitis

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance, color: Depends upon product selection
Odor: Strong
Physical State: No data available
pH: Not applicable
Vapor Pressure: No data available
Vapor Density: 2.0 (air = 1)
Boiling Point (°C): 56.05 °C at 1013.25 hPa
Melting Point (°C): -95.4 °C Melting Point
Flash Point (°F): 39
Flammability: Highly Flammable
Upper Flammable/Explosive Limit, % in air: No data available
Lower Flammable/Explosive Limit, % in air: No data available
Autoignition Temperature (°C): 465 deg C
Decomposition Temperature (°C): No data available
Specific Gravity: 0.7845 g/cm3 at 25 °C
Evaporation Rate: No data available
Odor Threshold: ND
Solubility: Complete; 100%
Partition Coefficient: n-octanol in water: No data available
VOC % by weight: 99.9
Molecular Weight: 58.08

10. STABILITY AND REACTIVITY

Stability:	Stable under normal conditions.
Conditions to Avoid:	None known.
Materials to Avoid / Chemical Incompatiability:	Strong oxidizing agents Strong acids
Hazardous Decomposition Products:	Carbon dioxide Carbon monoxide

11. TOXICOLOGICAL INFORMATION

Routes of Entry:	Inhalation, Skin Contact, Eye Contact, Ingestion
Target Organs Potentially Affected By Exposure:	Eyes, Central nervous system stimulation, Respiratory Tract, Skin
Chemical Interactions That Change Toxicity:	None Known

Immediate (Acute) Health Effects by Route of Exposure:

Inhalation Irritation:	Can cause minor respiratory irritation, dizziness, weakness, fatigue, nausea, and headache.
Skin Contact:	Can cause minor skin irritation, defatting, and dermatitis.
Eye Contact:	Can cause minor irritation, tearing and reddening.
Ingestion Irritation:	May be harmful if swallowed.
Ingestion Toxicity:	Harmful if swallowed. May cause systemic poisoning.

Long-Term (Chronic) Health Effects:

Carcinogenicity:	Contains a probable or known human carcinogen.
Reproductive and Developmental Toxicity:	No data available to indicate product or any components present at greater than 0.1% may cause birth defects.
Inhalation:	Upon prolonged and/or repeated exposure, can cause minor respiratory irritation, dizziness, weakness, fatigue, nausea, and headache.
Skin Contact:	Upon prolonged or repeated contact, can cause minor skin irritation, defatting, and dermatitis.

Component Toxicological Data:
NIOSH:

Chemical Name	CAS No.	LD50/LC50
Acetone	67-64-1	Dermal LD50 Rabbit >15700 mg/kg; Inhalation LC50 Rat 50100 mg/m3 8 h; Oral LD50 Rat 5800 mg/kg

Component Carcinogenic Data:
OSHA:

Chemical Name	CAS No.	
Benzo[a]pyrene	50-32-8	Present

ACGIH:

Chemical Name	CAS No.	
Benzo[a]pyrene	50-32-8	A2 - Suspected Human Carcinogen
Acetone	67-64-1	A4 - Not Classifiable as a Human Carcinogen

NIOSH:

Chemical Name	CAS No.
No data available	

NTP:

Chemical Name	CAS No.
No data available	

IARC:

Chemical Name	CAS No.	Group No.
Monograph 100F [2012]; Monograph 92 [2010]; Supplement 7 [1987]; Monograph 32 [1983] (overall evaluation upgraded from 2B to 1 based on mechanistic and other relevant data)	50-32-8	Group 1

12. ECOLOGICAL INFORMATION

Overview: This material is not expected to be harmful to the ecology.
Mobility: No data
Persistence: No data
Bioaccumulation: No data
Degradability: No data
Ecological Toxicity Data: No data available

13. DISPOSAL CONSIDERATIONS

Waste Description of Spent Product: Spent or discarded material is a hazardous waste.Mixing spent or discarded material with other materials may render the mixture hazardous. Perform a hazardous waste determination on mixtures.
Disposal Methods: Dispose of by incineration following Federal, State, Local, or Provincial regulations.
Waste Disposal of Packaging: Comply with all Local, State, Federal, and Provincial Environmental Regulations.

14. TRANSPORTATION INFORMATION

United States:
DOT Proper Shipping Name: Acetone
UN Number: UN1090
Hazard Class: 3
Packing Group: II

International:
IATA Proper Shipping Name: Acetone
UN Number: UN1090
Hazard Class: 3
Packing Group: II

Marine Pollutant: No

Chemical Name	CAS#	Marine Pollutant	Severe Marine Pollutant
No data available			

15. REGULATORY INFORMATION

United States:

Chemical Name	CAS#	CERCLA	SARA 313	SARA EHS 313	TSCA
Acetone	67-64-1	X	-	-	X
benzo (a) pyrene	50-32-8	X	X	-	X

The following chemicals are listed on CA Prop 65:

Chemical Name	CAS #	Regulation
Benzo[a]pyrene	50-32-8	Prop 65 Cancer

State Right To Know Listing:

Chemical Name	CAS#	New Jersey	Massachusetts	Pennsylvania	California
Acetone	67-64-1	X	X	X	X
benzo (a) pyrene	50-32-8	X	X	X	X

16. OTHER INFORMATION

Prior Version Date: 07/18/18
Other Information: Any changes to the SDS compared to previous versions are marked by a vertical line in front of the concerned paragraph.
References: No data available
Disclaimer: Restek Corporation provides the descriptions, data and information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. It is provided for your guidance only. Because many factors may affect processing or application/use, Restek Corporation recommends you perform an

assessment to determine the suitability of a product for your particular purpose prior to use. No warranties of any kind, either expressed or implied, including fitness for a particular purpose, are made regarding products described, data or information set forth. In no case shall the descriptions, information, or data provided be considered a part of our terms and conditions of sale. Further, the descriptions, data and information furnished hereunder are given gratis. No obligation or liability for the description, data and information given are assumed. All such being given and accepted at your risk.

SAFETY DATA SHEET

Version 5.10
Revision Date 06/21/2018
Print Date 11/10/2018

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Naphthalene

Product Number : 84679
Brand : Sigma-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

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 solids (Category 2), H228
Acute toxicity, Oral (Category 4), H302
Carcinogenicity (Category 2), H351
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)

H228	Flammable solid.
H302	Harmful if swallowed.
H351	Suspected of causing cancer.
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.
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.
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.
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

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	$C_{10}H_8$
Molecular weight	:	128.17 g/mol
CAS-No.	:	91-20-3
EC-No.	:	202-049-5
Index-No.	:	601-052-00-2
Registration number	:	01-2119561346-37-XXXX

Hazardous components

Component	Classification	Concentration
Naphthalene		
	Flam. Sol. 2; Acute Tox. 4; Carc. 2; Aquatic Acute 1; Aquatic Chronic 1; H228, H302, H351, 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
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 dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. 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
Sweep up and shovel. 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). Keep in suitable, closed containers for disposal. Contain spillage, pick up with an electrically protected vacuum cleaner or by wet-brushing and transfer to a 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
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.Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.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.
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
Naphthalene	91-20-3	TWA	10 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Hemolytic anemia Upper Respiratory Tract irritation Cataract 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
		The value in mg/m3 is approximate.		
		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
	-	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
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, 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 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: flakes, granules Colour: white
b)	Odour	aromatic
c)	Odour Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	Melting point/range: 79.5 - 81.0 °C (175.1 - 177.8 °F)
f)	Initial boiling point and boiling range	218 °C (424 °F) - lit.
g)	Flash point	80.0 °C (176.0 °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: 5.9 %(V) Lower explosion limit: 0.9 %(V)
k)	Vapour pressure	1.3 hPa (1.0 mmHg) at 53.0 °C (127.4 °F) 0.04 hPa (0.03 mmHg) at 25.0 °C (77.0 °F)
l)	Vapour density	No data available
m)	Relative density	1.085 g/cm3 at 24.7 °C (76.5 °F)
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)
p)	Auto-ignition temperature	526.0 °C (978.8 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	1.05 mm2/s at 81.5 °C (178.7 °F) -
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information

Surface tension	31.8 mN/m at 100.0 °C (212.0 °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
No data available

10.4 Conditions to avoid
Heat, flames and sparks.

10.5 Incompatible materials
Strong oxidizing agents

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 - 490.0 mg/kg

LC50 Inhalation - Rat - male and female - 4 h - > 0.4 mg/l
(OECD Test Guideline 403)

LD50 Dermal - Rabbit - 20,000 mg/kg

No data available

Skin corrosion/irritation
Skin - Rabbit
Result: No skin irritation - 24 h

Serious eye damage/eye irritation
Eyes - Rabbit
Result: Mild eye irritation

Respiratory or skin sensitisation
Maximisation Test - Guinea pig
Result: Does not cause skin sensitisation.
(OECD Test Guideline 406)

Germ cell mutagenicity
Ames test
S. typhimurium
Result: negative

Rat - male
Result: negative

Carcinogenicity

Carcinogenicity - Rat - male and female - inhalation (vapour)
Tumorigenic:Tumors at site or application.

IARC:	2B - Group 2B: Possibly carcinogenic to humans (Naphthalene)
NTP:	RAHC - Reasonably anticipated to be a human carcinogen (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

Additional Information

Repeated dose toxicity	Rat - male and female - Oral - NOAEL : 100 mg/kg - LOAEL : 400 mg/kg - OECD Test Guideline 408

RTECS: QJ0525000

Absorption into the body leads to the formation of methemoglobin which in sufficient concentration causes cyanosis. Onset may be delayed 2 to 4 hours or longer., Naphthalene is retinotoxic and systemic absorption of its vapors above 15ppm, may result in:, cataracts, optic neuritis, corneal injury, Eye irritation, Ingestion may provoke the following symptoms:, hemolytic anemia, hemoglobinuria, Nausea, Headache, Vomiting, Gastrointestinal disturbance, Convulsions, anemia, Kidney injury may occur., Seizures., Coma.

Heart -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	flow-through test LC50 - Pimephales promelas (fathead minnow) - 7.9 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

12.2 Persistence and degradability

Biodegradability	aerobic - Exposure time 28 d Result: 2 % - Not readily biodegradable.

12.3 Bioaccumulative potential

Bioaccumulation	Fish Bioconcentration factor (BCF): 427 - 1,158

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

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: 1334 Class: 4.1 Packing group: III
Proper shipping name: Naphthalene, crude
Reportable Quantity (RQ): 100 lbsMarine 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, CRUDE
Marine pollutant:yes Marine pollutant: yes

IATA
UN number: 1334 Class: 4.1 Packing group: III
Proper shipping name: Naphthalene, crude

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
Naphthalene	91-20-3	2007-03-01

SARA 311/312 Hazards
Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Naphthalene	91-20-3	2007-03-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Naphthalene	91-20-3	2007-03-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Naphthalene	91-20-3	2007-03-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. Naphthalene	91-20-3	2007-09-28

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
Flam. Sol.	Flammable solids
H228	Flammable solid.
H302	Harmful if swallowed.
H351	Suspected of causing cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

Further information

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: 5.10 Revision Date: 06/21/2018 Print Date: 11/10/2018

SAFETY DATA SHEET

Revision Date 19-Jan-2018 **Revision Number** 3

1. Identification

Product Name **1,2-Benzanthracene**

Cat No. : **AC105250000; AC105250010; AC105252500**

Synonyms Benzóa!anthracene; Tetraphene

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company

Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Carcinogenicity	Category 1B

Label Elements

Signal Word
Danger

Hazard Statements
May cause cancer

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Response
IF exposed or concerned: Get medical attention/advice
Storage
Store locked up
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Very toxic to aquatic life with long lasting effects
WARNING. Cancer - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Benz[a]anthracene	56-55-3	99

4. First-aid measures

Eye Contact Immediate medical attention is required. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.

Skin Contact Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Immediate medical attention is required.

Inhalation Remove from exposure, lie down. Remove to fresh air. If not breathing, give artificial respiration. Immediate medical attention is required.

Ingestion Call a physician immediately. Clean mouth with water.

Most important symptoms and effects No information available.

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Water spray. Carbon dioxide (CO_2). Dry chemical. Chemical foam.

Unsuitable Extinguishing Media No information available

Flash Point No information available
Method - No information available

Autoignition Temperature Not applicable

Explosion Limits
Upper No data available

Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Do not allow run-off from fire-fighting to enter drains or water courses.

Hazardous Combustion Products
Carbon monoxide (CO). Carbon dioxide (CO_2).
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
0	1	0	N/A

6. Accidental release measures

Personal Precautions	Ensure adequate ventilation. Use personal protective equipment as required.
Environmental Precautions	Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system. Prevent product from entering drains. Local authorities should be advised if significant spillages cannot be contained.
Methods for Containment and Clean Up	Sweep up and shovel into suitable containers for disposal.

7. Handling and storage

Handling	Do not breathe dust. Do not get in eyes, on skin, or on clothing. Handle product only in closed system or provide appropriate exhaust ventilation.
Storage	Keep in a dry, cool and well-ventilated place. Refer product specification and/or product label for specific storage temperature requirement. Keep container tightly closed.

8. Exposure controls / personal protection

Exposure Guidelines	This product does not contain any hazardous materials with occupational exposure limitsestablished by the region specific regulatory bodies.
Engineering Measures	Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment

Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Powder Solid

Appearance	Beige
Odor	Odorless
Odor Threshold	No information available
pH	No information available
Melting Point/Range	158 - 161 °C / 316.4 - 321.8 °F
Boiling Point/Range	437.6 °C / 819.7 °F
Flash Point	No information available
Evaporation Rate	Not applicable
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	No information available
Vapor Density	Not applicable
Specific Gravity	No information available
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	Not applicable
Decomposition Temperature	No information available
Viscosity	Not applicable
Molecular Formula	C18 H12
Molecular Weight	228.29

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products.

Incompatible Materials Strong oxidizing agents

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization No information available.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information No acute toxicity information is available for this product

Component Information

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation No information available

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Benz[a]anthracene	56-55-3	Group 2B	Reasonably Anticipated	A2	X	A2

Mutagenic Effects Ames test: positive.

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed No information available

Endocrine Disruptor Information

Component	EU - Endocrine Disrupters Candidate List	EU - Endocrine Disruptors - Evaluated Substances	Japan - Endocrine Disruptor Information
Benz[a]anthracene	Group III Chemical	Not applicable	Not applicable

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

The product contains following substances which are hazardous for the environment. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Benz[a]anthracene	Not listed	Not listed	EC50 = 0.26 mg/L 15 min	LC50: = 0.01 mg/L, 96h Static (Daphnia magna) EC50: = 0.0042 mg/L, 48h (Daphnia magna)

Persistence and Degradability May persist

Bioaccumulation/ Accumulation No information available.

Mobility . Is not likely mobile in the environment due its low water solubility.

Component	log Pow
Benz[a]anthracene	5.61

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Benz[a]anthracene - 56-55-3	U018	-

14. Transport information

DOT Not regulated
TDG Not regulated
IATA
- **UN-No** UN3077
- **Proper Shipping Name** ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.*
- **Hazard Class** 9
- **Packing Group** III

IMDG/IMO
- **UN-No** UN3077
- **Proper Shipping Name** Environmentally hazardous substances, solid, n.o.s.

Hazard Class 9
Packing Group III

15. Regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags
Benz[a]anthracene	56-55-3	X	ACTIVE	-

Legend:
TSCA - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories
Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Australia (AICS), China (IECSC), Korea (ECL).

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
Benz[a]anthracene	56-55-3	-	X	200-280-6	-	-	-	X	-

U.S. Federal Regulations

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Benz[a]anthracene	56-55-3	99	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Benz[a]anthracene	-	-	-	X

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Benz[a]anthracene	10 lb	-

California Proposition 65 This product contains the following Proposition 65 chemicals.

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Benz[a]anthracene	56-55-3	Carcinogen	0.033 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Benz[a]anthracene	X	X	X	X	X

U.S. Department of Transportation
Reportable Quantity (RQ): N

DOT Marine Pollutant	N
DOT Severe Marine Pollutant	N

U.S. Department of Homeland Security This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Revision Date 19-Jan-2018
Print Date 19-Jan-2018
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

Pesticides and Polychlorinated Biphenyls (PCBs)

http://www.epa.gov/pesticides/factsheets/riskassess.htm
Last updated on Wednesday, May 09, 2012

Pesticides: Topical & Chemical Fact Sheets

Assessing Health Risks from Pesticides

Este Web page está disponible en español

Current as of: April 5, 2007
735-F-99-002

Questions on Pesticides?

- Contact the National Pesticide Information Center (NPIC) 1-800-858-7378

The Federal Government, in cooperation with the States, carefully regulates pesticides to ensure that they do not pose unreasonable risks to human health or the environment. As part of that effort, the Environmental Protection Agency (EPA) requires extensive test data from pesticide producers that demonstrate pesticide products can be used without posing harm to human health and the environment. EPA scientists and analysts carefully review these data to determine whether to register (license) a pesticide product or a use and whether specific restrictions are necessary. This fact sheet is a brief overview of EPA's process for assessing potential risks to human health when evaluating pesticide products.

Background

There are more than 1055 active ingredients registered as pesticides, which are formulated into thousands of pesticide products that are available in the marketplace.

EPA plays a critical role in evaluating these chemicals prior to registration, and in reevaluating older pesticides already on the market, to ensure that they can be used with a reasonable certainty of no harm. The process EPA uses for evaluating the health impacts of a pesticide is called risk assessment.

EPA uses the National Research Council's four-step process for human health risk assessment:

Step One: Hazard Identification
Step Two: Dose-Response Assessment
Step Three: Exposure Assessment
Step Four: Risk Characterization

Step One: Hazard Identification (Toxicology)

The first step in the risk assessment process is to identify potential health effects that may occur from different types of pesticide exposure. EPA considers the full spectrum of a pesticide's potential health effects.

Generally, for human health risk assessments, many toxicity studies are conducted on animals by pesticide companies in independent laboratories and evaluated for acceptability by EPA scientists. EPA evaluates pesticides for a wide range of adverse effects, from eye and skin irritation to cancer and birth defects in laboratory animals. EPA may also consult the public literature or other sources of supporting information on any aspect of the chemical.

Step Two: Dose-Response Assessment

Paracelsus, the Swiss physician and alchemist, the “father” of modern toxicology (1493-1541) said,

> "The dose makes the poison."

In other words, **the amount of a substance a person is exposed to** is as important as **how toxic the chemical might be**. For example, small doses of aspirin can be beneficial to people, but at very high doses, this common medicine can be deadly. In some individuals, even at very low doses, aspirin may be deadly.

Dose-response assessment involves considering the dose levels at which adverse effects were observed in test animals, and using these dose levels to calculate an equal dose in humans.

Step Three: Exposure Assessment

People can be exposed to pesticides in three ways:

1. Inhaling pesticides (inhalation exposure),
2. Absorbing pesticides through the skin (dermal exposure), and
3. Getting pesticides in their mouth or digestive tract (oral exposure).

Depending on the situation, pesticides could enter the body by any one or all of these routes. Typical sources of pesticide exposure include:

- **Food**
  Most of the foods we eat have been grown with the use of pesticides. Therefore, pesticide residues may be present inside or on the surfaces of these foods.
- **Home and Personal Use Pesticides**
  You might use pesticides in and around your home to control insects, weeds, mold, mildew, bacteria, lawn and garden pests and to protect your pets from pests such as fleas. Pesticides may also be used as insect repellants which are directly applied to the skin or clothing.
- **Pesticides in Drinking Water**
  Some pesticides that are applied to farmland or other land structures can make their way in small amounts to the ground water or surface water systems that feed drinking water supplies.
- **Worker Exposure to Pesticides**
  Pesticide applicators, vegetable and fruit pickers and others who work around pesticides can be exposed due to the nature of their jobs. To address the unique risks workers face from occupational exposure, EPA evaluates occupational exposure through a separate program. All pesticides registered by EPA have been shown to be safe when used properly.

Step Four: Risk Characterization

Risk characterization is the final step in assessing human health risks from pesticides. It is the process of combining the hazard, dose-response and exposure assessments to describe the overall risk from a pesticide. It explains the assumptions used in assessing exposure as well as the uncertainties that are built into the dose-response assessment. The strength of the overall database is considered, and broad conclusions are made. EPA’s role is to evaluate both toxicity and exposure and to determine the risk associated with use of the pesticide.

Simply put,

> RISK = TOXICITY x EXPOSURE.

This means that the risk to human health from pesticide exposure depends on both the toxicity of the pesticide and the likelihood of people coming into contact with it. At least *some* exposure and *some* toxicity are required to result in a risk. For example, if the pesticide is very poisonous, but no people are exposed, there is no risk. Likewise, if there is ample exposure but the chemical is non-toxic, there is no risk. However, usually when pesticides are used, there is some toxicity and exposure, which results in a potential risk.

EPA recognizes that effects vary between animals of different species and from person to person. To account for this variability, *uncertainty factors* are built into the risk assessment. These uncertainty factors create an additional margin of safety for protecting people who may be exposed to the pesticides. FQPA requires EPA to use an extra 10-fold safety factor, if necessary, to protect infants and children from effects of the pesticide.

Types of Toxicity Tests EPA Requires for Human Health Risk Assessments

EPA evaluates studies conducted over different periods of time and that measure specific types of effects. These tests are evaluated to screen for potential health effects in infants, children and adults.

Acute Testing: Short-term exposure; a single exposure (dose).

- Oral, dermal (skin), and inhalation exposure
- Eye irritation
- Skin irritation
- Skin sensitization
- Neurotoxicity

Sub-chronic Testing: Intermediate exposure; repeated exposure over a longer period of time (i.e., 30-90 days).

- Oral, dermal (skin), and inhalation
- Neurotoxicity (nerve system damage)

Chronic Toxicity Testing: Long-term exposure; repeated exposure lasting for most of the test animal's life span. Intended to determine the effects of a pesticide after prolonged and repeated exposures.

- Chronic effects (non-cancer)
- Carcinogenicity (cancer)

Developmental and Reproductive Testing: Identify effects in the fetus of an exposed pregnant female (birth defects) and how pesticide exposure affects the ability of a test animal to successfully reproduce.

Mutagenicity Testing: Assess a pesticide's potential to affect the cell's genetic components.

Hormone Disruption: Measure effects for their potential to disrupt the endocrine system. The endocrine system consists of a set of glands and the hormones they produce that help guide the development, growth, reproduction, and behavior of animals including humans.

Risk Management

Once EPA completes the risk assessment process for a pesticide, we use this information to determine if (when used according to label directions), there is a reasonable certainty that the pesticide will not harm a person’s health.

Using the conclusions of a risk assessment, EPA can then make a more informed decision regarding whether to approve a pesticide chemical or use, as proposed, or whether additional protective measures are necessary to limit occupational or non-occupational exposure to a pesticide. For example, EPA may prohibit a pesticide from being used on certain crops because consuming too much food treated with the pesticide may result in an unacceptable risk to consumers. Another example of protective measures is requiring workers to wear personal protective equipment (PPE) such as a respirator or chemical resistant gloves, or not allowing workers to enter treated crop fields until a specific period of time has passed.

If, after considering all appropriate risk reduction measures, the pesticide still does not meet EPA's safety standard, the Agency will not allow the proposed chemical or use. Regardless of the specific measures enforced, EPA's primary goal is to ensure that legal uses of the pesticide are protective of human health, especially the health of children, and the environment.

