

64 NORTH 8TH STREET

BROOKLYN, NEW YORK

Remedial Action Work Plan

NYC VCP Project Number 20CVCP038K

OER Project Number 19EHAZ311K

Prepared For:

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LIST OF ACRONYMS

| Acronym | Definition |
|-------------|---|
| AOC | Area of Concern |
| AS/SVE | Air Sparging/Soil Vapor Extraction |
| BOA | Brownfield Opportunity Area |
| CAMP | Community Air Monitoring Plan |
| C&D | Construction and Demolition |
| CEQR | City Environmental Quality Review |
| CFR | Code of Federal Regulations |
| CHASP | Construction Health and Safety Plan |
| COC | Certificate of Completion |
| CQAP | Construction Quality Assurance Plan |
| CSOP | Contractors Site Operation Plan |
| DCR | Declaration of Covenants and Restrictions |
| ECs/ICs | Engineering Controls and Institutional Controls |
| ELAP | Environmental Laboratory Accreditation Program |
| HASP | Health and Safety Plan |
| HAZWOPER | Hazardous Waste