Human Health Risk Assessment and the Law

Federal law requires detailed evaluation of pesticides to protect human health and the environment. In 1996, Congress made significant changes to strengthen pesticide laws through the Food Quality Protection Act (FQPA). Many of these changes are key elements of the current risk assessment process. FQPA required that EPA consider:

- **A New Safety Standard**: FQPA strengthened the safety standard that pesticides must meet before being approved for use. EPA must ensure with a reasonable certainty that no harm will result from the legal uses of the pesticide.
- **Exposure from All Sources**: In evaluating a pesticide, EPA must estimate the combined risk from that pesticide from all non-occupational sources, such as:
  - Food Sources
  - Drinking Water Sources
  - Residential Sources
- **Cumulative Risk**: EPA is required to evaluate pesticides in light of similar toxic effects that different pesticides may share, or "a common mechanism of toxicity." Read about how EPA evaluates cumulative risk for pesticides.
- **Special Sensitivity of Children to Pesticides**: EPA must ascertain whether there is an increased susceptibility from exposure to the pesticide to infants and children. EPA must build an additional 10-fold safety factor into risk assessments to ensure the protection of infants and children, unless it is determined that a lesser margin of safety will be safe for infants and children.

For More Information

If you would like more information about EPA's pesticide programs, contact the Communication Service Branch at (703) 305-5017 or visit the Pesticides Web site.

For more information on specific pesticides, or to inquire about the symptoms of pesticide poisoning, call the National Pesticide Information Center (NPIC), a toll-free hotline information at: 1-800-858-7378, or visit their Web site EXIT Disclaimer .

Polychlorinated Biphenyls - ToxFAQs™

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

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

What are polychlorinated biphenyls?

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

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

What happens to PCBs when they enter the environment?

- PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.
- PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.
- PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.
- PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

How might I be exposed to PCBs?

- Using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation, and could be a source of skin exposure.
- Eating contaminated food. The main dietary sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat, and dairy products.
- Breathing air near hazardous waste sites and drinking contaminated well water.
- In the workplace during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials.

How can PCBs affect my health?

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

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over

several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

How likely are PCBs to cause cancer?

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. PCBs have been classified as probably carcinogenic, and carcinogenic to humans (group 1) by the Environmental Protection Agency (EPA) and International Agency for Research on Cancer (IARC), respectively.

How can PCBs affect children?

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

How can families reduce the risks of exposure to PCBs?

- You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.
- Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.
- Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.
- If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

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

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

Has the federal government made recommendations to protect human health?

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

References

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

Where can I get more information?

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

Phone: 1-800-232-4636.

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

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

Metals

Toxic Metals- Safe Work Practices

While many elements that are considered heavy metals have no known benefit for human physiology (e.g., lead, mercury, cadmium), others are essential to human biochemical processes (e.g., zinc, iron, cobalt). When heavy metals are taken up and stored faster than they are broken down or excreted, they can bio-accumulate in body tissues and reach toxic concentrations. The toxicity of heavy metals depends on a number of factors including the dose (acute or chronic), frequency and route of exposure, and the age and health-status of exposed individuals. The following is a list of commonly used toxic metals at the University. This list is not comprehensive.

Aluminum	**Iron**
Antimony	**Lead**
Arsenic	**Manganese**
Barium	**Mercury**
Beryllium	**Molybdenum**
Bismuth	**Nickel**
Boron	**Selenium**
Cadmium	**Silver**
Chromium	**Tin**
Cobalt	**Vanadium**
Copper	**Zinc**

In general, heavy metals bind to oxygen, nitrogen, and sulfhydryl groups in proteins, resulting in alterations of enzymatic activity. As a result, almost all organ systems are involved in heavy metal toxicity. Overexposure to toxic metals can impair function in the heart, liver, blood, intestines, kidneys and skin as well as disrupt processes of the immune, endocrine, central nervous and peripheral nervous systems. Many heavy metals are also recognized as being acutely toxic, germ cell mutagens, carcinogens or capable of causing adverse effects on sexual function and fertility. The negative physiological and neurological health effects associated with exposure to heavy metals makes safe work practices of critical importance.

Safe Work Practices

The following measures should be taken by researchers working with toxic metals:

- Read the **safety data sheet (SDS)** for each toxic metal or metal compound prior to use.
- Eliminate, substitute less toxic chemicals or reduce the quantities of toxic metals being used if possible.
- Work with toxic metals in a chemical fume hood, glove box or with other types of local exhaust ventilation.
- Wear personal protective equipment as indicated by safety data sheets or the lab's workplace hazard assessment form .
- Ensure containers are clearly labeled and inspect containers for leaks or damage prior to use.
- Store toxic metals in tightly-sealed containers away from incompatible materials.
- Corrosive, toxic metals (e.g. mercury) should be stored below eye level.
- Do not return contaminated or unused material to the original container.
- Ensure that emergency eyewash/shower stations are readily available.
- Ensure that all waste containers are compatible with the toxic metals and that the containers are properly labeled and stored.

Additional Resources

Agency for Toxic Substances and Disease Registry- ATSDR Toxic Substances Portal
http://www.atsdr.cdc.gov/substances/index.asp

Environmental Protection Agency- Hazardous Waste Characteristics
http://www.epa.gov/osw/hazard/wastetypes/wasteid/char/hw-char.pdf

Occupational Safety & Health Administration- Toxic Metals
http://www.osha.gov/SLTC/metalsheavy/index.html

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006
Version 5.0 Revision Date 29.10.2012
Print Date 19.04.2017
GENERIC EU MSDS - NO COUNTRY SPECIFIC DATA - NO OEL DATA

1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 Product identifiers

Product name : Arsenic

Product Number : 267961
Brand : Aldrich
Index-No. : 033-001-00-X
CAS-No. : 7440-38-2

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 Israel Ltd.
3 PARK RABIN, PLAUT
7670603 REHOVOT
ISRAEL

Telephone : +972 8948-4222
Fax : +972 8948-4200

1.4 Emergency telephone number

Emergency Phone # : +972 (8) 948-4222

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 [EU-GHS/CLP]
Acute aquatic toxicity (Category 1)
Chronic aquatic toxicity (Category 1)
Acute toxicity, Inhalation (Category 3)
Acute toxicity, Oral (Category 3)

Classification according to EU Directives 67/548/EEC or 1999/45/EC
Toxic by inhalation and if swallowed. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

2.2 Label elements

Labelling according Regulation (EC) No 1272/2008 [CLP]
Pictogram

Signal word Danger

Hazard statement(s)
H301 Toxic if swallowed.
H331 Toxic if inhaled.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)
P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P273 Avoid release to the environment.
P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/

physician.

P311	Call a POISON CENTER or doctor/ physician.
P501	Dispose of contents/ container to an approved waste disposal plant.
Supplemental Hazard Statements	none

According to European Directive 67/548/EEC as amended.

Hazard symbol(s)

R-phrase(s)

R23/25	Toxic by inhalation and if swallowed.
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

S-phrase(s)

S20/21	When using do not eat, drink or smoke.
S28	After contact with skin, wash immediately with plenty of soap and water.
S45	In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S60	This material and its container must be disposed of as hazardous waste.
S61	Avoid release to the environment. Refer to special instructions/ Safety data sheets.

2.3 Other hazards - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula : As
Molecular Weight : 74,92 g/mol

Component		Concentration
Arsenic		
CAS-No.	7440-38-2	-
EC-No.	231-148-6	
Index-No.	033-001-00-X	

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. 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

Absorption into the body leads to the formation of methemoglobin which in sufficient concentration causes cyanosis. Onset may be delayed 2 to 4 hours or longer.

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
Arsenic oxides

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
Wear respiratory protection. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

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.
Provide appropriate exhaust ventilation at places where dust is formed.

7.2 Conditions for safe storage, including any incompatibilities
Store in cool place. Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end uses
no data available

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

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.

The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.

Immersion protection
Material: Nitrile rubber
Minimum layer thickness: 0,11 mm
Break through time: > 480 min
Material tested:Dermatril® (Aldrich Z677272, Size M)

Splash protection
Material: Nitrile rubber
Minimum layer thickness: 0,11 mm
Break through time: > 30 min
Material tested:Dermatril® (Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 873000, 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 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 N99 (US) or type P2 (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).

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/range: 817 °C - lit.
f)	Initial boiling point and boiling range	613 °C - 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	5,727 g/mL at 25 °C
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

10. STABILITY AND REACTIVITY

10.1 Reactivity
no data available

10.2 Chemical stability
no data available

10.3 Possibility of hazardous reactions
no data available

10.4 Conditions to avoid
Heat. Exposure to air may affect product quality.

10.5 Incompatible materials
Oxidizing agents, Halogens, Palladium undergoes a violent reaction with arsenic, Zinc, Platinum oxide, Nitrogen trichloride, Bromine azide

10.6 Hazardous decomposition products
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
LD50 Oral - rat - 763 mg/kg
Remarks: Behavioral:Ataxia. Diarrhoea

LD50 Oral - mouse - 145 mg/kg
Remarks: Behavioral:Ataxia. Diarrhoea

Inhalation: 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 is or contains a component that has been reported to be carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

IARC: 1 - Group 1: Carcinogenic to humans (Arsenic)

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

Potential health effects

Inhalation	Toxic if inhaled. May cause respiratory tract irritation.
Ingestion	Harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure
Absorption into the body leads to the formation of methemoglobin which in sufficient concentration causes cyanosis. Onset may be delayed 2 to 4 hours or longer.

Additional Information
RTECS: CG0525000

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 9,9 mg/l - 96,0 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 3,8 mg/l - 48 h

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
no data available

12.6 Other adverse effects
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. 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

14.1 UN number
ADR/RID: 1558 IMDG: 1558 IATA: 1558

14.2 UN proper shipping name
ADR/RID: ARSENIC
IMDG: ARSENIC
IATA: Arsenic

14.3 Transport hazard class(es)

ADR/RID: 6.1	IMDG: 6.1	IATA: 6.1

14.4 Packaging group

ADR/RID: II	IMDG: II	IATA: II

14.5 Environmental hazards

ADR/RID: yes	IMDG Marine pollutant: yes	IATA: no

14.6 Special precautions for user

no data available

15. REGULATORY INFORMATION

This safety datasheet complies with the requirements of Regulation (EC) No. 1907/2006.

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

no data available

15.2 Chemical Safety Assessment

no data available

16. OTHER INFORMATION

Further information

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.

Mercury (Metal) **CAS No 7439-97-6**	**MATERIAL SAFETY DATA SHEET** **SDS/MSDS**

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : **Mercury** (Metal)

CAS-No. : 7439-97-6

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Industrial & for professional use only.

1.3 Details of the supplier of the safety data sheet

Company : Central Drug House (P) Ltd
7/28 Vardaan House
New Delhi-10002
INDIA

Telephone : +91 11 49404040
Email : care@cdhfinechemical.com

1.4 Emergency telephone number

Emergency Phone # : +91 11 49404040 (9:00am - 6:00 pm) [Office hours]

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008
Acute toxicity, Inhalation (Category 2), H330
Reproductive toxicity (Category 1B), H360D
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 Label elements

Labelling according Regulation (EC) No 1272/2008
Pictogram

Signal word Danger

Hazard statement(s)
H330 Fatal if inhaled.

H360D	May damage 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.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
Supplemental Hazard Statements	none

Restricted to professional users.

2.3 Other hazards

This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

SECTION 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 ingredients according to Regulation (EC) No 1272/2008

Component		Classification	Concentration
Mercury			
CAS-No.	7439-97-6	Acute Tox. 2; Repr. 1B; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H330, H360D, H372, H400, H410 M-Factor - Aquatic Acute: 1 - Aquatic Chronic: 100	<= 100 %
EC-No.	231-106-7		
Index-No.	080-001-00-0		

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
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

SECTION 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
Mercury/mercury oxides.

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

SECTION 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.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling
Avoid exposure - obtain special instructions before use.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
Store in cool place. 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): 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

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Components with workplace control parameters

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.

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.

SECTION 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 - lit.
f)	Initial boiling point and boiling range	356,6 °C - 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 at 20 °C 1 hPa at 126 °C
l)	Vapour density	6,93 - (Air = 1.0)
m)	Relative density	13,55 g/cm3 at 25 °C
n)	Water solubility	0,00006 g/l at 25 °C
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)

SECTION 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
Other decomposition products - No data available
In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity
LC50 Inhalation - Rat - male - 2 h - < 27 mg/m3

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 carcin**o**genicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (Mercury)

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

Mercury accumulates in almost all tissues, especially in the:, Kidney, Effects due to ingestion may include:, Nausea, Vomiting, Diarrhoea, intestinal bleeding

SECTION 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
This substance/mixture contains no components considered to be either persistent, bioaccumulative and

toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.

12.6 Other adverse effects
Very toxic to aquatic life with long lasting effects.

No data available

SECTION 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.

SECTION 14: Transport information

14.1 UN number

ADR/RID: 2809	IMDG: 2809	IATA: 2809

14.2 UN proper shipping name

ADR/RID:	Not permitted for transport
IMDG:	MERCURY
IATA:	Mercury

14.3 Transport hazard class(es)

ADR/RID: 8 (6.1)	IMDG: 8 (6.1)	IATA: 8 (6.1)

14.4 Packaging group

ADR/RID: III	IMDG: III	IATA: III

14.5 Environmental hazards

ADR/RID: yes	IMDG Marine pollutant: yes	IATA: no

14.6 Special precautions for user
No data available

SECTION 15: Regulatory information

This safety datasheet complies with the requirements of Regulation (EC) No. 453/2010.

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

Mercury CAS-No.: 7439-97-6
REACH - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, preparations and articles (Annex XVII)
Shall not be placed on the market
See Commission Regulation (EU) No 847/2012 for Conditions of restriction

Mercury CAS-No.: 7439-97-6
REACH - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, preparations and articles (Annex XVII)
Toxic to reproduction: category 1B
Restricted to professional users.
See Annex XVII to Regulation (EC) no 1907/2006 for Conditions of restriction

Mercury CAS-No.: 7439-97-6
Regulation (EC) No 649/2012 of the European Parliament and the Council concerning the export and import of dangerous chemicals

Mercury CAS-No.: 7439-97-6
Regulation (EC) No 649/2012 of the European Parliament and the Council concerning the export and import of dangerous chemicals

Mercury CAS-No.: 7439-97-6
Regulation (EC) No 649/2012 of the European Parliament and the Council concerning the export and import of dangerous chemicals

Mercury CAS-No.: 7439-97-6
Regulation (EC) No 649/2012 of the European Parliament and the Council concerning the export and import of dangerous chemicals
ANNEX V, PART 2: Chemicals other than persistent organic pollutants as listed in Annexes A and B to the Stockholm Convention on Persistent Organic Pollutants according to the provisions thereof.

15.2 Chemical Safety Assessment

For this product a chemical safety assessment was not carried out

SECTION 16: Other information

Full text of H-Statements referred to under sections 2 and 3.

H330	Fatal if inhaled.
H360D	May damage 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.

Further information

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. Central Drug House (P) Ltd and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.cdhfinechemical.com for additional terms and conditions of sale.

SAFETY DATA SHEET

Version 4.13
Revision Date 12/11/2017
Print Date 09/28/2018

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Lead

Product Number : 396117
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	:	207.2 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.
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	7439-92-1	Lead	30µg/ 100 ml	In blood	ACGIH - Biological Exposure Indices (BEI)
	Remarks	Not critical			
		Lead	30µg/ 100 ml	In blood	ACGIH - Biological Exposure Indices (BEI)
		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: Shot
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

Other decomposition products - No data available
Hazardous decomposition products formed under fire conditions. - Lead 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

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 carcinogen (Lead)
	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:	1910.1025 (Lead)
	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 substances, 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	1994-04-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Lead	7439-92-1	1994-04-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Lead	7439-92-1	1994-04-01

	CAS-No.	Revision Date
Lead	7439-92-1	1994-04-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Lead	7439-92-1	1994-04-01

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	1989-07-10
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Lead	7439-92-1	1989-07-10

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.

HMIS Rating

Health hazard:	1
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	1
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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: 4.13 Revision Date: 12/11/2017 Print Date: 09/28/2018

SAFETY DATA SHEET

Version 4.6
Revision Date 12/29/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Beryllium

Product Number : 378135
Brand : Aldrich

CAS-No. : 7440-41-7

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)
Acute toxicity, Oral (Category 3), H301
Acute toxicity, Inhalation (Category 2), H330
Skin irritation (Category 2), H315
Eye irritation (Category 2A), H319
Skin sensitisation (Category 1), H317
Carcinogenicity (Category 1B), H350
Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335
Specific target organ toxicity - repeated exposure (Category 1), H372

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)
H301 Toxic if swallowed.
H315 Causes skin irritation.
H317 May cause an allergic skin reaction.
H319 Causes serious eye irritation.
H330 Fatal if inhaled.
H335 May cause respiratory irritation.
H350 May cause cancer.

H372	Causes damage to organs through prolonged or repeated exposure.

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.
P272	Contaminated work clothing should not be allowed out of the workplace.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P284	Wear respiratory protection.
P301 + P310 + P330	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician. Rinse mouth.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician.
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.
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	:	Be
Molecular weight	:	9.01 g/mol
CAS-No.	:	7440-41-7
EC-No.	:	231-150-7

Hazardous components

Component	Classification	Concentration
Berylium foil		
	Acute Tox. 3; Acute Tox. 2; Skin Irrit. 2; Eye Irrit. 2A; Skin Sens. 1; Carc. 1B; STOT SE 3; STOT RE 1; H301, H315, H317, H319, H330, H335, H350, H372	<= 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
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
Beryllium 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
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.

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): 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
Berylium foil	7440-41-7	TWA	2.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		CEIL	5.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Peak	25.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		TWA	2.000000microg ram per cubic meter	USA. Occupational Exposure Limits (OSHA) - Table Z-2
	Remarks	Z27.29-1970		
		CEIL	5.000000microg ram per cubic meter	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z27.29-1970		
		Peak	25.000000micro gram per cubic meter	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z27.29-1970		
		TWA	0.000050 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Beryllium sensitization Chronic beryllium disease (berylliosis) Confirmed human carcinogen Danger of cutaneous absorption Sensitizer		
		C	0.000500 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		
		See Table Z-2		
		TWA	2.000000microg ram per cubic meter	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z27.29-1970		
		TWA	2.000000microg ram per cubic meter	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z27.29-1970		
		CEIL	5.000000microg ram per cubic meter	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z27.29-1970		
		CEIL	5.000000microg ram per cubic meter	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z27.29-1970		
		Peak	25.000000micro gram per cubic meter	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z27.29-1970		
		Peak	25.000000micro gram per cubic meter	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z27.29-1970		
		TWA	0.000050 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Beryllium sensitization		

		Chronic beryllium disease (berylliosis) Adopted values or notations enclosed are those for which changes are proposed in the NIC See Notice of Intended Changes (NIC) Confirmed human carcinogen Danger of cutaneous absorption Sensitizer		
		C	0.000500 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		
		See Table Z-2		
		TWA	2microgram per cubic meter	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z27.29-1970		
		CEIL	5microgram per cubic meter	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z27.29-1970		
		Peak	25microgram per cubic meter	USA. Occupational Exposure Limits (OSHA) - Table Z-2
		Z27.29-1970		
		C	0.0005 mg/m3	USA. NIOSH Recommended Exposure Limits
		Potential Occupational Carcinogen See Appendix A		

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.

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	No data available
e)	Melting point/freezing point	Melting point/range: 1,278 °C (2,332 °F) - lit.
f)	Initial boiling point and boiling range	2,970 °C (5,378 °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	No data available
l)	Vapour density	No data available
m)	Relative density	1.85 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.

10.3 Possibility of hazardous reactions
No data available

10.4 Conditions to avoid
No data available

10.5 Incompatible materials
Alkali metals

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

LD50 Intravenous - Rat - 0.496 mg/kg
Remarks: Liver:Hepatitis (hepatocellular necrosis), zonal.

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
Hamster
Lungs
Result: negative

Carcinogenicity

Carcinogenicity - Rat - Intratracheal
Tumorigenic:Neoplastic by RTECS criteria. Lungs, Thorax, or Respiration:Tumors. Lungs, Thorax, or Respiration:Bronchiogenic carcinoma.

Carcinogenicity - Rabbit - Intravenous
Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Musculoskeletal:Tumors.

Possible human carcinogen

IARC:	1 - Group 1: Carcinogenic to humans (Berylium foil)
NTP:	Known to be human carcinogen (Berylium foil)
	Known to be human carcinogenThe reference note has been added by TD based on the background information of the NTP. (Berylium foil)
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: DS1750000

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
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: 1567 Class: 6.1 (4.1) Packing group: II
Proper shipping name: Beryllium, powder
Reportable Quantity (RQ): 10 lbs

Poison Inhalation Hazard: No

IMDG
UN number: 1567 Class: 6.1 (4.1) Packing group: II EMS-No: F-G, S-G
Proper shipping name: BERYLLIUM POWDER

IATA
UN number: 1567 Class: 6.1 (4.1) Packing group: II
Proper shipping name: Beryllium powder

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
Berylium foil	7440-41-7	1993-04-24

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Berylium foil	7440-41-7	1993-04-24

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Berylium foil	7440-41-7	1993-04-24

New Jersey Right To Know Components

	CAS-No.	Revision Date
Berylium foil	7440-41-7	1993-04-24

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.	CAS-No.	Revision Date
Berylium foil	7440-41-7	2008-10-10

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Carc.	Carcinogenicity
Eye Irrit.	Eye irritation
H301	Toxic if swallowed.
H315	Causes skin irritation.
H317	May cause an allergic skin reaction.
H319	Causes serious eye irritation.
H330	Fatal if inhaled.
H335	May cause respiratory irritation.
H350	May cause cancer.
H372	Causes damage to organs through prolonged or repeated exposure.
Skin Irrit.	Skin irritation
Skin Sens.	Skin sensitisation

HMIS Rating

Health hazard:	4
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	4
Fire Hazard:	3
Reactivity Hazard:	3

Further information

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

SAFETY DATA SHEET

according to Regulation (EC) No. 1907/2006
Version 6.0 Revision Date 11.11.2016
Print Date 11.06.2020
GENERIC EU MSDS - NO COUNTRY SPECIFIC DATA - NO OEL DATA

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Zinc metal

Product Number : NIST683
Brand : Sigma-Aldrich
REACH No. : A registration number is not available for this substance as the substance or its uses are exempted from registration, the annual tonnage does not require a registration or the registration is envisaged for a later registration deadline.

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 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

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Not a hazardous substance or mixture according to Regulation (EC) No. 1272/2008.

2.2 Label elements

Not a hazardous substance or mixture according to Regulation (EC) No. 1272/2008.

2.3 Other hazards - none

SECTION 3: Composition/information on ingredients

3.1 Substances

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
No data available

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

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

8.2 Exposure controls
No data available

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
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)	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

SECTION 10: Stability and reactivity

10.1 Reactivity
No data available

10.2 Chemical stability
No data available

10.3 Possibility of hazardous reactions
No data available

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

Skin corrosion/irritation

Serious eye damage/eye irritation

Respiratory or skin sensitisation

Germ cell mutagenicity

Carcinogenicity

Reproductive toxicity

Specific target organ toxicity - single exposure

Specific target organ toxicity - repeated exposure

Aspiration hazard

Additional Information
RTECS: Not available

SECTION 12: Ecological information

12.1 Toxicity

12.2 Persistence and degradability

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

SECTION 13: Disposal considerations

13.1 Waste treatment methods
No data available

SECTION 14: Transport information

14.1 UN number
ADR/RID: - IMDG: - IATA: -

14.2 UN proper shipping name
ADR/RID: Not dangerous goods
IMDG: Not dangerous goods
IATA: Not dangerous goods

14.3 Transport hazard class(es)
ADR/RID: - IMDG: - IATA: -

14.4 Packaging group
ADR/RID: - IMDG: - IATA: -

14.5 Environmental hazards
ADR/RID: no IMDG Marine pollutant: no IATA: no

14.6 Special precautions for user
No data available

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
This safety datasheet complies with the requirements of Regulation (EC) No. 1907/2006.

15.2 Chemical safety assessment
For this product a chemical safety assessment was not carried out

SECTION 16: Other information

Safety Data Sheet: Copper

Section 1: Product Identification

Manufacturer/Supplier:
Wolverine Tube, Inc.
2100 Market Street NE
Decatur, AL 35601
(800) 633-3972

GHS Product Identifier: Copper
Other Means of ID: Cu, Copper Dust, Copper Fume

Recommended Use and Restrictions:
Solid copper, various forms and uses. Manufacture of articles.

Emergency Information:
CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300
International CHEMTREC, call: 1-703-527-3887

Section 2: Hazard Identification

Classification: Copper and copper alloys are considered an "article" and are not hazardous in its solid form. However, certain processes such as cutting, milling, grinding, melting and welding could result in some serious hazardous materials being emitted. The GHS classification below pertains to these emitted products during these processes.

Signal Word, Hazard Statements & Symbols: WARNING

Symbols	Hazard	GHS Classification	Hazard Statements
	STOT (repeated exposure)	Category – 2	Causes damage to lungs, kidney and blood through prolonged or repeated exposure.
	Skin Irritation	Category – 2	Causes skin irritation.
	Acute Toxicity – Inhalation	Category – 4	Harmful if inhaled.
	Acute Toxic to Aquatic Life	Category – 1	Very toxic to aquatic life.
	Chronic Toxic to Aquatic Life	Category – 1	Very toxic to aquatic life with long lasting effects.
N/A	Eye Irritation	Category – 2B	Causes eye irritations.

Notes:
STOT – Specific Target Organ Toxicity

Precautionary Statements

Prevention:
Do not breathe dust/fume/gas/vapor/spray. Use in a well-ventilated area. Avoid generating dust. Dusts and fines from processing may be ignitable. Use personal protective equipment as required. Wash thoroughly after handling. Do not eat, drink or smoke when using this product. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Contaminated work clothing should not be allowed out of the workplace.

First Aid Response:
EYES: Flush eyes with plenty of water for at least 15 minutes. Seek medical attention if eye irritation persists.
SKIN: Wash affected area with mild soap and water. Seek medical attention if skin irritation persists.
INHALATION: Remove individual to fresh air. Check for clear airway, breathing and presence of pulse. If necessary administer CPR. Consult a physician immediately.
INGESTION: Dust may irritate mouth and gastrointestinal tract. If ingested, seek medical attention.

Storage:
Store away from strong acids, alkalis and oxidizers. Store away from mercury, acetylene and halogens. Store in accordance with federal, state and local regulations.

Disposal: Copper should be recycled whenever possible. Otherwise, dispose of in accordance with applicable federal, state and local regulations.

Section 3: Composition and Information on Ingredients

Composition:

Name:	CAS #	% by Weight
Copper	7440-50-8	100

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use eye ointment. Seek medical attention immediately.

Skin Contact: After contact with skin, wash immediately with plenty of water. Gently and thoroughly was the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient (moisturizing cream or lotion). If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Ingestion: Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Important Symptoms and Effects: Copper and copper alloys as sold and shipped is not likely to present acute or chronic health effects. However, during processing (cutting, milling, grinding, melting or welding) emitted byproducts may cause irritations, difficulty breathing, coughing or wheezing. May cause allergic skin reactions.

Section 5: Fire and Explosion Data

Suitable Extinguishing Media: Non-flammable. Not applicable for solid product. Use Class D extinguishing agents or sand on fires involving dusts or fines. Use extinguishers appropriate for surrounding materials. DO NOT use water on molten metal. DO NOT use water on dust, powder or fume fires.

Specific Hazards: Dusts from grinding operations may burn if they are ignited. Dust, powder and fumes are flammable when exposed to flame or by chemical reaction with oxidizing agents.

Hazardous Combustion Products: At temperatures above the melting point, fumes containing copper oxides and smaller amounts of other alloying elements (if present) may be liberated.

Special Protective Equipment and Precautions for Firefighters: Firefighters should wear self-contained NIOSH-approved breathing apparatus and full protective clothing.

Explosion Data: Molten metal in contact with water may be explosive.

Section 6: Accidental Release Measures

Personal Precautions, PPE and Emergency Procedures: Not applicable to copper in solid state. Avoid dust formation. Ensure adequate ventilation. Clean-up personnel should be protected against contact with eyes and skin protection.

Environmental Precautions: Not applicable to copper in solid state. Do not flush into surface water or sanitary sewer system.

Methods and Materials for Containment and Clean-up: Solid metal does not pose any problems. Dust spills should be cleaned up avoiding dust generation. Wash down with water if in contact with acids. Avoid inhalation of dusts. Collect scrap copper for recycling.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not breathe dust. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible.

Storage:
Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool well-ventilated place.

Incompatibilities:
Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls and Personal Protection

Control Parameters: The exposure limit for copper dusts and fumes has been established as follows in the table below. All OEL values are established as 8-hour Time Weighted Average (TWA) concentrations unless otherwise noted.

Chemical Name	CAS Number	OSHA PEL	ACGIH TLV	NIOSH REL
Copper	7440-50-8	1 mg/m^3 (dust) 0.1 mg/m^3 (fume)	1 mg/m^3 (dust) 0.2 mg/m^3 (fume)	1 mg/m^3 (dust) 0.1 mg/m^3 (fume)

Appropriate Engineering Controls: Provide general or local exhaust ventilation to minimize airborne concentrations during milling, grinding, melting and welding operations.

Individual Protective Measures: Dependent upon process being performed on material. Each operation must be addressed for suitable equipment.

Gloves: As required.
Clothing: N/A
Eyes: Safety glasses or goggles.
Footwear: N/A
Respirator: If concentrations exceed established limits use NIOSH/MSHA approved particulate respirator when generating dust or fume.
Other: With molten metal, use full body cover clothing suitably treated to prevent burns.

Section 9: Chemical and Physical Properties

Physical State:	Solid	**Other Information:**	Not Applicable
Odor:	Not Applicable	**Appearance:**	Reddish metallic solid
pH:	Not Applicable	**Odor Threshold:**	Not Applicable
Boiling Point:	2595°C (4703°F)	**Melting Point:**	1083°C (1981°F)
Evaporation Rate:	Not Applicable	**Flash Point:**	N/A
UFL%:	Not Applicable	**Flammability**	Not Flammable
Vapor Pressure:	Not Applicable	**LFL%:**	Not Applicable
Relative Density:	8.94	**Vapor Density:**	Not Applicable
Solubility:	Not Soluble	**Specific Gravity:**	No Data
Auto-Ignition Temp:	Not Applicable	**Partition Coefficient:**	No Data
Viscosity:	Not Applicable	**Decomposition Temperature:**	No Data

Section 10: Stability and Reactivity Data

Stability: The product is stable. Copper and its alloys are stable under normal storage and handling conditions.

Possibility of Hazardous Reactions: Hazardous polymerization cannot occur.

Conditions to Avoid: Reacts violently with hydrogen peroxide and other oxidizers. Reaction with acids could produce noxious gases. In contact with acids, hydrogen gas may evolve. Avoid dust formation. Molten metal can react violently with water or moisture.

Incompatible Materials: Yes, strong acids, alkalis and oxidizers. Also, mercury, acetylene and halogens.

Hazardous Decomposition: None.

Section 11: Toxicological Data

LD_{50} Oral: No Data
LD_{50} Dermal: No Data
LD_{50} Inhalation: No Data
Other: No Data

Likely Routes of Entry: None for copper and alloys in their natural solid form. Inhalation of metal particulate or elemental oxide fumes generated during welding, burning, grinding or machining may pose acute or chronic health effects. In finely divided form, skin contact may produce localized irritation and/or contact dermatitis.

Eyes: High concentrations of dust may cause irritation to the eyes. Fumes can cause eye irritation.
Skin: May cause skin irritations. Prolonged skin contact with coated copper may cause skin irritation in sensitive individuals. Workers with anemia, kidney damage, digestive, respiratory, nervous system, pregnant women and fertile females warrant particular attention.
Inhalation: Dust may irritate the nose and throat. If heated, copper fumes may cause metal fume fever, a delayed, benign, transient flu-like condition.

Symptoms related to Product Characteristics: None for copper and alloys in their natural solid state.

Effects of Acute Exposure to Material: Can cause metal fume fever, a metallic taste in the mouth, dryness or irritation of the throat, and coughing. After 4-48 hours symptoms can include sweating, shivering, headache, fever, muscle aches, nausea, vomiting, weakness and tiredness.

STOT (Single Exposure): Causes damage to organs (kidneys, respiratory system).
STOT (Repeated Exposure): Respiratory system. Skin irritation. Reproductive system.
Mutagenicity: Suspected of causing genetic effects.
Carcinogenicity:
IARC: N/A
EPA-D (Not classifiable as to human carcinogenicity).

LD_{50}: Not established
LC_{50}: Not established

Section 12: Ecological Data

Ecotoxicity: No data available for copper and alloys in their natural solid state. However, individual components of the material have been found to be toxic to the environment. Metal dusts may migrate into soil and groundwater and be ingested by wildlife.

Component	Toxicity to Fish	Toxicity to Algae	Toxicity to Microorganisms
Copper	LC_{50} Fathead Minnow 96 hr. 0.0068-0.0156 mg/L	EC_{50} Freshwater Algae 72 hr. 0.0426-0.0535 mg/L	EC_{50} Water Flea 48 hr. 0.03 mg/L

Persistence and Degradability: No Data
Bioaccumulative Potential: No Data
Mobility in Soil: No Data
Other Adverse Effects: None Known.

Section 13: Disposal Information

Waste Disposal Methods: Recover copper for recycling.

Container Cleaning and Disposal: Dispose of in accordance with applicable federal, provincial/state and local regulations.

Section 14: Transport Information

General Shipping Information: Material not regulated for shipping.

Shipping Name and Description: N/A
UN Number: N/A
Hazard Class: N/A
Packing Group/Risk Group: N/A

Transport Regulations: Canadian Transportation of Dangerous Goods Regulations (TDG) March 2011.
US Department of Transport (DOT) Hazardous Materials shipping information (Title 49 – Transportation March 2011).

Section 15: Other Regulatory Information

Regulatory Information: The components of this material are subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act (SARA – October 2006), as follows:

Chemical Name	SARA 302 (40 CFR 355, App. A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)	CERCLA Reportable Quantities
Copper	No	No	Yes	5,000 pounds

SARA Threshold Planning Quantity: There are no specific Threshold Planning Quantities for the material. The default Federal SDS submission and inventory requirement filing threshold of 10,000 lb. (4,540 kg) therefore applies, per 40 CFR 370.20.

CERCLA Reportable Quantity (RQ): 5,000 lb.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 05/11/2015 09:00

Last Updated: 05/18/2015 09:00

The information contained herein is believed to be accurate but is not warranted to be so. All hazard classifications involve data and interpretations that may vary from company to company. They are intended only for rapid, general identification of the magnitude of a specific hazard. To deal adequately with the safe handling of this product, all the information contained in this SDS must be considered and reasonable safety precautions followed. The information contained in the Safety Data Sheet is based on the individual properties of the components of the mixture. Terrell Technical Services, Inc. has compiled the information and recommendations contained in this Safety Data Sheet from sources believed to be reliable and to represent the most reasonable current opinion on the subject when the SDS was prepared. No warranty, guarantee, or representation is made as to the correctness or sufficiency of the information. The user of this product must decide for itself what specific safety measures are necessary to safely use this product, either alone or in combination with other products.

No warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. Terrell Technical Services, Inc., assumes no responsibility for personal injury or property damage to venders, users, or third parties caused by the material. Such vendees or users assume all risks associated with the use of the material. Any questions regarding this product should be directed to the manufacturer of the product as described in Section 1.

SAFETY DATA SHEET

Version 6.1
Revision Date 01/15/2020
Print Date 05/29/2020

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Chromium

Product Number : 266299
Brand : Aldrich
CAS-No. : 7440-47-3

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

SECTION 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

SECTION 3: Composition/information on ingredients

3.1 Substances

Formula : Cr
Molecular weight : 52.00 g/mol
CAS-No. : 7440-47-3
EC-No. : 231-157-5

Component	Classification	Concentration

Chromium		
		<= 100 %

SECTION 4: First aid measures

4.1 Description of first aid measures

General advice
Move out of dangerous area.

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

SECTION 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

Chromium oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

SECTION 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.

SECTION 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.

Air sensitive. Keep in a dry place.
Storage class (TRGS 510): 13: Non 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

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Chromium	7440-47-3	TWA	0.5 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	respiratory tract irritation 2018 Adoption		
		PEL	0.5 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)
		see Sections 1532.2, 5206 & 8359		
		TWA	1 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants

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.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder 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: 1,857 °C (3,375 °F) - lit.
f)	Initial boiling point and boiling range	2,672 °C 4,842 °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	7.14 g/mL 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

SECTION 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

10.6 Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Chromium oxides
Other decomposition products - No data available
In the event of fire: see section 5

SECTION 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.

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
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: GB4200000

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

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	LC50 - Cyprinus carpio (Carp) - 14.3 mg/l - 96 h
Toxicity to daphnia	EC50 - Daphnia magna (Water flea) - 0.07 mg/l - 48 h

and other aquatic invertebrates

12.2 Persistence and degradability
The methods for determining biodegradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential
Bioaccumulation — Oncorhynchus mykiss (rainbow trout) - 30 d - 50 µg/l(Chromium)

Bioconcentration factor (BCF): 1.03 - 1.22

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

SECTION 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.

SECTION 14: Transport information

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Chromium)
Reportable Quantity (RQ): 5000 lbs
Reportable Quantity (RQ): 10 lbs
Poison Inhalation Hazard: No

IMDG
Not dangerous goods

IATA
Not dangerous goods

SECTION 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
Chromium	7440-47-3	2007-07-01

SARA 311/312 Hazards
Chronic Health Hazard

Reportable Quantity : D007 lbs

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
Chromium	7440-47-3	2007-07-01

SECTION 16: Other information

Further information

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.

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Version: 6.1 Revision Date: 01/15/2020 Print Date: 05/29/2020

Abbreviations used in Toxicity data

The table below gives the main abbreviations which will be found in the toxicity data for chemicals listed on these (and many other) web pages.

asn	Aspergillus nidulans
ast	Ascites tumor
bcs	Bacillus subtilis
bfa	body fluid assay
bmr	bone marrow
brd	bird (domestic or lab)
bwd	wild bird species
chd	child
ckn	chicken
CL	ceiling concentration
clr	Chlamydomonas reinhardi
ctl	cattle
cyt	cytogenetic analysis
D	day
dck	duck
dlt	cominant lethal test
dmg	Drosophila melanogaster
dnd	DNA damage
dni	DNA inhibition
dnr	nNA repair
dns	unscheduled DNA synthesis
dom	domestic animal (goat, sheep)
dpo	Drcsophila pseudo-obscura
emb	embryo
esc	Escherichia cold
eug	Euglena gracilis
eye	administration into eye (irritant)
fb	fiber
fbr	fibroblast
frg	frog
gm	gram
gpg	guinea pig
grb	gerbil
grh	grasshopper
H	hour
ham	hamster
hla	HeIa cell
hma	host-mediated assay
hmi	Haemophilus influenzae

hmn	human
hor	horse, donkey
I	intermittent
ial	intraaural
IARC	International Agency for Research on Cancer
iat	intraarterial
ice	intracerebral
icv	intracervical
idr	intradermal
idu	intraduodenal
ihl	inhalation
imm	immersion
imp	implant
ims	intramuscular
inf	infant
ipc	intraplacental
ipl	intrapleural
ipr	intraperitoneal
irn	intrarenal
isp	intraspinal
itr	intratracheal
itt	intratesticular
iu	international unit
iut	intrauterine
ivg	intravaginal
ivn	intravenous
kdy	kidney
kg	kilogram
klp	Klebsiella pneumoniae
L	liter
LC50	lethal concentration 50 percent kill
LCLo	lowest published lethal concentration
LD50	lethal dose 50 percent kill
LDlo	lowest published lethal dose
leu	leukocyte
Liq	liquid
lng	lung
lvr	liver
lym	lymphocyte
M	minute
m3	cubic meter
mam	mammal (species unspecified)
man	man
ug	microgram

umol	micromole
mg	milligram
mky	monkey
mL	milliliter
MLD	mild irritation effects
mma	microsomal mutagenicity assay
mmo	mutation in microorganisms
mmol	millimole
mmr	mammary gland
mnt	micronucleus test
MOD	moderate irritation effects
mol	mole
mppcf	million particles per cubic foot
mrc	gene conversion and mitotic recombination
msc	mutation in mammalian somatic cells
mul	multiple routes
mus	mouse
n/a	not available
ng	nanogram
nml	non-mammalian species
nmol	nanomole
nsc	Neurospora crassa
ocu	ocular
ofs	other fish
omi	other microorganisms
oms	other mutation test systems
oin	other insects
open	open irritation test
orl	oral
ORM	Other Regulated Material (DoT)
oth	other cell types
otr	oncogenic transformation
ovr	ovary
par	parenteral
pg	picogram
pgn	pigeon
pic	phage inhibition capacity
pig	pig
Pk	peak concentration
pmol	picomole
post	after birth
ppb	parts per billion (v/v)
pph	parts per hundred (v/v) (percent)
ppm	parts per million (v/v)

ppt	parts per trillion (v/v)
preg	pregnant
qal	quail
rat	rat
rbt	rabbit
rec	rectal
rns	rinsed with water
S	second
sal	salmon
sat	Salmonella typhimurium
sce	sister chromatic exchange
scu	subcutaneous
SEV	severe irritation effects
skn	administration onto skin
sln	sex chromosome loss and nondisjunction
slt	specific locus test
slw	silkworm
smc	Saccharomyces cerevisiae
spm	sperm morphology
spr	sperm
sql	squirrel
srm	Serratia marcescens
ssp	Schizosaccharomyces pombe
STEL	short term exposure limit
TC	toxic concentration (other than lowest concentration)
TCLo	lowest published toxic concentration
TD	toxic dose (other than lowest toxic dose)
TDLo	lowest published toxic dose
tes	testis
TLV	Threshold Limit Value
tod	toad
trk	turkey
trn	heritable translocation test
TWA	time weighted average
unr	unreported
W	week
wmn	woman
Y	year

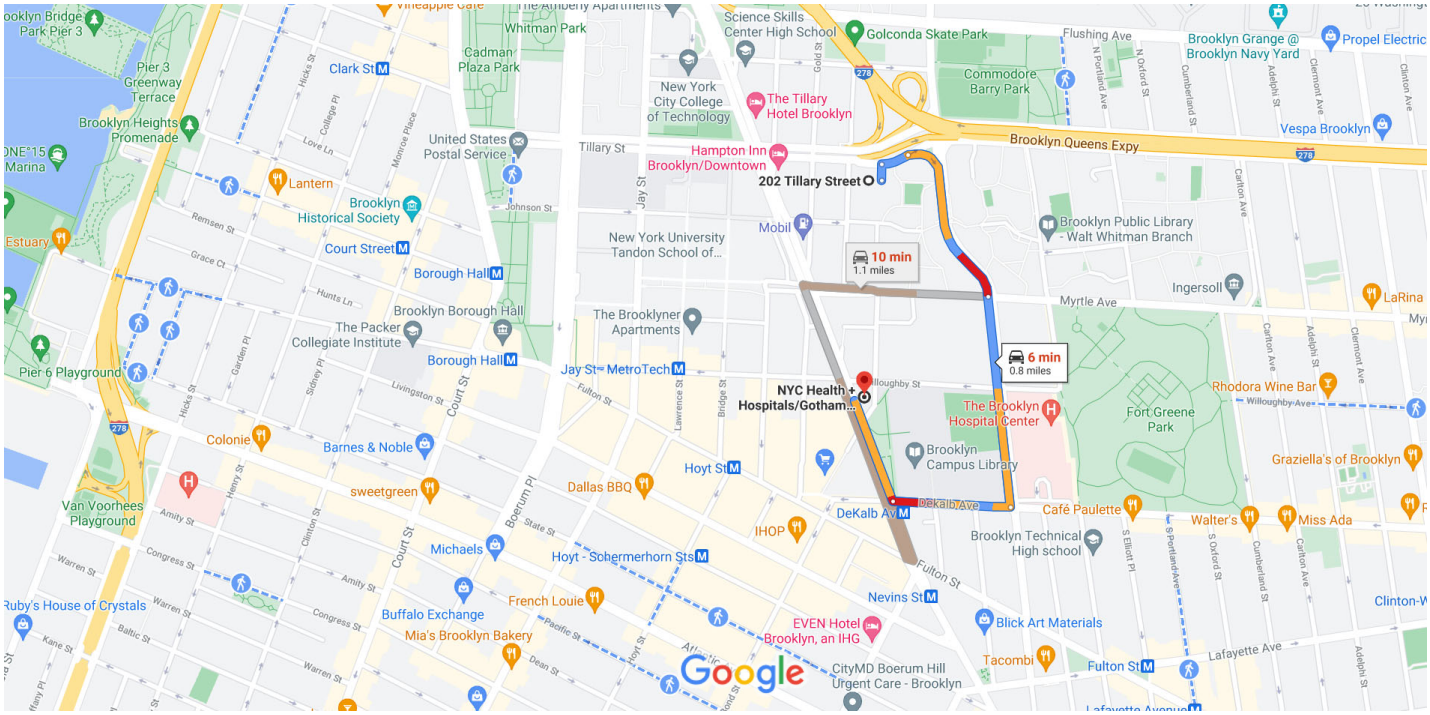
Last updated: September 30, 2000.

ATTACHMENT II - Hospital Route

Google Maps

202 Tillary St, Brooklyn, NY 11201 to NYC Health + Hospitals/Gotham Health, Fort Greene

Drive 0.8 mile, 6 min



Map data ©2021 Google 500 ft

202 Tillary St

Brooklyn, NY 11201

1. Head north toward Tillary St
   102 ft
2. Turn right onto Tillary St
   180 ft
3. Turn right onto Navy St
   0.2 mi
4. Continue onto Ashland Pl
   0.3 mi
5. Turn right onto Dekalb Ave
   0.1 mi
6. Turn right onto Flatbush Ave/Flatbush Ave Ext
   Destination will be on the right
   0.1 mi

NYC Health + Hospitals/Gotham Health, Fort Greene

295 Flatbush Ave, Brooklyn, NY 11201

These directions are for planning purposes only.
You may find that construction projects, traffic,

weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

Appendix D – Community Acceptance Plan

CITIZEN PARTICIPATION PLAN

The New York State Department of Environmental Conservation (NYSDEC) and YYY Brooklyn NY LLC c/o Maddd Equities, LLC have established this Citizen Participation Plan (CPP) because the opportunity for citizen participation is an important component of the NYSDEC BCP. This CPP describes how information about the project will be disseminated to the Community during the remedial process. As part of its obligations under the NYSDEC BCP, YYY Brooklyn NY LLC c/o Maddd Equities, LLC will maintain a repository for project documents and provide public notice at specified times throughout the remedial program. This Plan also takes into account potential environmental justice concerns in the community that surrounds the project Site. Under this CPP, project documents and work plans are made available to the public in a timely manner. Public comment on work plans is strongly encouraged during public comment periods. Work plans are not approved by the NYSDEC until public comment periods have expired and all comments are formally reviewed. An explanation of cleanup plans in the form of a public meeting or informational session is available upon request to NYSDEC's project manager assigned to this Site, Jane O'Connell, who can be contacted about these issues or any others questions, comments or concerns that arise during the remedial process at (718) 482-4599.

Project Contact List: NYSDEC has established a Site Contact List for this project to provide public notices in the form of fact sheets to interested members of the Community. Communications will include updates on important information relating to the progress of the cleanup program at the Site as well as to request public comments on the cleanup plan. The Project Contact List includes owners and occupants of

adjacent buildings and homes, principal administrators of nearby schools, hospitals and day care centers, the public water supplier that serves the area, established document repositories, the representative Community Board, City Council members, other elected representatives and any local Brownfield Opportunity Area (BOA) grantee organizations. Any member of the public or organization will be added to the Site Contact List on request. A copy of the Site Contact List is maintained by NYSDEC's project manager. If you would like to be added to the Project Contact List, contact NYSDEC at (718) 482-4599.

Repositories: A document repository is maintained online. Internet access to view NYSDEC's document repositories is available at public libraries. This document repository is intended to house, for community review, all principal documents generated during the cleanup program including Remedial Investigation plans and reports, Remedial Action work plans and reports, and all public notices and fact sheets produced during the lifetime of the remedial project. The library nearest the Site is:

Brooklyn Public Library – Walt Whitman Branch
93 St. Edwards Street, Brooklyn, New York
(718) 935-0244
Monday, Wednesday, Friday, Saturday: 10:00 am – 4:00 pm
Tuesday, Thursday: 1:00 pm – 7:00 pm

Digital Documentation: NYSDEC requires the use of digital documents in our repository as a means of minimizing paper use while also increasing convenience in access and ease of use.

Issues of Public Concern: No issues of public concern were identified.

Public Notice and Public Comment: Public notice to all members of the Project Contact List is required at three major steps during the performance of the cleanup program (listed below) and at other points that may be required by NYSDEC. Notices will include Fact Sheets with descriptive project summaries, updates on recent and upcoming project activities, repository information, and important phone and email contact information. All notices will be reviewed and approved by NYSDEC prior to distribution and mailed by the Enrollee. Public comment is solicited in public notices for all work plans developed under the NYSDEC BCP. Final review of all work plans by NYSDEC will consider all public comments. Approval will not be granted until the public comment period has been completed.

Citizen Participation Milestones: Public notice and public comment activities occur at several steps during a typical NYSDEC BCP project. These steps include:

- **Public Notice of the availability of the Remedial Investigation Report and Remedial Action Work Plan and a 30-day public comment period on the Remedial Action Work Plan:** Public notice in the form of a Fact Sheet is sent to all parties listed on the Site Contact List announcing the availability of the Remedial Investigation Report (RIR) and Remedial Action Work Plan (RAWP) and the initiation of a 30-day public comment period on the Remedial Action Work Plan. The Fact Sheet summarizes the findings of the RIR and provides details of the RAWP. The public comment period will be extended an additional 15 days upon public request. A public meeting or informational session will be conducted by NYSDEC upon request.
- **Public Notice announcing the approval of the RAWP and the start of remediation:** Public notice in the form of a Fact Sheet is sent to all parties listed

on the Site Contact List announcing the approval of the RAWP and the start of remediation.

- **Public Notice announcing the completion of remediation, designation of Institutional and Engineering Controls and issuance of the Notice of Completion:** Public notice in the form of a Fact Sheet is sent to all parties listed on the Site Contact List announcing the completion of remediation, providing a list of all Institutional and Engineering Controls implemented for to the Site and announcing the issuance of the Notice of Completion.
-

Appendix E – Sustainability Report

SUSTAINABILITY STATEMENT

This Sustainability Statement documents sustainable activities and green remediation efforts planned under this remedial action.

Reuse of Clean, Recyclable Materials and Reduced Consumption of Non-Renewable Resources: Reuse of clean, locally derived recyclable materials reduces consumption of non-renewable virgin resources and can provide energy savings and greenhouse gas reduction.

An estimate of the quantity (in tons) of clean, non-virgin materials (reported by type of material) reused under this plan will be quantified and reported in the Final Engineering Report (FER).

Reduced Energy Consumption and Promotion of Greater Energy Efficiency: Reduced energy consumption lowers greenhouse gas emissions, improves local air quality, lessens in-city power generation requirements, can lower traffic congestion, and provides substantial cost savings.

Best efforts will be made to quantify energy efficiencies achieved during the remediation and will be reported in the FER. Where energy savings cannot be easily quantified, a gross indicator of the amount of energy saved or the means by which energy savings was achieved will be reported.

Conversion to Clean Fuels: Use of clean fuel improves NYC's air quality by reducing harmful emissions.

Natural gas will be utilized for fuel in the new building. An estimate of the volume of clean fuels used during remedial activities will be quantified and reported in the FER.

Recontamination Control: Recontamination after cleanup and redevelopment is completed undermines the value of work performed, may result in a property that is less protective of public health or the environment, and may necessitate additional cleanup work later or impede future redevelopment. Recontamination can arise from future releases that occur within the property or by influx of contamination from off-Site.

A composite cover system will be installed across the entire Site, including a vapor barrier membrane which will be installed across the entire building footprint. These components will protect the Site by aiding in eliminating the risk of future migration of soil vapor contamination from currently unknown off-site sources and by preventing the occurrence of new contamination. An estimate of the area of the Site that utilizes recontamination controls under this plan will be reported in the FER in square feet.

Stormwater Retention: Stormwater retention improves water quality by lowering the rate of combined stormwater and sewer discharges to NYC's sewage treatment plants during periods of precipitation and reduces the volume of untreated influent to local surface waters.

An estimate of the enhanced stormwater retention capability of the redevelopment project will be included in the FER.

Linkage with Green Building: Green buildings provide a multitude of benefits to the city across a broad range of areas, such as reduction of energy consumption, conservation of resources, and reduction in toxic materials use.

The number of Green Buildings that are associated with this brownfield redevelopment property will be reported in the FER. The total square footage of green building space created as a function of this brownfield redevelopment will be quantified for residential, commercial, and industrial/manufacturing uses.

Paperless Voluntary Cleanup Program: YYY Brooklyn NY LLC c/o Maddd Equities, LLC is participating in NYSDEC's BCP Paperless Cleanup Program. Under this program, submission of electronic documents will replace submission of hard copies for the review of project documents, communications, and milestone reports.

Low-Energy Project Management Program: YYY Brooklyn NY LLC c/o Maddd Equities, LLC is participating in NYSDEC's low-energy project management program. Under this program, whenever possible, meetings are held using remote communication technologies, such as videoconferencing and teleconferencing to reduce energy consumption and traffic congestion associated with personal transportation.

Trees and Plantings: Trees and other plantings provide habitat and add to NYC's environmental quality in a wide variety of ways. Native plant species and native habitat provide optimal support to local fauna, promote local biodiversity, and require less maintenance.

According to the redevelopment plans, multiple trees will be in the first-floor outdoor terrace area of the Site. An estimate of the land area that will be vegetated, including the number of trees planted or preserved, will be reported in square feet in the FER.

Appendix F – Quality Assurance Plan

QUALITY ASSURANCE PROJECT PLAN

Quality Assurance Project Plan

PRD Electronics Manufacturing Site
NYSDEC Site No. C3224342

PREPARED FOR

YYY Brooklyn NY LLC
c/o Maddd Equities, Inc.
15 Verbena Avenue
Floral Park, New York 11001

PREPARED BY

VHB Engineering, Surveying, Landscape Architecture and Geology, P.C.
1 Penn Plaza
Suite 715
New York, New York 10119

February 2022

REVISED December 15, 2022

Table of Contents

Appendices .....

1

Introduction

1.1 Purpose

VHB Engineering, Surveying, Landscape Architecture and Geology, P.C. (VHB), on behalf of YYY Brooklyn NY LLC c/o Maddd Equities, LLC (Applicant), has prepared this Quality Assurance Project Plan (QAPP) to describe the measures that will be taken to ensure that the data generated during performance of the remedial action for the PRD Electronics Manufacturing Site, located at 202-208 Tillary Street, in Brooklyn, New York (Site), are of quality sufficient to meet project-specific data quality objectives (DQOs). The Site comprises the two (2) contiguous tax lots identified as Block 2050, Lot 100 and Lot 98 on the City of New York Tax Maps and is located in the downtown section of Brooklyn. The New York City Housing Authority (NYCHA) Ingersoll House apartment complexes are located east and south of the Site. The Tillary Street Women's Shelter, Prince Street, the NYC 84th Precinct Police Department, and a NYC Fire Department Station are located west of the Site.

YYY Brooklyn NY LLC c/o Maddd Equities, LLC submitted an application in November 2021 to the Brownfield Cleanup Program (BCP). The remedial activities will be conducted under the New York State Department of Environmental Conservation (NYSDEC) BCP (Site # C224342). This QAPP was prepared in accordance with the guidance provided in the NYSDEC Technical Guidance DER-10 Technical Guidance for Site Investigation and Remediation (DER-10), the NYSDEC BCP Guidance, and the United States Environmental Protection Agency's (USEPA) Guidance for the Data Quality Objectives Process (EPA QA/G 4).

1.2 Project Objectives

The objectives of the remedial action are the excavation, transport and off-site disposal of soil/urban historic fill to achieve compliance with the NYSDEC Restricted-Residential Use Soil Cleanup Objectives (SCOs) in support of the proposed Site redevelopment.

1.3 Project Team Organization

VHB, on behalf of the Applicant, will provide oversight of ground intrusive activities associated with implementation of the Remedial Action Work Plan (RAWP). The third-party data validator and analytical laboratory have not yet been selected for this project. Upon selection, this information will be provided to the NYSDEC prior to field sampling activities. The project team organization and information are provided below.

1.3.1 VHB Project Engineer

Catherine Applegate, PE
VHB Engineering, Surveying, Landscape Architecture and Geology, P.C.
1 Penn Plaza, Suite 715
New York, New York 10119
Telephone: (973) 776-3734
Email: capplegate@vhb.com

The Project Engineer will provide technical guidance and oversight throughout the project, will provide technical review of required documents in accordance with NYSDEC DER-10, and will develop remedial alternatives for the Site.

1.3.2 VHB Project Manager

Catherine Applegate, PE
VHB Engineering, Surveying, Landscape Architecture and Geology, P.C.
One Penn Plaza, Suite 715
New York, New York 10119
Telephone: (973) 776-3734
Email: capplegate@vhb.com

The Project Manager will provide overall management for the implementation of ground intrusive activities. The Project Manager is also responsible for scheduling, coordination of field activities, verification of proper procedures by field staff, laboratory coordination, data review and interpretation, and report preparation.

1.3.3 VHB Quality Assurance Officer

Rachael Barr, Project Manager, Environmental Scientist
VHB Engineering, Surveying, Landscape Architecture and Geology, P.C.
One Penn Plaza, Suite 715
New York, New York 10119

Telephone: (973) 776-3748
Email: rbarr@vhb.com

The Quality Assurance Officer (QAO) is responsible for reviewing sampling procedures, ensuring that data was collected and analyzed using the appropriate procedures, is not directly involved in the collection and analysis of the samples from the subject property, acts in conjunction with the Project Manager to develop the sampling and analytical portion of the QAPP, may conduct periodic field and sampling audits, interfaces with the laboratory to resolve problems and interfaces with the data validator and preparer of the Data Usability Summary Report (DUSR) to resolve any issues.

2

Quality Assurance/Quality Control for Collection of Data

The overall quality assurance/quality control (QA/QC) objectives are to develop and implement procedures in association with sampling, laboratory analysis, field data and reporting which will provide sufficient quality data to characterize existing conditions and determine an appropriate remedial approach. The QA/QC objectives for all data include completeness, representativeness, comparability, precision and accuracy.

2.1 Completeness

The parameters selected for analysis are determined based upon the objectives for the investigation, and the analysis must be appropriate and inclusive. Laboratory completeness is assessed by comparing the total number of parameters analyzed with the number of parameters successfully determined and validated. Analytical data must meet a 90 percent completeness criterion. If the criterion is not met, sample results will be evaluated for trends in rejected and unusable data. The effect of unusable data required for a determination of compliance will also be evaluated.

2.2 Representativeness

Representativeness expresses the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. It is dependent upon the adequate design of the sampling program and is satisfied ensuring that the scope of work is followed and that specified

sampling and analysis techniques are utilized. The rationale for the sampling locations is discussed in the RAWP. Representativeness will be satisfied by verifying that field personnel follow the RAWP and utilize proper sampling techniques. Laboratory representativeness is ensured by compliance with nationally-recognized analytical methods, compliance with sample holding times, and maintaining sample integrity while the samples are in the possession of the laboratory. This is accomplished by following applicable methods, laboratory-issued standard operating procedures (SOPs) and the laboratory's QA Manual. The laboratory is required to be properly certified and accredited.

2.3 Comparability

Comparability expresses the confidence with which one set of data can be compared to another. This objective is achieved in the field by conducting sampling in accordance with the RAWP and QAPP. Laboratory comparability is achieved by following the laboratory's QA Manual, through consistent sample preparation and analysis in conformance with approved laboratory methods and through strict adherence to sample holding times.

2.4 Precision

Precision is a measure of reproducibility of repeated measurements of the same parameter under a specific set of conditions and is calculated as a range or as a standard deviation. Field sampling precision is measured through the collection of duplicate samples, and analytical precision is measured by analyzing QC duplicates or matrix spike duplicates.

2.5 Accuracy

Accuracy is the agreement of a measured value with the true or expected value. Accuracy in the field is monitoring through the use of field and trip blanks, and analytical accuracy is measured through percent recoveries of surrogate compounds added to each sample, laboratory method blanks, instrument calibration and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks.

3

Remedial Action Work Plan Sampling Program

Post-excavation soil samples will be collected during the remedial action. Sampling locations, analytical suites, and frequency vary based on the area to be excavated and the results of the RI. As requested by NYSDEC in its email of December 7, 2022, a Soil Vapor Intrusion (SVI) investigation will be conducted following the completion of construction activities. A SVI Investigation Workplan will be prepared for submittal to NYSDEC following construction of the building.

Sampling locations, analytical parameters and frequency may vary by medium. Specifics regarding the field procedures are provided in Section 4 of this QAPP.

3.1 Soil Sampling

A total of 17 endpoint samples locations and depths will be collected from the bottoms and sidewalls of the areas of excavation.

Endpoint samples will be analyzed for Total Contaminant List (TCL) Volatile Organic Compounds (VOCs) and Semi-volatile Organic Compounds (SVOCs), Target Analyte List (TAL) metals, total chromium and hexavalent chromium, as described below. Laboratory analytical results will be compared to 6 NYCRR Part 375 Table 375-6.8 Unrestricted and Restricted-Residential Use SSCOs.

Sampling results from the RI will act as in-situ endpoint samples for a majority of the Site. For the two (2) hot spot areas, identified as areas surrounding SB-1 and SB-8, bottom and sidewall samples will be collected and analyzed as follows:

From each hotspot location, five (5) confirmation samples will be collected [one (1) from the base and four (4) from the sidewall of the excavation] for an overall total of 10 samples. Endpoint samples from SB-1 will be analyzed for TCL +30 (VOCs and SVOCs), total chromium and hexavalent chromium; and SB-8 will be analyzed for SVOCs +20, total chromium and hexavalent chromium. Three (3) bottom samples and four (4) sidewall samples will be collected from Lot 98 and analyzed for TCL +30/TAL, total chromium and hexavalent chromium.

The locations of in-situ and proposed endpoint samples are shown on **Figure 5** of the RAWP, the Proposed Endpoint Sample Location Map. **Table 1** presents the number and location of samples and the sampling rationale.

Table 1. Proposed Sampling Schedule

Locations	Sample Type	Sample ID	Analyses (see notes below)	Rationale
Area surrounding SB-1	Bottom Sidewall Sidewall Sidewall Sidewall	EP-1 EP-2 EP-3 EP-4 EP-5	TCL +30 Total chromium Hexavalent chromium	Results of the RI identified exceedances of a the NYRRES Use SCOs for several VOCs benzene (16 mg/kg), toluene (540 mg/kg), ethylbenzene (190 mg/kg), total xylenes (300 mg/kg), and 1,2,4-trimethylbenzene (110 mg/kg) and several SVOCs including benzo(a)anthracene (1.3 mg/kg) in the interval 16-18′
Area surrounding SB-8 and **TWP-3**	Bottom Sidewall Sidewall Sidewall Sidewall	EP-6 EP-7 EP-8 EP-9 EP-10	SVOCs +20 Total chromium Hexavalent chromium	Several SVOCs consisting of benzo(a)anthracene (6.4 mg/kg), benzo(a)pyrene (6.8 mg/kg), benzo(b)fluoranthene (8.7 mg/kg), chrysene (5.3 mg/kg), dibenzo(a,h)anthracene (0.8 mg/kg), and indeno(1,2,3-cd)pyrene (3.8 mg/kg) exceeded the NYRRES Use SCOs in soil sample SB-8 (0-2) Chromium was detected above applicable standards in TWP-3 (59.02 µg/L)
Area surrounding **TWP-2**	Bottom Sidewall Bottom Sidewall Bottom Sidewall Sidewall	EP-6 EP-11 EP-12 EP-13 EP-14 EP-15 EP-16	TCL +30/TAL Total chromium Hexavalent chromium	The presence of urban historic fill was identified during the RI. Chromium was detected above applicable standards in TWP-2 (120.4 µg/L)
QA/QC Samples will collected during investigative work.			TCL +30 Total chromium Hexavalent chromium	Trip Blank – One per sample cooler Field Blank – One per sample equipment type Duplicate – One in 20 Matrix Spike/Matrix Spike Duplicate – One in 20

**Note: Total Compound List (TCL) plus 30/ Target Analyte List (TAL) (TCL + 30/TAL) includes:*

- *TCL VOC + 10 tentatively identified compounds (TICs);*
- *TCL base neutral acids (BNA)/SVOCs + 20 TICs;*
- *TCL Pesticides;*
- *TCL Polychlorinated biphenyls (PCBs);*
- *TAL Metals (including hexavalent chromium); and*
- *Total Cyanide*

If odor/visual evidence of contamination or elevated photoionization detector (PID) readings are noted, additional samples will be collected from the interval that exhibits the highest concentration.

Post-remediation endpoint sample locations and depths will be biased towards the areas and depths of highest contamination identified during previous sampling episodes unless field indicators such as field instrument measurements or visual contamination identified during the remedial action indicate that other locations and depths may be more heavily contaminated. In all cases, post-remediation samples should be biased toward locations and depths of the highest expected contamination.

3.2 Soil Vapor Samples

Pending completion of new building construction, soil vapor samples will be collected to determine the potential for soil vapor concentrations to impact the new building. Soil vapor samples will be collected in accordance with the October 2006 New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York and June 2015 USEPA Soil Vapor Guidance. The soil vapor samples will be analyzed for VOCs using USEPA Method TO-15. Soil vapor point installation and soil vapor sampling procedures are outlined below in Section 4.3.

The number and location of soil vapor samples will be provided in a SVI Workplan to be submitted to NYSDEC prior to the commencement of the soil vapor investigation.

3.3 Indoor and Outdoor Air Samples

Indoor air samples will be collected to represent the various foundation configurations in the basement of the new building. Indoor air samples will be collected during the heating season from the breathing zone, at a minimum of 3 feet above the ground.

Outdoor air samples will be collected up-wind of the subject property to determine whether contaminants are migrating from an up-wind source and establish ambient air conditions. The indoor and outdoor air samples will be collected concurrently.

4

Field Sampling Procedures

This section provides a discussion of the field procedures to be used during sampling of the soil and soil vapor being evaluated as part of the RAWP. As mentioned previously, the proposed post-excavation soil sampling locations are depicted on **Figure 5** of the RAWP. A description of the number and type of soil vapor samples will be provided in a SVI Workplan to be submitted to NYSDEC prior to the SVI investigation.

4.1 Soil Sampling

Soil samples will be collected at the base and sidewalls of the excavation.

The soil from each interval will be observed for lithology and evidence of contamination (i.e., staining, odors, and/or visible product), and screened for VOCs using a PID equipped with a 10.6 eV lamp. Samples for VOC analysis will be placed in laboratory-supplied bottleware. Soil samples will be collected according to **Table 1** above. These samples will be placed in the laboratory-supplied containers and shipped to the laboratory under chain of custody procedures in accordance with applicable guidance.

4.2 Soil Vapor Sampling

Soil vapor samples will be collected from a depth of approximately two feet above the observed groundwater table using new Teflon® lined tubing well attached to an expendable soil vapor sampling point with a 6-inch stainless steel screen. The soil vapor points will be backfilled with #2 sand to approximately one foot above the screen. The remainder of the borehole will be backfilled with a cement/bentonite slurry to grade.

Prior to sample collection, the Teflon®-lined tubing will be purged of approximately two volumes of the tubing using a vacuum pump or equivalent. A tracer gas (i.e., helium) will be used to enrich the atmosphere in the immediate vicinity of the sampling location in order to test the borehole seal and verify that ambient air is not being drawn into the sample in accordance with the procedures outlined in the NYSDOH Guidance. Following purging and verification with the tracer gas, the tubing will be connected to the pre-cleaned (batch-certified) laboratory supplied 2.7-liter summa canister. All soil vapor samples will be collected using the canisters with regulators calibrated to collect samples over a 2-hour period and analyzed using USEPA Method TO-15 for VOCs.

5

Quality Assurance/Quality Control

In addition to field investigation sampling discussed in Section 4.0, above, field QA/QC samples will be collected and/or analyzed. The requirements and procedures for the QA/QC samples are outlined below.

5.1 Duplicate Samples

In accordance with NYSDEC DER-10, duplicate samples are required at a frequency of one duplicate sample per 20 investigative samples per matrix. Duplicates will be submitted for laboratory analysis of the same parameters as the corresponding investigative sample. The time and corresponding investigative sample of the duplicate sample will be recorded by field personnel in the project field notes for reference, but will not be recorded on any sample containers, labels, chain-of-custody or other material submitted to the laboratory. The analytical results of the duplicate will be compared to the corresponding investigative sample to measure the precision of the field sample collection methods and the precision of laboratory methods and instrumentation.

5.2 Field Blanks

Typical field blanks consist of distilled or deionized water. Field blanks are prepared at the project site by pouring the distilled/deionized/PFAS-free water from one container into a set of laboratory-supplied bottleware. Field blanks will be collected at a frequency of one per 20 soil investigative samples and one per 20 groundwater investigative samples and are analyzed for the same analytical suite as the investigative samples. Field blanks are not

collected in association with soil vapor samples and field blanks are utilized to determine if ambient site conditions have the potential to result in sample contamination.

5.3 Trip Blanks

The laboratory is responsible for preparing the trip blank sampling container. Typical trip blanks consist of distilled or deionized water. One typical trip blank will be included with each cooler containing at least one soil or groundwater sample which will be submitted for laboratory analysis of VOCs. The aforementioned trip blanks will be analyzed for VOCs.

5.4 Matrix Spike/Matrix Spike Duplicates

Matrix spike (MS) and matrix spike duplicates (MSD) samples are collected at a frequency of one MS/MSD sample per 20 investigative samples per matrix. The MS/MSD samples will be submitted for laboratory analysis of the same parameters as the corresponding investigative sample. The corresponding investigative sample of the duplicate sample will be recorded by field personnel in the project field notes for reference and will also be recorded on sample containers, labels and the chain-of-custody submitted to the laboratory.

The MS and MSD samples are prepared in the laboratory by adding a known volume of specific analytes to the investigative sample. The MS and MSD samples are then analyzed via the sample procedure as the investigative sample. Percent recovery of each of the spiked analytes reflects the ability of the laboratory and method to accurately determine the quantity of the analyte in that sample; thus, the percent recovery quantifies the accuracy in the specific sample matrix. Comparison of the MS and MSD analytical results reflects the precision of the laboratory analytical method.

6

Sample Handling and Analysis

Field QA/QC procedures will be used to provide performance information with regard to accuracy, precision, representativeness, completeness, and comparability associated with the sampling and analysis for this investigation. Field QA/QC procedures will be used to document that samples are representative of actual conditions at the Site and identify possible cross-contamination from field activities or sample transit.

6.1 Sample Custody

Sample handling in the field will conform to appropriate sample custody procedures. Field custody procedures include proper sample identification, completion of chain-of-custody forms, and packaging and shipping procedures. Sample labels will be attached to all sampling bottles before field activities begin to ensure proper sample identification; all sample labels should be pre-printed or filled out using waterproof ink. Each label will identify the site and sample location. Styrofoam or bubble wrap will be used to absorb shock and prevent breakage of sample containers. Ice or ice packs will be placed in between the plastic bags for sample preservation purposes.

After each sample is collected and appropriately identified, the following information will be entered into the chain-of-custody form:

- Site name and address;
- Sampler(s)' name(s) and signature(s);
- Names and signatures of persons involved in the chain of possession of samples;
- Sample number;

- Number of containers;
- Sample location;
- Date and time of collection;
- Type of sample, sample matrix and analyses requested;
- Preservation used (if any); and
- Any pertinent field data collected (e.g., pH, temperature, conductivity, Dissolved Oxygen [DO]).

The sampler will sign and date the "Relinquished" blank space prior to removing one copy of the custody form and sealing the remaining copies of the form in a Ziploc plastic bag taped to the underside of the sample cooler lid. The sample cooler will be sealed with tape prior to delivery or shipment to the laboratory.

6.2 Field Instruments

Field personnel will be trained in the proper operation of all field instruments (Community Air Monitoring Plan [CAMP] equipment, Trimble equipment, PID, groundwater pump, groundwater monitoring equipment utilized for low-flow sampling, etc.) prior to the start of field activities. Instruction manuals for the equipment will be on-site during the remedial investigation activities for reference and information regarding the appropriate calibration, operation and maintenance of the equipment. The equipment will be calibrated according to manufacturer specifications at the start of each day of fieldwork, if applicable. If an instrument fails calibration or is determined to be malfunctioning, the project manager will be contacted immediately, and a replacement instrument will be provided. Calibration, equipment issues and any associated corrective actions will be documented each day in the field notes.

6.3 Report Logs

Field logs and borings logs will be completed during the course of this investigation. A field log will be completed on a daily basis which will describe field activities including:

- Project number, name, manager, and address;
- The date and time;
- The weather conditions;
- On-site personnel and associated affiliations;
- Description of field activities; and
- Pertinent sample collection information including sample identification numbers, description of samples, location of sampling points, GPS coordinates of each sampling location, number of samples taken, method of sample collection and any factors that may affect its quality, time of sample collection, name of collector, and field screening results, QA/QC sample information.

A boring log will be completed for the soil boring and will include the following information:

- Project number, name, manager, and location;
- The date and time;
- Drilling company and method used;
- Boring number;
- GPS coordinates of the boring location;
- Total boring depth and water table depths; and
- Pertinent soil sample information including sample number, interval, depth, amount recovered, color, composition, percent moisture, visual and olfactory observations of contamination, and PID readings.

A groundwater monitoring well completion log will be completed for each groundwater monitoring well which will include the following information:

- Project number, name, manager, and location;
- The date and time;
- Drilling company and method used;
- Groundwater monitoring well ID;
- GPS coordinates of the boring location;
- Total boring depth and water table depths;
- Well construction information including well diameter, well screen interval, riser length, and sand pack and hydrated bentonite seal interval depths within the annular space.

6.4 Laboratory Data

The laboratory will report analytical data results in the New York Analytical Services Protocol (ASP) Category B deliverable format for samples collected as part of the RAWP. The NYSDEC Category B deliverable is required for the preparation of a DUSR. Information provided in a Category B deliverable includes the following:

- A narrative of the sample delivery group;
- Contract Lab Sample Information sheets;
- NYSDEC Data Package Summary Forms;
- Chain-of-custody forms;
- Laboratory analytical results;
- Calibration information;
- Surrogate recoveries;
- Laboratory blank results;
- MS/MSD recoveries;
- Laboratory QA/QC samples;
- Internal standard area and retention time summary;
- Chromatograms; and

› Raw data files.

The laboratory analytical data will include data flags where appropriate. Data flags are utilized in instances such as estimated detections below the reporting limit, estimated concentrations due to poor recovery, estimated concentrations due to poor spike sample recovery, and detection of a reported analyte in the associated laboratory method blank sample.

6.4.1 Sampling Equipment

During sampling activities, cosmetics, moisturizers, hand cream, unauthorized sunscreen and insect repellant, stain and oil resistant clothing (such as GORE-TEX) including water-resistant/water-proof boots, teflon and other products with the potential to contain PFAS will not be permitted. Boots must be made of PVC or polyurethane. Sampling materials are limited to stainless steel, high-density polyethylene (HDPE), acetate, silicon or polypropylene equipment. Plastic clipboards, binders, hard cover notebooks, adhesives, aluminum foil, sharpies or permanent markers are not permitted to be utilized. Water utilized for decontamination and equipment blanks must be "PFAS-free" and should be provided by the laboratory, if possible. Alconox and liquinox are permitted to be utilized during decontamination.

6.4.2 Sampling Protocols

Field staff will wash their hands prior to sampling activities and will wear gloves provided by the laboratory. Upon completion of the sampling, the gloves will be placed in a bag supplied by the laboratory and will be returned to the laboratory with the collected samples.

6.4.3 Sample Containers and Storage

Coolers are to be filled with loose ice; ice packs are prohibited. All sample containers will be provided by the laboratory and will be made of HDPE or polypropylene. Water utilized for equipment blanks must be "PFAS-free" and should be provided by the laboratory, if possible.

Appendices

Appendix A – Professional Profiles

Catherine Applegate, PE

Professional Engineer

Catherine is a Senior Engineer with a demonstrated ability to manage large-scale projects in a Client-focused environment. Her broad experience includes environmental investigation and remediation; regulatory compliance audits for industrial and commercial facilities; design of vapor mitigation systems; development of spill prevention and emergency response plans. Her project experience includes management of large-scale environmental investigations with multi-region EPA oversight, direction of field operations and assessment of environmental conditions.

Education

MSE, Engineering Management and Technology, University of Pennsylvania, 1993

BS, Chemical Engineering, Rutgers University, 1989

Registrations/Certifications

NJ Professional Engineer License #24GE04080200

NY Professional Engineer License #099148-1

PA Professional Engineer License #PE04830E

MD Professional Engineer License #53896

40 Hour Hazmat Training Certification and 8 Hour HAZWOPER Refresher Annually

10-Hour OSHA Construction Safety Certification

15 years of professional experience

Environmental Anticipatory Boring Program, Livonia Station, New York, NY

Catherine prepared the Environmental Anticipatory Boring Program (EABP) for the New York City subway station project at Livonia Station in support of ADA upgrades. The EABP was approved by the Metropolitan Transportation Authority (MTA) and implemented at the site. Catherine directed the collection of samples for waste characterization from sidewalk, utility trench and elevator pits; evaluated waste classification data and prepared a waste classification report.

Environmental Anticipatory Boring Program, Greenpoint Avenue Station, New York, NY

As Project Manager, Catherine prepared the EABP in support of New York City subway station upgrades under the Americans with Disability Act (ADA) at the Greenpoint Avenue Station and the Grand Concourse Access Road near the intersection of Bedford Park Boulevard. Following approval of the EABP by the Metropolitan Transportation Authority (MTA), Catherine directed the collection of soil samples from areas to be excavated, including elevator pits and utility relocations. Following receipt of waste characterization analysis, Catherine provided technical support for management of disposed soil.

Remedial Action Work Plan and Vapor Mitigation System Design, 1755 Watson Avenue LLC, Bronx, NY

Catherine directed the implementation of the remedial action for the development of property under NYCOER oversight. The property is E-designated for Hazardous Materials, Air Quality and Noise. The project consisted of excavation of over 11,000 tons of fill/soil; waste characterization and design of sub-slab vapor depressurization system. She provided design engineering vapor mitigation system, an active sub-slab depressurization system (SSDS) and construction oversight of the SSDS.

Remedial Action Work Plan and Oversight, 118th Street, New York, NY

Catherine developed a remedial action workplan for the site redevelopment, which consisted of a nine-story residential building. The workplan includes excavation and disposal of 2,700 cubic yards of fill/soil, management of excavated materials, and engineering design of composite cover and vapor barrier. Oversight of the remedial action is ongoing.

Design of Vapor Mitigation System, E. 91st Street. Manhattan, NY
Catherine conducted a pressure field communication test of the sub-slab of an existing residential and childcare building. She provided engineering design and construction oversight of an active sub-slab depressurization system (SSDS) and vapor barrier, and provided technical support for SSDS start-up.

Remedial Investigation and Remedial Action Work Plan, Tillary Street, New York, NY
Catherine serves as Project Manager for the Phase II/RI and remedial action for the site redevelopment. The Site is E-designated for Hazardous Materials. The Remedial Action Work Plan (RAWP) supports the development of a 33-stort mixed use residential tower and includes excavation of soil and design of composite cover system.

Soil and Groundwater Remediation, Former Bader Gas Station, Salem, Salem County, NJ

Catherine served as the Project Manager for the remediation of petroleum-contaminated soil and the in-situ treatment of groundwater at the site of a former gas station; prepared Soil Erosion Sediment Control Plan; coordinated on-site field work, including excavation of 4,200 tons of non-hazardous materials, and dewatering of 4,600 gallons of groundwater and site restoration.

Sediment Sampling and Analysis Plan, Point Pleasant Packing, Point Pleasant Beach, Ocean County, NJ
Catherine prepared a Sediment Sampling and Analysis Plan (SSAP) in accordance with the N.J.A.C. 7:7 Coastal Management Rules, Management and Regulation of Dredging Activities and Dredge Material in New Jersey's Tidal Waters to support a dredging project in the Manasquan River. She worked with the Monmouth University Urban Coast Institute to collect samples based on bathymetric survey, and collected samples via boat-mounted Vibra core from riverbed in accordance with NJDEP-approved SSAP. Catherine provided technical support for the Waterfront Development application to NJDEP.

Landfill Closure and Post-Closure Plan, Oceanport Landfill, Monmouth County, NJ
Catherine prepared the Closure and Post-Closure Plan for the landfill. Tasks included the protection of wetlands and eagle nesting pair on the site and in the adjacent properties, management of asbestos-containing materials, design of cap, relocation of exposed debris, preparation of Materials Acceptance Protocol for management of imported materials and construction oversight. The Closure and Post-Closure Plan has received NJDEP approval.

Management of Landfill Post-Closure Monitoring, Pennsville Sanitary Landfill, Salem County, NJ

Catherine performed engineering inspections, oversight of operations and maintenance under the Landfill Closure and Post/Closure Plan and Landfill Closure Disruption Approval issued by NJDEP, including repairs to landfill cap, gas venting and groundwater monitoring wells. Provides program management for ongoing landfill gas and groundwater quarterly monitoring.

Rachael Barr

Project Manager/Environmental Scientist

Education

BA, Environmental Science, Stockton University, Pomona New Jersey

Registrations/Certifications

OSHA 40-Hour Training + Annual 8-Hour Refresher Training

Subsurface Evaluation and Closure - NJDEP License No. 491088

Certificate in 8-hour Supervisor Training

Certificate in 10-Hour Construction

Continuing Professional Education

Regulatory Training in Underground Storage Tanks – Rutgers University

Site Remediation Basics – Rutgers University

Geology, Hydrogeology & Chemistry - Rutgers University

VHB Office

Manasquan, NJ

Rachael has expertise in commercial, industrial and residential environmental projects. She performs Site Investigations (SIs), Remedial Investigations (RIs), develops Remedial Action Workplans (RAWs), plan and perform Phase I/II Environmental Site Assessments (ESAs) as part of Due Diligence inquiries. In addition, she performs Wetland Delineations and In-Situ Chemical Oxidation (ISCO) Design and Implementation. She oversees UST removals and closures, soil and groundwater sampling, monitoring well installation, soil boring programs, and preparation of reports. She is also responsible for oversight of subcontractors and project team staff, scope design and cost preparation for investigations, and coordination and interaction with Clients, regulatory agencies and the public. Rachael is involved in all aspects of the reporting process: sample gathering, data evaluation, organizing and preparing text for submittal. She has worked with a variety of Clients on diverse site conditions throughout her career.

15 years of professional experience

Project Management of Urban Redevelopment of Mixed-use Residential/Commercial Community Facility at 2395 Frederick Douglass Blvd., NY

As Project Manager, Rachael conducted a Phase II/RI to compile/evaluate data and information necessary to develop a RAWP. An RA was performed pursuant to the New York City Office of Environmental Remediation (NYCOER)-approved RAWP in a manner that has rendered the site protective of public health and the environment consistent with the end use of the property. A RAR has been completed and will be submitted to NYCOER for a NOS. The construction of the onsite building and SSDS are on-going and a final inspection with NYCOER is pending. The site is enrolled in the NYC Voluntary Cleanup Program (VCP)

Phase I Environmental Site Assessment (ESA), Remedial Investigation (RI), Remedial Action Workplan (RAWP), Brooklyn, NY

Rachael performed a Phase I ESA and Phase II/RI to compile/evaluate data and information necessary to develop a RAWP for a five-story residential building, at 31 Ainslie Street in Brooklyn, NY. An RA was performed pursuant to the NYCOER-approved RAWP. An RCR was completed and submitted to the NYCOER. The site is E-Designated for Hazardous Materials. A Notice of Satisfaction (NOS) was issued for the site in 2019 and an SMP approved for annual inspections of the sub-slab depressurization system (SSDS) and composite cover.

Phase I ESA, RI, RAWP of a 15 Story Mixed Use Complex, Brooklyn, NY

Rachael conducted a Phase II/RI to compile/evaluate data and information necessary to develop a RAWP for a mixed use building at 500 Metropolitan Avenue in Brooklyn, NY. An RA was performed pursuant to the NYCOER-approved RAWP. The site is E-Designated for Hazardous Materials. A RCR was completed and approved the NYCOER. The NOC was issued in 2018. Additional services she provided were a Phase I ESA and hazardous waste management.

Phase I ESA, RI, RAWP, Waste Characterization, RA, SMP of a 12 Story Residential Building, Bronx, NY (MLK Plaza)

The redevelopment consisted of the construction of a 12-story residential building at 869 E.147th Street with a partial basement and 168 dwelling units. The site was enrolled in the NYC VCP and E- Designated for Hazardous Materials and Noise. Rachael prepared a Phase I ESA and Phase II/RI were to develop a RAWP. An RA was performed pursuant to the NYCOER-approved RAWP. The NOS was issued by NYCOER for Hazardous Materials and Noise in 2019.

Remedial Investigations for Bulk Storage Facilities, Various Sites and Locations in NJ

Rachael managed and ensured environmental assessment, remedial investigation, and remediation activities were completed according to New Jersey Department of Environmental Protection (NJDEP) requirements. She provided monthly project status updates to the client, coordinated multiple soil and groundwater sampling events per year including permitting, and provided oversight and health and safety protocol measurers for her staff. She also, developed NJDEP Site Investigation Reports, Remedial Action Workplans, Remedial Investigation Reports, Remedial Action Reports, proposals, and budget tracking. Project examples include:

Exxon Mobil Bayway Refinery, Linden, New Jersey
Bristol-Myers Squibb, Pennington, New Jersey
Exxon Trenton Terminal, Hamilton, New Jersey
Motiva Shell Terminal– Sewaren, New Jersey

Soil and Groundwater Investigations (UST Removals), Various Locations, NJ

Rachael has managed all project aspects of soil and groundwater investigation /remediation projects relating to leaking UST removals. She has successfully delineated soil and groundwater impacts and performed numerous rounds of soil and groundwater sampling and conducted periodic monitoring to assess compliance with environmental standards and regulations. She has directed indoor vapor investigations and completed necessary reporting for various facilities throughout New Jersey.

In-Situ Remediation, Various Locations, NJ

Rachael has managed several residential and commercial projects that have required the use of in-situ remediation where contamination cannot safely be removed by excavation methods. Aspects of her projects included the review of injection infrastructure designs, technical report writing, logistics, costs, safety plans, NJDEP requirements and correspondence between the client and regulators.

Wetland Delineation/Ecological Studies, Various Locations, NJ

Rachael has performed various ecological studies including exotic plant management, wetland delineation and restoration including technical report writing and permitting for the following projects:

Point Reyes National Sea Shore, CA – Exotic Plant Management/Invasive Species Control

Commercial – Del Marva Power Company, DE – Wetland Delineation

Commercial – 21 Progress Street, Edison, NJ – Wetland Restoration

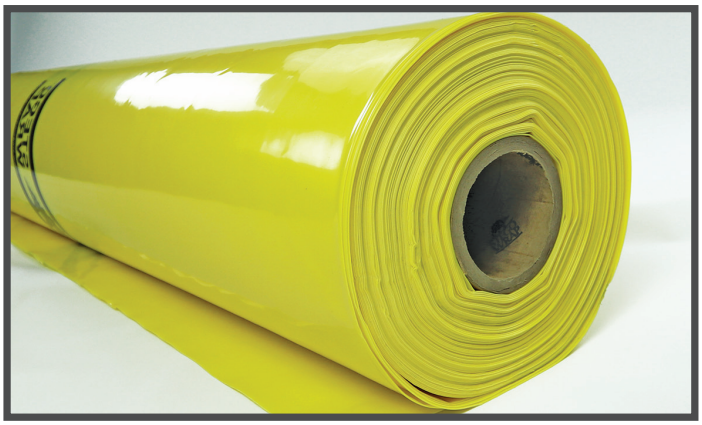
Appendix G – Vapor Barrier Specifications

STEGO® WRAP 20-MIL VAPOR BARRIER

A STEGO INDUSTRIES, LLC INNOVATION | VAPOR RETARDERS 07 26 00, 03 30 00 | VERSION: DEC 10, 2018

1. PRODUCT NAME

STEGO WRAP 20-MIL VAPOR BARRIER



2. MANUFACTURER

Stego Industries, LLC
216 Avenida Fabricante, Suite 101
San Clemente, CA 92672 USA
Sales, Technical Assistance
Ph: (877) 464-7834
contact@stegoindustries.com
www.stegoindustries.com

3. PRODUCT DESCRIPTION

USES: Stego Wrap 20-Mil Vapor Barrier is used as a below-slab vapor barrier.

COMPOSITION: Stego Wrap 20-Mil Vapor Barrier is a multi-layer plastic extrusion manufactured with only the highest grade of prime, virgin, polyolefin resins.

ENVIRONMENTAL FACTORS: Stego Wrap 20-Mil Vapor Barrier can be used in systems for the control of soil gases (radon, methane), soil poisons (oil by-products) and sulfates.

4. TECHNICAL DATA

TABLE 4.1: PHYSICAL PROPERTIES OF STEGO WRAP 20-MIL VAPOR BARRIER

PROPERTY	TEST	RESULTS
Under Slab Vapor Retarders	ASTM E1745 Class A, B & C – Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs	Exceeds Class A, B & C
Water Vapor Permeance	ASTM F1249 – Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor	0.0071 perms
Permeance After Conditioning (ASTM E1745 Sections 7.1.2 - 7.1.5)	ASTM E154 Section 8, F1249 – Permeance after wetting, drying, and soaking ASTM E154 Section 11, F1249 – Permeance after heat conditioning ASTM E154 Section 12, F1249 – Permeance after low temperature conditioning ASTM E154 Section 13, F1249 – Permeance after soil organism exposure	0.0088 perms 0.0081 perms 0.0084 perms 0.0077 perms
Methane Transmission Rate	ASTM D1434 - Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting	152.2 GTR* (mL(STP)/m^2*day)
Radon Diffusion Coefficient	K124/02/95	9.9 x 10^{-12} m^2/second
Puncture Resistance	ASTM D1709 – Test Method for Impact Resistance of Plastic Film by Free-Falling Dart Method	3500+ grams**
Tensile Strength	ASTM D882 – Test Method for Tensile Properties of Thin Plastic Sheeting	97.7 lbf/in
Thickness		20 mil
Roll Dimensions	width x length: area:	14' x 105' 1470 ft^2
Roll Weight		140 lb

Note: perm unit = grains/(ft^2*hr*in-Hg)
*GTR = Gas Transmission Rate
**The material maxed out the testing equipment and did not fail at 3746 grams.

Continued...
Note – legal notice on page 2.

STEGO® WRAP 20-MIL VAPOR WRAP BARRIER

A STEGO INDUSTRIES, LLC INNOVATION | VAPOR RETARDERS 07 26 00, 03 30 00 | VERSION: DEC 10, 2018

5. INSTALLATION

UNDER SLAB: Unroll Stego Wrap 20-Mil Vapor Barrier over an aggregate, sand or tamped earth base. Overlap all seams a minimum of 6 inches and tape using Stego® Tape or Stego® Crete Claw® Tape. All penetrations must be sealed using a combination of Stego Wrap and Stego Accessories.

For additional information, please refer to Stego's complete installation instructions.

6. AVAILABILITY & COST

Stego Wrap 20-Mil Vapor Barrier is available through our network of building supply distributors. For current cost information, contact your local Stego distributor or Stego Industries' Sales Representative.

7. WARRANTY

Stego Industries, LLC believes to the best of its knowledge, that specifications and recommendations herein are accurate and reliable. However, since site conditions are not within its control, Stego Industries does not guarantee results from the use of the information provided herein. Stego Industries, LLC does offer a limited warranty on Stego Wrap. Please see www.stegoindustries.com/legal.

8. MAINTENANCE

None required.

9. TECHNICAL SERVICES

Technical advice, custom CAD drawings, and additional information can be obtained by contacting Stego Industries or by visiting the website.

Contact Number: (877) 464-7834
Website: www.stegoindustries.com

10. FILING SYSTEMS

- www.stegoindustries.com

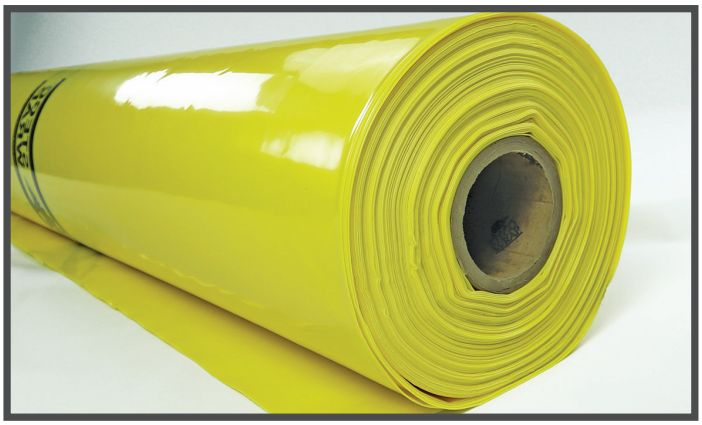
STEGO® WRAP 20-MIL VAPOR BARRIER

A STEGO INDUSTRIES, LLC INNOVATION | VAPOR RETARDERS 07 26 00, 03 30 00 | VERSION: DEC 10, 2018

07-10-00-7 Waterproofing - Slab

1. PRODUCT NAME

STEGO WRAP 20-MIL VAPOR BARRIER



2. MANUFACTURER

Stego Industries, LLC
216 Avenida Fabricante, Suite 101
San Clemente, CA 92672 USA
Sales, Technical Assistance
Ph: (877) 464-7834
contact@stegoindustries.com
www.stegoindustries.com

3. PRODUCT DESCRIPTION

USES: Stego Wrap 20-Mil Vapor Barrier is used as a below-slab vapor barrier.

COMPOSITION: Stego Wrap 20-Mil Vapor Barrier is a multi-layer plastic extrusion manufactured with only the highest grade of prime, virgin, polyolefin resins.

ENVIRONMENTAL FACTORS: Stego Wrap 20-Mil Vapor Barrier can be used in systems for the control of soil gases (radon, methane), soil poisons (oil by-products) and sulfates.

4. TECHNICAL DATA

TABLE 4.1: PHYSICAL PROPERTIES OF STEGO WRAP 20-MIL VAPOR BARRIER

PROPERTY	TEST	RESULTS
Under Slab Vapor Retarders	ASTM E1745 Class A, B & C – Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs	Exceeds Class A, B & C
Water Vapor Permeance	ASTM F1249 – Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor	0.0071 perms
Permeance After Conditioning (ASTM E1745 Sections 7.1.2 - 7.1.5)	ASTM E154 Section 8, F1249 – Permeance after wetting, drying, and soaking ASTM E154 Section 11, F1249 – Permeance after heat conditioning ASTM E154 Section 12, F1249 – Permeance after low temperature conditioning ASTM E154 Section 13, F1249 – Permeance after soil organism exposure	0.0088 perms 0.0081 perms 0.0084 perms 0.0077 perms
Methane Transmission Rate	ASTM D1434 - Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting	152.2 GTR* (mL(STP)/m^2*day)
Radon Diffusion Coefficient	K124/02/95	9.9 x 10^{-12} m^2/second
Puncture Resistance	ASTM D1709 – Test Method for Impact Resistance of Plastic Film by Free-Falling Dart Method	3500+ grams**
Tensile Strength	ASTM D882 – Test Method for Tensile Properties of Thin Plastic Sheeting	97.7 lbf/in
Thickness		20 mil
Roll Dimensions	width x length: area:	14' x 105' 1470 ft^2
Roll Weight		140 lb

Note: perm unit = grains/(ft^2*hr*in-Hg)
*GTR = Gas Transmission Rate
**The material maxed out the testing equipment and did not fail at 3746 grams.

Continued...
Note – legal notice on page 2.

STEGO® WRAP 20-MIL VAPOR WRAP BARRIER

A STEGO INDUSTRIES, LLC INNOVATION | VAPOR RETARDERS 07 26 00, 03 30 00 | VERSION: DEC 10, 2018

5. INSTALLATION

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For additional information, please refer to Stego's complete installation instructions.

6. AVAILABILITY & COST

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8. MAINTENANCE

None required.

9. TECHNICAL SERVICES

Technical advice, custom CAD drawings, and additional information can be obtained by contacting Stego Industries or by visiting the website.

Contact Number: (877) 464-7834
Website: www.stegoindustries.com

10. FILING SYSTEMS

- www.stegoindustries.com

☐ FURNISH AS SUBMITTED DATE 3/25/2020
☐ FURNISH AS CORRECTED CHECKED BY FRA
☐ REVISE AND RESUBMIT
☐ REVIEWED

SUBJECT TO CONTRACT PLANS AND SPECIFICATIONS FOR THIS WORK EXCEPT AS TO FIGURE DIMENSIONS

AUFGANG ARCHITECTS

The Architect's approval is only for conformance with the design concept of the work and the information given in the Contract Documents. The Architect's approval of a specific item shall not indicate approval of any assembly of which the item is a component.

FSA'S REVIEW OF THIS DRAWING IS TO VERIFY CONFORMANCE WITH ONLY THE DESIGN CONCEPT OF THE PROJECT COMPARE WITH THE INFORMATION GIVEN IN THE CONTRACT DOCUMENTS. THE CONSTRUCTION MANAGER ("CM") IS RESPONSIBLE FOR THE FOLLOWING: DIMENSIONS (TO BE CONFIRMED AND COMPLETED AT THE JOB SITE); QUANTITIES OF MATERIALS; SCHEDULING OF CONSTRUCTION; CHECKING OF ALL FIELD CONDITIONS; INFORMATION THAT PERTAINS SOLELY TO THE FABRICATION PROCESS AND/OR TO THE TECHNIQUES OF CONSTRUCTION; AND FOR THE COORDINATION, CONTROL, AND SUPERVISION OF THE WORK OF ALL TRADES. THIS REVIEW SHALL NOT RELIEVE THE CM FROM RESPONSIBILITY FOR DEVIATIONS FROM DRAWINGS TO SPECIFICATIONS, OR ERRORS IN SHOP DRAWINGS OR SCHEDULES.

FSA
FRANK SETA & ASSOCIATES, LLC
BUILDING ENVELOPE CONSULTANTS

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☐ REJECTED
☐ REVISE & RESUBMIT
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☐ REVISE & RESUBMIT FOR RECORD ONLY
☒ SUBJECT TO OWNERS APPROVAL - CM TO COORDINATE
☐ NOT REVIEWED
☐ SUBMIT MISSING INFORMATION

BY: A. Berlinger DATE: 02.12.20

This submittal is subject to review and acceptance of Office of Environmental Remediation as product is substitution of for integrally bonded Grace Florprufe 120 membrane noted on Contract Drawings.

TREMCO
Commercial Sealants & Waterproofing

TREMDrain® S

Multi-Composite Drainage and Protection Boards

Product Description

TREMDrain® S offers the highest compressive strength available within the TREMDrain Series and consists of a nonwoven, needle-punched, polypropylene fabric, polystyrene core and polymeric film backing.

Basic Uses

The TREMDrain Series of mats are used with TREMproof® and Paraseal® waterproofing membranes serving both as a protection course and replacement for traditional pipe and stone drainage systems.

Features and Benefits

- TREMDrain Series Drainage and Protection Boards replace or eliminate the need for a separate protection course.
- Provide an uninterrupted flow plane and eliminate the opportunity for hydrostatic pressure to form against a wall.
- Lightweight and easy to install compared to conventional pipe and stone drainage.

Availability

Immediately available from your local Tremco Sales Representative, Tremco Distributor or Tremco Warehouse.

Packaging

4' x 50' (1.22 M x 15.8 M)

Storage

Store out of direct sunlight. Vertical storage recommended.

Limitations

- Not for use beneath sand-set vehicular pavers.

Installation

Refer to TREMDrain Series Application Instructions for specific application details. The techniques included may require modification to adjust to job-site conditions. Consult your local Tremco Sales Representative or Tremco Technical Service for specific design requirements.

Warranty

Tremco warrants its Products to be free of defects in materials, but makes no warranty as to appearance or color. Since methods of application and on-site conditions are beyond our control and can affect performance, Tremco makes no other warranty, expressed or implied, including warranties of MERCHANTABILITY and FITNESS FOR A PARTICULAR PURPOSE, with respect to Tremco Products. Tremco's sole obligation shall be, at its option, to replace or to refund the purchase price of the quantity of Tremco Product proven to be defective, and Tremco shall not be liable for any loss or damage.

Please refer to our website at www.tremcosealants.com for the most up-to-date Product Data Sheets.

NOTE: All Tremco Safety Data Sheets (SDS) are in alignment with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) requirements.

TYPICAL PHYSICAL PROPERTIES

PROPERTY	TEST METHOD	VALUES US	VALUES SI
Typical Applications		Under Slab, Split Slab	
Flow Capacity per unit width	ASTM D4716	9 gpm/ft	112 Lpm/M
Roll Length		50'	15.24 M
Roll Width		4'	1.22 M
Roll Weight		30 lb	13.61 kg
Fabric			
Material		Nonwoven Needle-punched Polypropylene	
Weight	ASTM D3776	3.5 oz/yd²	118.67 g/M²
Grab Tensile Strength	ASTM D4632	100 lbf	445 N
Puncture Strength	ASTM D4833	65 lbf	289 N
Trapezoidal Tear	ASTM D4533	50 lbf	222 N
Mullen Burst Strength	ASTM D3786	225 psi	1,551 kPa
Grab Elongation	ASTM D4632	65%	
AOS	ASTM D4751	70 sieve	210 micron
Permittivity	ASTM D4491	2.6 sec $^{-1}$	
Permeability	ASTM D4491	0.3 cm/sec	
Flow Rate	ASTM D4491	165 gpm/ft²	6,732 Lpm/M²
Root Barrier Fabric		None	
Core			
Material		Polystyrene	
Thickness	ASTM D1777	1/4"	6.35 mm
Compressive Strength		30,000 lb/ft²	146,472 kg/M²

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FSA
FRANK SETA & ASSOCIATES, LLC
BUILDING ENVELOPE CONSULTANTS

- ☒ NO EXCEPTIONS TAKEN
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- ☐ REJECTED
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- ☐ RECEIVED FOR INFORMATIONAL PURPOSES ONLY
- ☐ REVISE & RESUBMIT FOR RECORD ONLY
- ☐ SUBJECT TO OWNERS APPROVAL - CM TO COORDINATE
- ☐ NOT REVIEWED
- ☒ SUBMIT MISSING INFORMATION

BY: A. Berlinger DATE: 02.12.20

- ☐ FURNISH AS SUBMITTED
- ☒ FURNISH AS CORRECTED
- ☐ REVISE AND RESUBMIT
- ☐ REVIEWED

DATE 3/25/2020
CHECKED BY FRA

SUBJECT TO CONTRACT PLANS AND SPECIFICATIONS FOR THIS WORK EXCEPT AS TO FIGURE DIMENSIONS

AUFGANG ARCHITECTS

The Architect's approval is only for conformance with the design concept of the work and the information given in the Contract Documents. The Architect's approval of a specific item shall not indicate approval of any assembly of which the item is a component.

FSA General Review Comments

This submittal is subject to architect/geotechnical consultant review and acceptance.
Reviewed as single component of a complete foundation waterproofing assembly.
Install in full compliance with manufacturer's instructions and details.
Product data is acceptable, but installation shall not commence without submission/approval of **project-specific shop drawings** (showing location for product application and details at substrate joints/cracks, intersection of horizontal/vertical surfaces, inside/outside corners, terminations/penetrations in membrane system), test reports/certifications,warranty.

Tremco Commercial Sealants & Waterproofing

3735 Green Rd
Beachwood OH 44122
216.292.5000 / 800.321.7906

1451 Jacobson Ave
Ashland OH 44805
419.289.2050 / 800.321.6357

220 Wicksteed Ave
Toronto ON M4H1G7
416.421.3300 / 800.363.3213

1445 Rue de Coulomb
Boucherville QC J4B 7L8
514.521.9555

www.tremcosealants.com

PRODUCT DATA

07-10-00-8 Waterproofing - Slab

For Review
02/04/2020 4:32:11 PM

MasterFormat: 07 14 16

W. R. MEADOWS SEALTIGHT

NO. 709

NOVEMBER 2017
(Supersedes August 2017)

HYDRALASTIC™ 836

Cold-Applied, Single-Component Waterproofing

DESCRIPTION

HYDRALASTIC 836 is a cold-applied, solvent-free, single-component waterproofing compound. It does not shrink, has a low volatile organic compound (VOC) content, and has a very low odor. It will not crack in extreme cold or slump due to softening at high temperatures.

USES

HYDRALASTIC 836 is suitable for use on interior or exterior concrete surfaces, where protection from water intrusion is desired. The product can be used for both above-grade and below-grade applications. HYDRALASTIC 836 is excellent for horizontal and vertical applications, such as waterproofing plaza decks, planter boxes, and sealing parapets. The product is ideal for positive-side waterproofing for foundations and also in between-slab (split slab) applications. HYDRALASTIC 836 can also be used in vertical applications.

FEATURES/BENEFITS

- Bonds to both concrete and asphalt.
- Skins over in 30 minutes at 75° F (23° C); no dust pick up.
- Easy application; no mixing required.
- Can be applied to green concrete.
- Will not slump.
- Will not harm EPS or Styrofoam materials.
- Does not freeze; will not be damaged due to freezing weather conditions.
- Cures to a tough, flexible membrane.

PACKAGING

5 Gal. (18.93 L) Pails.

COVERAGE

Approximate coverage per gallon (3.78 L):

26 ft.^{2} (2.4 m^2)	60 mils (dry)
17.5 ft.^{2} (1.6 m^2)	90 mils (dry)
13 ft.^{2} (1.2 m^2)	120 mils (dry)

SHELF LIFE

When stored indoors and in original, unopened containers at temperatures between 40° - 70° F (4° - 21° C), shelf life is six months from date of manufacture.

SPECIFICATIONS

- ASTM C 836
- Complies with all current federal, state, and local maximum allowable VOC requirements, including National EPA VOC Emission Standard for Architectural Coatings, CARB, LADCO, OTC Phase I and II, and SCAQMD.

TECHNICAL DATA

PROPERTY	TYPICAL TEST VALUE	TEST METHOD
Solids Content By Weight, %:	98	ASTM C1250
Tensile Strength, psi:	100	ASTM D412
Elongation at Break, %:	425	ASTM D412
Permeability, perm in.:	0.1	ASTM E96 BW
Shore 00 Hardness:	57	ASTM D2240
Service Temperature, ° F (° C):	-40° - 200° (-40° -70°)	
Minimum Application Temperature, ° F (° C):	Above 30 (-1) and rising	
VOC Content, g/L:	36	ASTM D2369

APPLICATION

New Concrete Design Finish … For best results, all new concrete surfaces should be designed with a light trowel finish and provide a flat, uniform surface. The surface should then be treated with a light broom finish. Wet curing is preferable. Any membrane curing compounds must be mechanically removed. Address any projections and fill in any voids or indentations to provide a smooth, level surface.

Surface Preparation … HYDRALASTIC 836 is intended for concrete, asphalt, metal, and wood surfaces. For existing concrete remedial work or new concrete lacking profile, lightly roughen or rough grind substrate. Remove all unsound substrate and provide a relatively flat, profiled, roughened surface. Substrate must be structurally sound, dust-free, and free of frost, grease, oil, dirt, curing compounds, release agents, or any other surface or penetrated contaminants that will adversely affect bond. Use denatured alcohol to remove all grime, oil, loose paint, frost, and other contamination, from all working surfaces. DO NOT USE petroleum solvents such as mineral spirits or xylene.

Repair any concrete deterioration, defects or voids and fill bug holes, minor surface defects or tie holes with MEADOW-PATCH® 5 or MEADOW-PATCH 20 from W. R. MEADOWS. Irregularities in concrete that could cause a protrusion should be ground to a smooth surface. Penetrations should be grouted and structurally sound All penetration areas must have sufficient room for adequate waterproofing to be applied.

CONTINUED ON REVERSE SIDE …

W. R. MEADOWS, INC.
P.O. Box 338 • HAMPSHIRE, IL 60140-0338
Phone: 847/214-2100 • Fax: 847/683-4544
1-800-342-5976
www.wrmeadows.com

Do not use asphalt-based primers on concrete or metal surfaces. Do not condition any concrete or metal surfaces with primers designed for asphalt. Asphalt-type primers will act as a bond breaker and soften the cured material. Residual asphalt or old, non-live coal tar pitch-coated surfaces that may remain after surface preparation may be suitable for waterproofing with HYDRALASTIC 836. In this case, a sample test application should be conducted to determine appropriateness.

Priming … For porous substrates where air and/or moisture release may cause pinhole or blister problems to occur in the applied membrane, priming the substrate prior to application of HYDRALASTIC 836 is recommended. Contact a W. R. MEADOWS representative for priming recommendations. Priming is recommended to remove trapped air/vapor from the substrate and promote a better bond with the substrate.

Application Method … Gentle mixing using a slow-speed drill and paddle may be necessary if product has settled. Do not over mix. Make sure product is conditioned at 75° F (2° C) by storing product overnight or at least 12 hours prior to use for ease of application. Apply by trowel, squeegee, or roller. A flat-blade squeegee is suggested for best results. Notched rubber squeegees waste material and do not provide a uniform coat. Flat-blade squeegees provide a uniform mil thickness. HYDRALASTIC 836 can also be applied horizontally with a squeegee or roller and vertically with a roller. Test periodically to make sure adequate adhesion is achieved. HYDRALASTIC 836 has a work life of one hour at 75° F (23° C). Make sure all spreading and finishing of the product has been completed within this timeframe.

A single-coat application (60 mils) can be used for typical waterproofing applications such as foundation walls and planters. In critical waterproofing applications such as plaza decks, podiums, or other similar horizontal waterproofing applications, a 120-mil layer of HYDRALASTIC 836 embedded with REINFORCING FABRIC HCR from W. R. MEADOWS is recommended. For all horizontal installations, refer to High Build Reinforced System installation guidelines provided at www.wrmeadows.com for proper installation guidelines. If there are no details available for your specific application, please contact a W. R. MEADOWS representative for recommendations.

If a second coat is necessary, apply as soon as possible, but no more than eight hours apart at 75° F (23° C). As ambient, substrate, and material temperatures increase, an oily like film may develop on the surface and act as a bond breaker.

For next-day or second-coat applications, rub the tie-in area down [6″ - 8″ (152 - 203 mm wide)] with acetone or alcohol. This removes the oil film.

Protect the Membrane … On all vertical and horizontal installations, protect HYDRALASTIC 836 with PROTECTION COURSE (PC-2) or MEL-DRAIN™ (type with the polyester backing film) from W. R. MEADOWS or contact W. R. MEADOWS for additional protection course options. Application of protection should be done after material can be walked on without causing damage to the integrity of the membrane.

HYDRALASTIC 836 will not typically wash off if rain begins during or after application. Stop all work if rain begins and protect open or unused material from rainfall.

Tack-Free Drying Time … HYDRALASTIC 836 features a fast-drying time. Drying time is usually four hours, depending on temperature and relative humidity.

Cleanup … Uncured HYDRALASTIC 836 cleans up easily with alcohol or other solvents. Cured material is best removed by mechanical means.

PRECAUTIONS

Do not expose product to exterior UV for longer than 14 days. HYDRALASTIC 836 is not to be used as a liner in a water-containing structure and is not to be used as an exposed or wearing surface. For this purpose, use the GEMITE® line of products. Do not use on surfaces that are later to be painted. This data sheet provides a summary of the factors, precautions, limitations, and design theories that should be considered when designing a complete waterproofing and drainage system, but is not stand alone or complete; project, environmental, and application specific requirements must be considered before drafting a guide specification, determining suitability or application of material. Refer to Safety Data Sheet for health and safety information.

LEED INFORMATION

May help contribute to LEED credits:

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

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

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FSA

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BY: A. Berlinger DATE: 02.12.20

FSA General Review Comments

This submittal is subject to architect/geotechnical consultant review and acceptance.
Reviewed as single component of a complete foundation waterproofing assembly.
Install in full compliance with manufacturer's instructions and details.
Product data is acceptable, but installation shall not commence without submission/approval of **project-specific shop drawings** (showing location for product application and details at substrate joints/cracks, intersection of horizontal/vertical surfaces, inside/outside corners, terminations/penetrations in membrane system), test reports/certifications,warranty.

☐ FURNISH AS SUBMITTED DATE 3/25/2020
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☐ REVIEWED

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AUFGANG ARCHITECTS

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LIMITED WARRANTY

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

Disclaimer

with the use of this
product, it is recom
information is valid
owner for the desig
suitability of produ

PRODUCT DATA

MasterFormat: 07 13 26

NO. 714

OCTOBER 2013
(Supersedes July 2012)

MEL-ROL®

Rolled, Self-Adhering Waterproofing Membrane

DESCRIPTION

MEL-ROL waterproofing system is a flexible, versatile, dependable, roll-type waterproofing membrane. It is composed of a nominally 56 mil thick layer of polymeric waterproofing membrane on a heavy duty, four-mil thick, cross-laminated polyethylene carrier film. The two components are laminated together under strict quality-controlled production procedures.

A handy overlap guideline is printed 2 ½" (63.5 mm) in from the material edge on each side to assure proper overlap coverage and to assist in maintaining a straight application. Special exposed polymeric membrane strips are provided on both sides for positive membrane-to-membrane adhesion in the overlap area. The membrane strips are protected by a pull-off release strip. All components of the MEL-ROL waterproofing system work together to provide a cost-effective, positive waterproofing system that's quick and easy to apply.

W. R. MEADOWS accessory products included in the MEL-ROL waterproofing system are: BEM, MEL-ROL LIQUID MEMBRANE, MEL-PRIME™ adhesive (solvent-based and water-based), POINTING MASTIC, DETAIL STRIP, CATALYTIC BONDING ASPHALT, TERMINATION BAR, PROTECTION COURSE and MEL-DRAIN™ drainage board.

USES

MEL-ROL waterproofing system provides a cost-effective answer to properly waterproof foundations, vertical walls, and below-grade floors in residential and commercial construction. It is equally effective for use as between-the-slab waterproofing on plaza decks, parking decks, and structural slabs. Use it as a waterproofing membrane to isolate mechanical and electronic rooms, laboratories, kitchens, and bathrooms. MEL-ROL offers positive protection when "wrapped around" major rapid transit, vehicular, utility, and pedestrian tunnel projects. MEL-ROL can also be used on insulated concrete forms (ICF).

Installation of PROTECTION COURSE from W. R. MEADOWS is recommended before backfilling. MEL-ROL can also be used with drainage boards when specified.

FEATURES/BENEFITS

- Provides cost-effective, flexible, versatile, dependable, positive waterproofing protection against damaging moisture migration and the infiltration of free water.
- Offers a quick and easy-to-apply system for maximum productivity.
- Special membrane-to-membrane adhesion provides additional overlap security.
- Meets or exceeds the test requirements of all currently applicable specifications.
- Components work together for positive waterproofing protection.
- Handles with ease on the jobsite.
- Available in a low temperature version for use when air and surface temperatures are between 20° F (-7° C) and 60° F (16° C). An extra-low temp version is also available, ideal for application in extra-low temperatures down to 0º F (-18º C).

PACKAGING

38.5" (977.9 mm) wide x 62.5' (19.1 m) long, one roll per carton.

COVERAGE

Provides 200 ft.^{2} (18.6 m^2) per roll. Gross coverage is 200 ft.^{2} (18.6 m^2). [Net coverage is 187.5 ft.^{2} (17.4 m^2) with overlap of 2 ½" (63.5 mm).]

STORAGE AND HANDLING

Store membrane cartons on pallets and cover if left outside. Keep materials away from sparks and flames. Store where temperature will not exceed 90° F (32° C) for extended periods of time.

SPECIFICATIONS

- A.R.E.M.A.® Specifications Chapter 29, Waterproofing
- LARR Report 26022

APPLICATION

Surface Preparation … Concrete should be cured at least 72 hours, be clean, dry, smooth, and free of voids. Repair spalled areas; fill all voids and remove all sharp protrusions.

CONTINUED ON REVERSE SIDE…

W. R. MEADOWS, INC.
P.O. Box 338 • HAMPSHIRE, IL 60140-0338
Phone: 847/214-2100 • Fax: 847/683-4544
1-800-342-5976
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MEL-ROL COMBINES POSITIVE WATERPROOFING PROTECTION WITH EASE OF HANDLING

EXCLUSIVE FEATURES

A handy overlap guideline is printed 2 ½" (63.5 mm) in from the material edge on each side, assuring proper overlap coverage and assisting in maintaining a straight application. The polymeric waterproofing membrane is protected by a special, easy-to-remove release paper. The exposed membrane strips on the material edges are protected by a pull-off release strip. Exposed polymeric membrane strips are provided on both sides of MEL-ROL for positive membrane-to-membrane adhesion in the overlap area ... note the detail, as shown in inset photo.

TECHNICAL DATA		
PROPERTY	**TYPICAL VALUE**	**TEST METHOD**
COLOR … Carrier Film Polymeric Membrane	White Black	
THICKNESS … Carrier Film Polymeric Membrane	4 mils 56 mils	
TENSILE STRENGTH ... Carrier Film Membrane	5900 psi min. (40.71 MPa) 460 psi (3230 KPa)	ASTM D 412 (Die C)
ELONGATION	971.3%	ASTM D 412
LOW TEMP CRACK BRIDGING 100 Cycle -25° F (-32° C)	Pass	ASTM C 836
PEEL ADHESION	11.8 lb./in. (2068 N/m)	ASTM D 903
LAP ADHESION	8.62 lbf/in. (1508.5 N/m)	ASTM D 1876
WATER VAPOR PERMEABILITY	0.036 Perms	ASTM E-96, B
WATER ABSORPTION	0.1%, 72 hrs. max.	ASTM D 1970
HYDROSTATIC RESISTANCE	Equiv. to 230.9' (70.38 m) of water	ASTM D 5385
PUNCTURE RESISTANCE	48.24 lbf (214.6 N)	ASTM E 154
EXPOSURE TO FUNGI	Pass, 16 weeks	Soil Test
FLEXIBILITY @ -20° F (-29° C)	Pass	ASTM D 1970

MEL-ROL IS QUICK AND EASY TO APPLY

Temperature ... Apply in dry, fair weather when the air and surface temperatures are above 40° F (4° C). Do not apply to frozen concrete.

MEL-ROL LOW TEMP can be used when air and surface temperatures are between 20° F (-7° C) and 60° F (16° C).

Surface Conditioning … Apply MEL-PRIME adhesive to surfaces that will be covered within one working day. If left exposed overnight, additional adhesive must be applied. Follow all instructions and precautions on containers.

REMOVE release paper from MEL-ROL from the top edge of the roll and firmly press exposed area to the wall. Remove the release paper from the rolls in a downward direction, pressing MEL-ROL into place on the wall.

Footing Details … Use DETAIL STRIP for impaction sheet coverage. First, fold strips lengthwise and then cut at the fold. Material is then ready to install as 4 ½" (114.3 mm) strips on either side of the rebar. Any excess can be turned down on the face of the footing. Next, fill the voids around rebars in the keyway with CATALYTIC BONDING ASPHALT. Pour the walls. Install DETAIL STRIP horizontally along the wall where it meets the footing, placing half the material up the wall and the other half onto the footing. Extend the material 4 ½" (114.3 mm) beyond outside corners. Slit extended portion of DETAIL STRIP lengthwise. Place the horizontal flap out onto the footing and bend the vertical flap around the wall. (See Diagram A.) Repeat this procedure in the opposite direction as shown in Diagram B.

MEL-ROL can be applied to concrete, masonry surfaces, wood, insulated wall systems, and metal. All substrates must be clean, dry, and free of all surface irregularities.

Horizontal Application … Remove release paper on edge, then position the MEL-ROL membrane. Pull balance of release paper off, running the roll from low to high points, so all laps will shed water. Stagger end laps and overlap all seams at least 2 ½" (63.5 mm). Apply a double-thickness of the MEL-ROL membrane over construction, control, all expansion joints and over cracks greater than 1/16" (1.59 mm) wide.

DIAGRAM A
Outside Corner

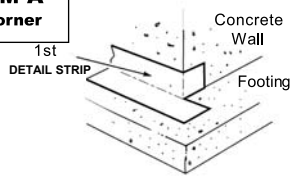
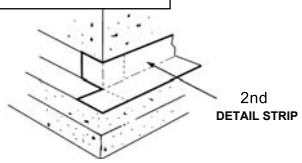


DIAGRAM B
Outside Corner



Vertical Wall Application … Masonry walls may require the application of a cementitious parge-coat. Allow the parge-coat to dry before priming and applying MEL-ROL. When applied, the parge-coat will produce a smooth, uniform, and well-bonded surface. Remove release paper, then apply vertically in lengths approximately 8' (2.44 m) long over the top of the horizontal DETAIL STRIP at the footing. Overlap seams at least 2 ½" (63.5 mm). Tightly butt edges of membrane and apply POINTING MASTIC in corner applications. (See Diagram C.)

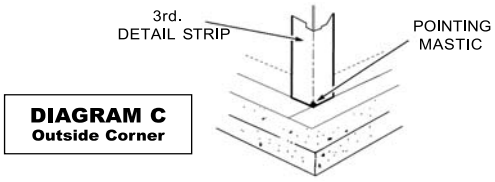


DIAGRAM C
Outside Corner

To the top terminations, apply POINTING MASTIC at least 1/8" (3.18 mm) thick and 1" (25.4 mm) wide. As an option, TERMINATION BAR may be used to mechanically fasten the membrane.

Hand-Rub and Roll Press … Once positioned, immediately hand-rub the MEL-ROL membrane firmly to the surface, removing any bubbles or wrinkles, then pressure roll the complete surface to assure positive adhesion.

Inside Corners ... Before MEL-ROL is applied, place a vertical DETAIL STRIP on inside corners extending the material 4 ½" (114.3 mm) beyond each side of the corner. (See Diagram D.) Terminate at the footing and finish the corner with POINTING MASTIC.

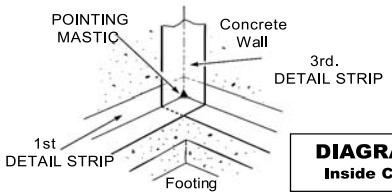
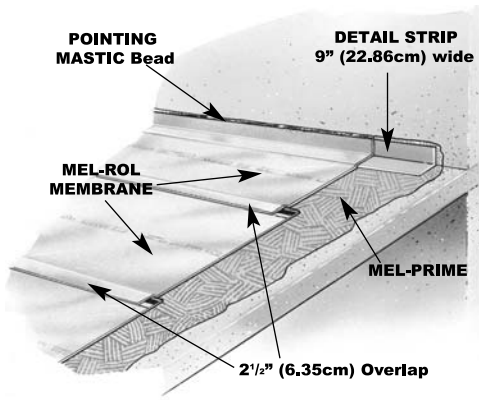
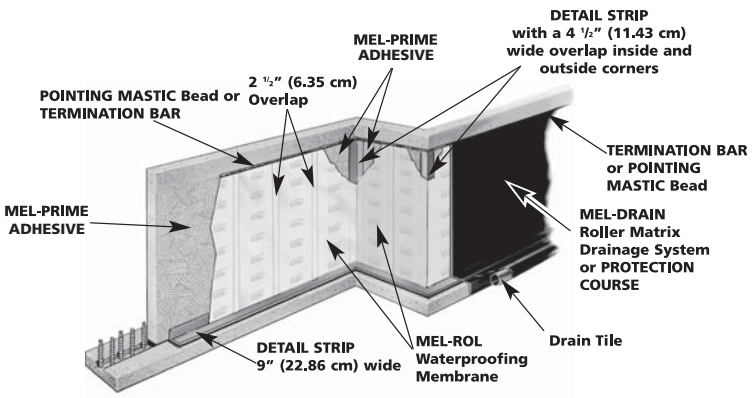


DIAGRAM D
Inside Corner

Outside Corners … Bend DETAIL STRIP vertically over the outside corner and extend 4 ½" (114.3 mm) beyond each side of the corner. Terminate the material at the footing. Finish the corner with POINTING MASTIC. (See Diagram C.)

Drains and Protrusions … All protrusions should be sealed with two layers of membrane applied at least 6" (152.4 mm) in all directions. Seal all terminations with POINTING MASTIC. Around drains, apply two layers of MEL-ROL and put a bead of POINTING MASTIC between the membrane and clamping rings and at all terminations, drains, and protrusions. See ASTM D 5898.





Inspect and Repair … A thorough inspection should be made before covering and all necessary repairs made immediately. Tears and inadequate overlaps should be covered with MEL-ROL ... slit fish mouths and patch. Seal edges of all patches with POINTING MASTIC. Where applicable, horizontal applications can be flood-tested for 24 hours. All leaks should be marked and repaired when membrane dries.

Protect the Membrane … on all vertical and horizontal installations with the immediate application of PROTECTION COURSE if no drainage system is used, or MEL-DRAIN. To secure PROTECTION COURSE, use POINTING MASTIC as an adhesive, and/or physically attach at the top edge using TERMINATION BAR. Backfilling should be done immediately, using care and caution to avoid damaging the waterproofing application.

PRECAUTIONS

Avoid the use of products that contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with MEL-ROL. The use of MEL-ROL does not negate the need for relief of hydrostatic heads. A complete drain tile system should be placed around the exterior of footing and under slabs, as required.

ACCESSORIES

MEL-PRIME W/B … This water-based adhesive prepares concrete surfaces for MEL-ROL application. Arrives ready to use. Requires no additional mixing. MEL-PRIME W/B emits no unpleasant odors and works with all W. R. MEADOWS waterproofing membranes. Applies easily with manual sprayer or roller; VOC-compliant. MEL-PRIME W/B is for use at temperatures of 40° F (4° C) and up.

COVERAGE: 150 - 200 ft.^{2}/gal. (3.7 - 4.9 m^2/L)

PACKAGING: 1 Gallon (3.79 Liter) Units (4 units per carton), 5 Gallon (18.93 Liter) Pails

MEL-PRIME … This solvent-based adhesive is for use at temperatures of 25° F (-4° C) and above. Apply by roller.

COVERAGE: 250-350 ft.^{2}/gal. (6.14 to 8.59 m^2/L) PACKAGING: 5 Gallon (18.93 Liter) Pails

MEL-ROL LIQUID MEMBRANE … A two-component material used as a flashing to form fillets at corners and at protrusions. May be used as a substitute for POINTING MASTIC. Product can also be used in between walls and footings in lieu of DETAIL STRIP.

COVERAGE: As a fillet, approximately 135 lineal feet per gallon (10.87 m per liter) PACKAGING: 1 Gallon (3.79 Liter) Units, 4 Units per carton.

BEM … BEM can be used as a fillet to round out 90° angles, such as the wall-footing connection, and can be used as a substitute for MEL-ROL LIQUID MEMBRANE.

COVERAGE: As a fillet, approximately 135 lineal ft./gal. (10.9 m/L). PACKAGING: 28 Oz. (828 mL) Cartridges (12 per Carton)

POINTING MASTIC … Used as an adhesive and for sealing top edge terminations on DETAIL STRIP and membrane, and to adhere PROTECTION COURSE.

COVERAGE: 1/8” x 1” x 200’/gal. (3.18 mm x 25.4 mm x 16.10 ml). PACKAGING: 5 Gallon (18.93 Liter) Pails, 29 Oz. (857.65 ml) Cartridges, 12/ctn.

CATALYTIC BONDING ASPHALT … Easy-to-apply, one-component material for sealing around rebar.

COVERAGE: 5 gal./1000 ft.^{2}/gal. (4.9 m^2/L) PACKAGING: 5 Gallon (18.93 Liter) Pails.

DETAIL STRIP … Convenient, easy-to-use DETAIL STRIP provides an economical and effective method for sealing vertical and horizontal butt joints, i.e. inside or outside corners and where walls and footings meet.

PACKAGING: 9” x 50’ (.23 x 15.24 m) roll, 4 rolls per carton.

PROTECTION COURSE … Use for vertical and horizontal applications. Adhere with POINTING MASTIC or use mechanical fasteners.

PACKAGING: 4’ x 8’ (1.22 x 2.44 m) panels.

MEL-DRAIN … is a dimple-raised molded polystyrene fabric designed to provide high flow capacity to reduce hydrostatic pressure buildup around waterproofing and vaporproofing membranes. Choice of drain types are available for vertical, horizontal, and site applications. Use MEL-PRIME to condition surface prior to application of MEL-DRAIN.

TERMINATION BAR … is a high strength, pre-formed, multi-purpose, plastic strip designed to support vertical membrane systems and PROTECTION COURSE at their termination point.

PACKAGING: 10' (Holes every 6" o/c, 2" from either end), 25 pieces per carton.

MAINTAIN ENERGY EFFICIENCY

Wet insulating materials lose much of their “R” factor performance characteristics, reducing the energy efficiency of the structure. W. R. MEADOWS thermal and moisture protection products play a key role in *maintaining* the structure’s energy efficiency and aiding in the integrity of other structural systems, such as insulation.

LEED INFORMATION

May help contribute to LEED credits:

- EA Credit 1: Optimize Energy Performance
- IEQ Credit 3.1: Construction Indoor Air Quality

For CAD details, spec and data sheet, further LEED information, and MSDS, visit www.wrmeadows.com.

FSA'S REVIEW OF THIS DRAWING IS TO VERIFY CONFORMANCE WITH ONLY THE DESIGN CONCEPT OF THE PROJECT COMPARE WITH THE INFORMATION GIVEN IN THE CONTRACT DOCUMENTS. THE CONSTRUCTION MANAGER ("CM") IS RESPONSIBLE FOR THE FOLLOWING: DIMENSIONS (TO BE CONFIRMED AND COMPLETED AT THE JOB SITE); QUANTITIES OF MATERIALS; SCHEDULING OF CONSTRUCTION; CHECKING OF ALL FIELD CONDITIONS; INFORMATION THAT PERTAINS SOLELY TO THE FABRICATION PROCESS AND/OR TO THE TECHNIQUES OF CONSTRUCTION AND FOR THE COORDINATION, CONTROL AND SUPERVISION OF THE WORK OF ALL TRADES. THIS REVIEW SHALL NOT RELIEVE THE CM FROM RESPONSIBILITY FOR DEVIATIONS FROM DRAWINGS, SPECIFICATIONS OR ERRORS IN SHOP DRAWINGS OR SCHEDULES.

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☒ SUBMIT MISSING INFORMATION

FSA
FRANKSETH & ASSOCIATES, LLC

BY: A. Berlinger DATE: 02.12.20

LIMITED WARRANTY

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

Disclaimer

FSA General Review Comments
This submittal is subject to architect/geotechnical consultant review and acceptance.
Reviewed as single component of a complete foundation waterproofing assembly.
Install in full compliance with manufacturer’s instructions and details.
Product data is acceptable, but installation shall not commence without submission/approval of **project-specific shop drawings** (showing location for product application and details at substrate joints/cracks, intersection of horizontal/vertical surfaces, inside/outside corners, terminations/penetrations in membrane system), test reports/certifications,warranty.

with the use of this product, it is recom information is valid owner for the desig suitability of produ

PRODUCT DATA

07-10-00-9 Waterproofing - Slab

For Review
02/04/2020 4:32:11 PM

MasterFormat: 07 13 00

W. R. MEADOWS SEALTIGHT

NO. 714-F

SEPTEMBER 2017
(Supersedes January 2016)

PRECON®

Pre-Applied/Underslab Waterproofing Membrane

DESCRIPTION

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

USES

PRECON is used as a blindside membrane in vertical applications where access to the positive side is limited. The membrane can also be used for horizontal applications for underslab waterproofing and vaporproofing.

FEATURES/BENEFITS

- Provides a waterproof seal between the membrane and poured concrete wall.
- Helps prevent moisture migration into the structure.
- Reduces methane and radon gas intrusion.

PACKAGING

4' (1.2 m) wide x 50' (15.2 m) long rolls, one roll per carton.

STORAGE AND HANDLING

Store membrane cartons on pallets and cover if left outside. Keep materials away from sparks and flames.

SPECIFICATIONS

- ASTM E1993-98 - Standard Specification for Bituminous Water Vapor Retarders used in Contact with Soil or Granular Fill under Concrete Slabs.
- LARR Report 26023

APPLICATION

Surface Preparation ... Inspect all surfaces for any conditions detrimental to the proper completion of the work. Surfaces should be structurally sound. Remove debris or any other foreign material that could damage the membrane.

PRECON can be used with a caisson wall shoring system without the use of a drainage board, such as MEL-DRAIN™ from W. R. MEADOWS. W. R. MEADOWS recommends proper site drainage, but due to certain site conditions this sometimes cannot be done effectively. The decision to remove the drainage board should be at the discretion of the engineer. In situations where a drainage board is not applied, surface preparation is important. The substrate needs to be sound, solid, and smooth. Any gaps or voids >1" (25 mm) need to be grouted. When PRECON is used with MEL-DRAIN from W. R. MEADOWS, the system can bridge gaps <2" (50.8 mm). However, gaps >2" (50.8 mm) will need to be grouted.

CONTINUED ON REVERSE SIDE...

W. R. MEADOWS, INC.
P.O. Box 338 • HAMPSHIRE, IL 60140-0338
Phone: 847/214-2100 • Fax: 847/683-4544
1-800-342-5976
www.wrmeadows.com

Application Method … PRECON may be applied at temperatures down to 40° F (5° C); however, in less than ideal environments or marginal conditions, consider the use of PRECON LOW TEMP below 60° F (16° C). PRECON LOW TEMP can be used in temperatures down to 25° F (-4° C). MEL-PRIME™ from W. R. MEADOWS should be used to enhance the bond at the selvedge edge when conditions warrant with both PRECON and PRECON LOW TEMP.

Prior to application of the blindside membrane, attach MEL-DRAIN™ rolled matrix drainage system from W. R. MEADOWS to lagging or soil retention system.

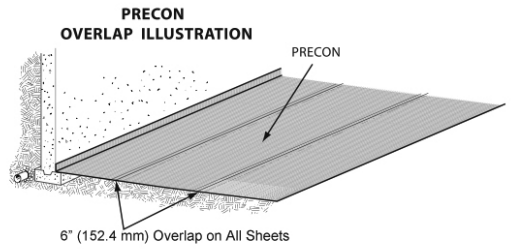
In vertical applications of PRECON, mechanically attach with fasteners every 12" (304.8 mm) across the top, within ½" (13 mm) of the top edge of the membrane. Install the membrane with the fabric side facing toward the concrete pour.

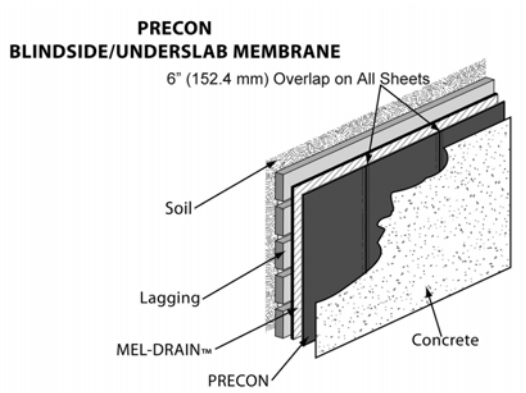
Remove release paper on 6" (152.4 mm) overlap. Apply membrane and roll press into place with a tile type roller.

End Laps … Overlap membrane 6" (152.4 mm). Prior to overlap, apply BEM, HYDRALASTIC 836, or MEL-ROL® LIQUID MEMBRANE (two-component) from W. R. MEADOWS in area to be lapped. Roll press membrane into BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE. At terminations of membrane, apply BEM, HYDRALASTIC 836, or MEL-ROL LIQUID MEMBRANE 12" (304.8 mm) wide centered over the termination and while still wet, embed 12" (31 cm) wide DETAIL FABRIC into the HYDRALASTIC 836 or MEL-ROL LIQUID MEMBRANE and roll press into place. Ensure that DETAIL FABRIC is centered over the termination with 6" (152.4 mm) on each side of lap edge. Apply additional HYDRALASTIC 836 on all terminations of DETAIL FABRIC.

Penetrations and Protrusions … Detail around all horizontal and vertical penetrations using BEM or MEL-ROL LIQUID MEMBRANE (two-component) from W. R. MEADOWS. Apply BEM or MEL-ROL LIQUID MEMBRANE by forming a fillet around the pipe or protrusion, overlapping the fabric side of PRECON and the protrusion a minimum of 2.5" (64 mm). If the gap between the protrusion and the membrane is greater than ½" (13 mm), apply PRECON FABRIC TAPE over uncured BEM or MEL-ROL LIQUID MEMBRANE. All penetration and protrusion surfaces must be clean, rust-free, and sound prior to application of BEM or MEL-ROL LIQUID MEMBRANE.

*MEL-ROL LIQUID MEMBRANE is a two-component material, not to be confused with MEL-ROL LM.





For horizontal applications involving a cluster of penetrations, consider the use of HYDRALASTIC 836. Prior to application of HYDRALASTIC 836, prepare the surfaces of the penetrations as above and provide a block out using 2' x 4' (.6 x 1.2 m) lumber or other in order to create a "pitch pan" area to receive HYDRALASTIC 836.

Patching ... Prior to pouring, inspect membrane for punctures or damage and repair as necessary with HYDRALASTIC 836 and/or DETAIL FABRIC. (BEM or MEL-ROL LIQUID MEMBRANE may be used in place of HYDRALASTIC 836.) In addition, ensure the membrane is free of standing water and has been cleaned of any deleterious materials that will affect the bond of the concrete to the membrane.

Underslab Application … Refer to ACI 302.1R-04: Chapter 4 – Site Preparation and Placing Environment for sub-grade preparation prior to PRECON placement.

PRECAUTIONS

Concrete should be poured within 60 days of membrane installation. For installations below 40° F (4° C), contact W. R. MEADOWS technical services. When using bar supports, use those with a flat bottom.

LEED INFORMATION

May help contribute to LEED credits:

- EA Credit 1: Optimize Energy Performance
- EAp2: Minimum Energy Performance
- EAc2: Optimize Energy Performance
- MRc9: Construction and Demolition Waste Management

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

TECHNICAL DATA

Property	Test Method	PRECON Results
Color		Black
Thickness	ASTM D1000	73 mil (1.85 mm)
Low Temp Flexibility	ASTM D1970, 180° @ -20° F (-28.9° C)	Pass
Resistance to Hydrostatic Head	ASTM D5385-93	230’ (70 m)
Elongation, Polymeric Membrane	ASTM D412-06	> 400%
Tensile Strength, Film	ASTM D882	9200 psi (63.4 MPa)
Crack Cycling	ASTM C836 @ -15° F (-26° C)	Pass
Puncture Resistance	ASTME 154	> 210 lb. (> 934 N)
Peel Adhesion to Concrete	ASTMD 903	10 lb./in (1754 N/m)
Moisture Vapor Transmission	ASTME 96B	0.0011 perms (0.0004 grains/ft.^{2}/hr) (0.007 gram/m^2/24 hr)
Resistance to Fungi in Soil	GSA-PBS 07115 – 16 Weeks	No Effect
Radon Transmittance (m/s)	k124/02/95	<3.0 x 10^{-9}
Radon Coefficient (m2/s)	k124/02/95	<5.6 x 10^{-12}

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BUILDING ENVELOPE CONSULTANTS

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- [ ] NOT REVIEWED
- [x] SUBMIT MISSING INFORMATION

BY: A. Berlinger DATE: 02.12.20

- [ ] FURNISH AS SUBMITTED
- [x] FURNISH AS CORRECTED
- [ ] REVISE AND RESUBMIT
- [ ] REVIEWED

DATE 3/25/2020
CHECKED BY FRA

SUBJECT TO CONTRACT PLANS AND SPECIFICATIONS FOR THIS WORK EXCEPT AS TO FIGURE DIMENSIONS

AUFGANG ARCHITECTS

The Architect's approval is only for conformance with the design concept of the work and the information given in the Contract Documents. The Architect's approval of a specific item shall not indicate approval of any assembly of which the item is a component.

FSA General Review Comments
This submittal is subject to architect/geotechnical consultant review and acceptance.
Reviewed as single component of a complete foundation waterproofing assembly.
Install in full compliance with manufacturer’s instructions and details.
Product data is acceptable, but installation shall not commence without submission/approval of **project-specific shop drawings** (showing location for product application and details at substrate joints/cracks, intersection of horizontal/vertical surfaces, inside/outside corners, terminations/penetrations in membrane system), test reports/certifications,warranty.

LIMITED WARRANTY

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

Disclaimer

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

STEGO® DATA

STEGO® TAPE

A STEGO INDUSTRIES, LLC INNOVATION | VAPOR RETARDERS 07 26 00, 03 30 00 | VERSION: JULY 20, 2018

1. PRODUCT NAME

STEGO TAPE

2. MANUFACTURER

Stego Industries, LLC
216 Avenida Fabricante, Suite 101
San Clemente, CA 92672
Sales, Technical Assistance
Ph: (877) 464-7834
contact@stegoindustries.com
www.stegoindustries.com

3. PRODUCT DESCRIPTION

USES: Stego Tape is a low-permeance tape designed for protective sealing, hanging, seaming, splicing, and patching applications where a highly conformable material is required. It has been engineered to bond specifically to Stego® Wrap, making it ideal for sealing Stego Wrap seams and penetrations.

COMPOSITION: Stego Tape is composed of polyethylene film and an acrylic, pressure-sensitive adhesive.

SIZE: Stego Tape is 3.75" x 180'. Stego Tape ships 12 rolls in a case.

4. TECHNICAL DATA

APPLICABLE STANDARDS:
Pressure Sensitive Tape Council (PSTC)

- PSTC 101 – International Standard for Peel Adhesion of Pressure-Sensitive Tape

American Society for Testing & Materials (ASTM)

- ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs

TABLE 4.1: PHYSICAL PROPERTIES OF STEGO TAPE

PROPERTY	RESULTS
Dimensions	3.75" x 180'
Total Thickness	6 mil
Permeance	0.03 perms
Tensile Strength	17 lb/in
Elongation (at break) MD	1060%
Adhesion (20 min dwell ss, PSTC 101)	84 oz/in
Ultraviolet Resistance	Excellent

Note: perm unit = grains/(ft²*hr*in-Hg)

Continued...
Note - legal notice on page 2.

STEGO® TAPE

A STEGO INDUSTRIES, LLC INNOVATION | VAPOR RETARDERS 07 26 00, 03 30 00 | VERSION: JULY 20, 2018

5. INSTALLATION

SEAMS: Overlap Stego Wrap 6 inches and seal with Stego Tape. Make sure the area of adhesion is free from dust, dirt, moisture and frost to allow maximum adhesion of the pressure sensitive tape.

PIPE PENETRATION SEALING
1) Install Stego Wrap around pipe by slitting/cutting material
2) If void space around pipe is minimal, seal around base of pipe with Stego Tape (Stego® Mastic can be used for additional coverage)

DETAIL PATCH FOR PIPE PENETRATION SEALING
1) Cut a piece of Stego Wrap that creates a 6 inch overlap around all edges of the void space
2) Cut an "X" in the center of the detail patch
3) Slide detail patch over pipe, secure tightly
4) Tape down all sides of detail patch with Stego Tape
5) Seal around base of pipe with Stego Tape (Stego Mastic can be used for additional coverage)

Stego Tape should be installed above 40°F. In temperatures below 40°F take extra care to remove moisture or frost from the area of adhesion.

For additional information, please refer to Stego's complete installation instructions.

6. AVAILABILITY & COST

Stego Tape is available through our network of building supply distributors. For current cost information, contact your local Stego distributor or Stego Industries' Sales Representative.

7. WARRANTY

Stego Industries, LLC believes to the best of its knowledge, that specifications and recommendations herein are accurate and reliable. However, since site conditions are not within its control, Stego Industries does not guarantee results from the use of the information provided herein. Stego Industries, LLC does offer a limited warranty on Stego Wrap. Please see www.stegoindustries.com/legal.

8. MAINTENANCE

None required.

9. TECHNICAL SERVICES

Technical advice, custom CAD drawings, and additional information can be obtained by contacting Stego Industries or by visiting the website.

Email: contact@stegoindustries.com
Contact Number: (877) 464-7834
Website: www.stegoindustries.com

10. FILING SYSTEMS

- www.stegoindustries.com

STEGO® DATA

STEGO® CRETE CLAW® TAPE (6" wide)

A STEGO INDUSTRIES, LLC INNOVATION | VAPOR RETARDERS 07 26 00, 03 30 00 | VERSION: JULY 20, 2018

1. PRODUCT NAME

STEGO CRETE CLAW TAPE (6" wide)

2. MANUFACTURER

Stego Industries, LLC
216 Avenida Fabricante, Suite 101
San Clemente, CA 92672
Sales, Technical Assistance
Ph: (877) 464-7834
contact@stegoindustries.com
www.stegoindustries.com

3. PRODUCT DESCRIPTION

USES: Stego Crete Claw Tape is a multi-layered tape that is used to seal Stego® Wrap Vapor Barrier to the perimeter of the slab while the concrete is placed. Stego Crete Claw Tape allows wet concrete to cast into the textured top surface to form a mechanical bond/seal.

COMPOSITION: Stego Crete Claw Tape is composed of polyethylene film, aperture film, and an acrylic, pressure-sensitive adhesive.

SIZE: Stego Crete Claw Tape is 6" x 180'. Stego Crete Claw Tape (6" wide) ships 8 rolls in a case.

4. TECHNICAL DATA

TABLE 4.1: PHYSICAL PROPERTIES OF STEGO CRETE CLAW TAPE (6" wide)

PROPERTY	RESULTS
Dimensions	6" x 180'
Total Thickness	26 mil
Permeance: ASTM F1249	0.03 perms
180° Adhesion Peel Strength: ASTM D903	17.6 lbf/in
Sheer Adhesion Strength: 1 in^2 shear test using an Instron 3345 Machine	>49 lbf/in^2*

* Specimens failed by stretching vapor barrier to failure before pulling Stego Crete Claw Tape from concrete.
Note: perm unit = grains/(ft^2*hr*in-Hg)

5. INSTALLATION

SECURING STEGO WRAP TO SLAB: Clean surface of Stego Wrap to ensure that it is free of moisture, frost, dirt, and debris prior to the installation of Stego Crete Claw Tape. When ready to apply Stego Crete Claw Tape, peel back the release liner and apply to Stego Wrap. Stego Crete Claw Tape should be completely on Stego Wrap.

To detail, cut Stego Crete Claw Tape with a box knife or scissors. Stego Crete Claw Tape should be installed above 40°F for maximum adhesion. For additional information please refer to Stego's complete installation instructions.

TIP: Wrap the release liner back over the entire roll while unrolling Stego Crete Claw Tape. This technique will allow the release liner to pull off easily and keep it out of the way.

Continued...
Note - legal notice on page 2

STEGO® CRETE CLAW® TAPE (6" wide)

A STEGO INDUSTRIES, LLC INNOVATION | VAPOR RETARDERS 07 26 00, 03 30 00 | VERSION: JULY 20, 2018

6. AVAILABILITY & COST

Stego Crete Claw Tape is available through our network of building supply distributors. For current cost information, contact your local Stego distributor or Stego Industries' Sales Representative.

7. WARRANTY

Stego Industries, LLC believes to the best of its knowledge, that specifications and recommendations herein are accurate and reliable. However, since site conditions are not within its control, Stego Industries does not guarantee results from the use of the information provided herein. Stego Industries, LLC does offer a limited warranty on Stego Wrap. Please see www.stegoindustries.com/legal.

8. MAINTENANCE

Store Stego Crete Claw Tape in a dry and temperate area.

9. TECHNICAL SERVICES

Technical advice, custom CAD drawings, and additional information can be obtained by contacting Stego Industries or by visiting the website.

Email: contact@stegoindustries.com
Contact Number: (877) 464-7834
Website: www.stegoindustries.com

10. FILING SYSTEMS

- www.stegoindustries.com

STEGO® WRAP VAPOR BARRIER/RETARDER INSTALLATION INSTRUCTIONS

IMPORTANT: Please read these installation instructions completely, prior to beginning any Stego Wrap installation. The following installation instructions are based on ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs. If project specifications call for compliance with ASTM E1643, then be sure to review the specific installation sections outlined in the standard along with the techniques referenced in these instructions.

UNDER-SLAB INSTRUCTIONS:

FIGURE 1: UNDER-SLAB INSTALLATION

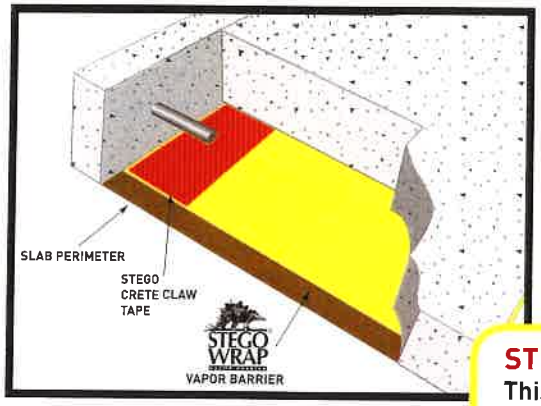
1. Stego Wrap can be installed over an aggregate, sand, or tamped earth base. It is not necessary to have a cushion layer or sand base, as Stego Wrap is tough enough to withstand rugged construction environments.

2. Unroll Stego Wrap over the area where the slab is to be placed. Stego Wrap should completely cover the concrete placement area. All joints/seams both lateral and butt should be overlapped a minimum of 6" and taped using Stego® Tape.

   NOTE: The area of adhesion should be free from dust, dirt, moisture, and frost to allow maximum adhesion of the pressure-sensitive tape.

3. ASTM E1643 requires sealing the perimeter of the slab. *Extend vapor retarder over footings and seal to foundation wall, grade beam, or slab at an elevation consistent with the top of the slab or terminate at impediments such as waterstops or dowels.* Consult the structural engineer of record before proceeding.

FIGURE 2a: SEAL TO SLAB AT PERIMETER



SEAL TO SLAB AT PERIMETER:*

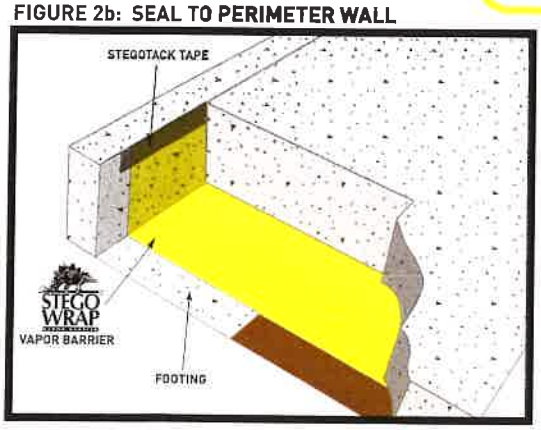
NOTE: Clean the surface of Stego Wrap to ensure that the area of adhesion is free from dust, dirt, moisture, and frost to allow maximum adhesion of the pressure-sensitive adhesive.

a. Install Stego® Crete Claw® Tape on the entire perimeter edge of Stego Wrap.

b. Prior to the placement of concrete, ensure that the top of Stego Crete Claw Tape is free of dirt, debris, or mud to maximize the bond to the concrete.

STEGO LABOR SAVER!
This method not only complies with ASTM E1643, but it also:
- **reduces labor compared to other perimeter sealing techniques.**
- **can be used even without an existing wall or footing, unlike alternatives.**

FIGURE 2b: SEAL TO PERIMETER WALL



OR **SEAL TO PERIMETER WALL WITH STEGOTACK® TAPE:***

a. Make sure area of adhesion is free of dust, dirt, debris, moisture, and frost to allow maximum adhesion.

b. Remove release liner on one side and stick to desired surface.

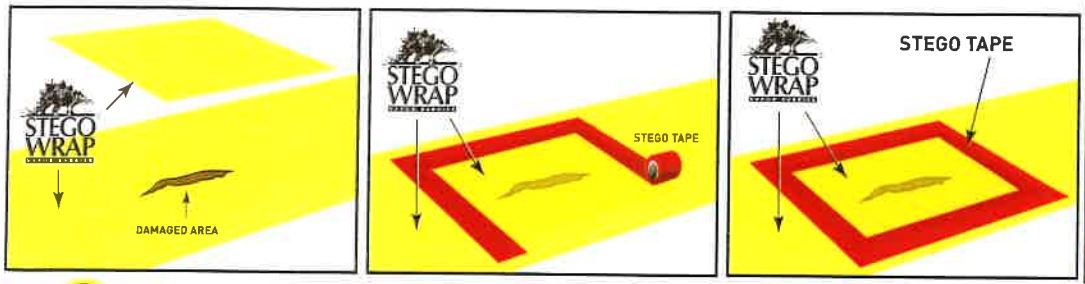
c. When ready to apply Stego Wrap, remove the exposed release liner and press Stego Wrap firmly against StegoTack Tape to secure.

* If ASTM E1643 is specified, consult with project architect and structural engineer to determine which perimeter seal technique should be employed for the project.

Continued...
Note - legal notice on page 2.

4. In the event that Stego Wrap is damaged during or after installation, repairs must be made. For holes, cut a piece of Stego Wrap to a size and shape that covers any damage by a minimum overlap of 6" in all directions. Clean all adhesion areas of dust, dirt, moisture, and frost. Tape down all edges using Stego Tape **(See Figure 3)**.

FIGURE 3: SEALING DAMAGED AREAS



NOTE: Stego Industries recommends the use of vapor barrier-safe concrete accessories, like Beast® Screed, to help minimize the amount of penetrations in a Stego Wrap Installation.

5. **IMPORTANT: ALL PENETRATIONS MUST BE SEALED.** All pipe, ducting, rebar, wire penetrations and block outs should be sealed using Stego Wrap, Stego Tape and/or Stego Mastic **(See Figure 4a)**. If penetrations are encased in other materials, such as expansive materials like foam, unless otherwise specified, Stego Wrap should be sealed to the underlying penetration directly.

FIGURE 4a: PIPE PENETRATION SEALING

STEGO WRAP PIPE PENETRATION REPAIR DETAIL:

1: Install Stego Wrap around pipe penetrations by slitting/cutting material as needed. Try to minimize the void space created.

2: If Stego Wrap is close to pipe and void space is minimized then seal around pipe penetration with Stego Tape and/or Stego Mastic. **(See Figure 4a)**

3: If detail patch is needed to minimize void space around penetration, then cut a detail patch to a size and shape that creates a 6" overlap on all edges around the void space at the base of the pipe. Stego Pre-Cut Pipe Boots are also available to speed up the installation.

4: Cut an "X" the size of the pipe diameter in the center of the pipe boot and slide tightly over pipe.

5: Tape down all sides of the pipe boot with Stego Tape.

6: Seal around the base of the pipe using Stego Tape and/or Stego Mastic. **(See Figure 4b)**

FIGURE 4b: DETAIL PATCH FOR PIPE PENETRATION SEALING

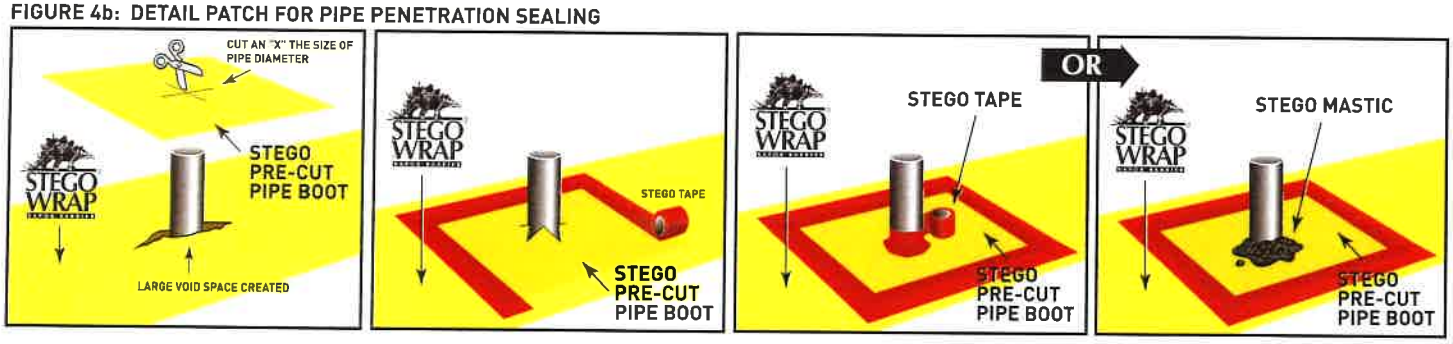
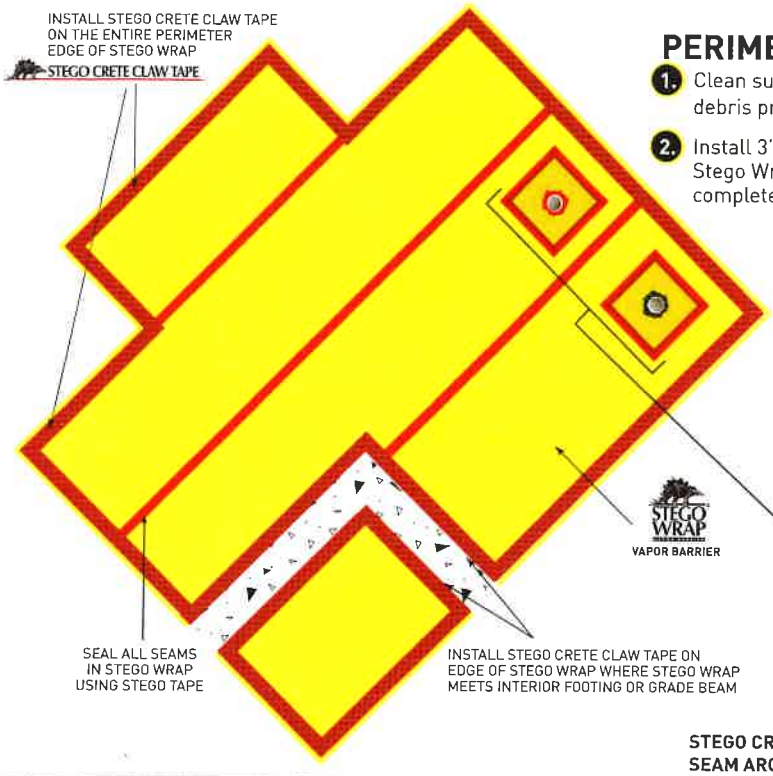


FIGURE 5: MULTIPLE PIPE PENETRATION SEALING

MULTIPLE PIPE PENETRATION SEALING:
Multiple pipe penetrations in close proximity and very small pipes may be sealed using Stego Wrap and Stego Mastic for ease of installation **(See Figure 5)**.

NOTE: Stego Industries, LLC's ("Stego") installation instructions are based on ASTM E1643 - *Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs*. These instructions are meant to be used as a guide, and do not take into account specific job site situations. Consult local building codes and regulations along with the building owner or owner's representative before proceeding. If you have any questions regarding the above mentioned installation instructions or Stego products, please call us at 877-464-7834 for technical assistance. While Stego employees and representatives may provide technical assistance regarding the utility of a specific installation practice or Stego product, they are not authorized to make final design decisions.

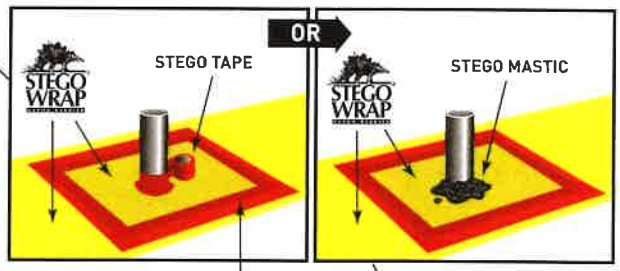
STEGO® CRETE CLAW® TAPE INSTALLATION INSTRUCTIONS



PERIMETER SEAL TO SLAB

1. Clean surface of Stego Wrap to ensure that it is free of moisture and debris prior to the installation of Stego Crete Claw Tape.
2. Install 3" or 6" Stego Crete Claw Tape on the entire perimeter of the Stego Wrap installation. Stego Crete Claw Tape should be completely on Stego Wrap.

SEAL ALL PENETRATIONS WITH STEGO TAPE AND/OR STEGO MASTIC. STEGO CRETE CLAW TAPE IS NOT MEANT FOR REPAIRING PENETRATIONS.



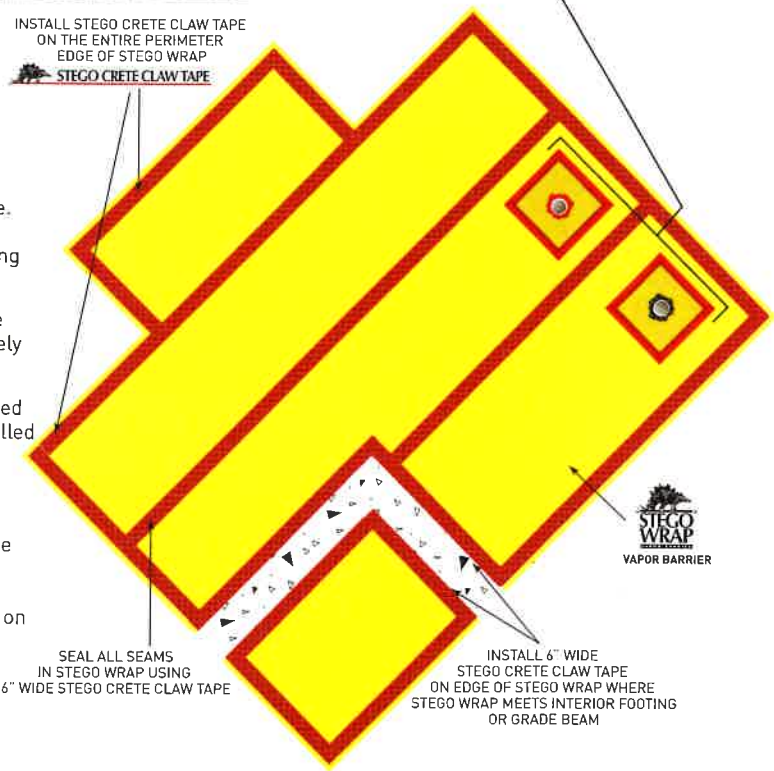
STEGO CRETE CLAW TAPE CAN BE USED TO SEAL SEAM AROUND DETAIL PATCH FOR ADDED PROTECTION.

SECURING STEGO WRAP TO THE BOTTOM OF THE SLAB

1. Clean surface of Stego Wrap to ensure that it is free of moisture and debris prior to the installation of 6" wide Stego Crete Claw Tape.
2. Overlap seams a minimum of 6". Seal all seams in Stego Wrap using Stego Crete Claw Tape.
3. Install 6" wide Stego Crete Claw Tape on the entire perimeter of the Stego Wrap Installation. Stego Crete Claw Tape should be completely on Stego Wrap.
4. Install additional Stego Crete Claw Tape if required. Lab and simulated field tests have shown that if 6" wide Stego Crete Claw Tape is installed on all seams and around the perimeter, then it is more than strong enough to support Stego Wrap. If determined by the architect or engineer, additional Stego Crete Claw Tape may be specified.
5. Prior to the placement of concrete, ensure that Stego Crete Claw Tape is free of dirt or debris to ensure maximum bond to the concrete.

These are general instructions. Installation requirements may change on a project-by-project basis.

IMPORTANT - For the application of securing Stego Wrap to the bottom of the slab, always use 6" wide Stego Crete Claw Tape.



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STEGO INDUSTRIES, LLC • SAN CLEMENTE, CA 92672 • 949-257-4100 • 877-464-7834

www.stegoindustries.com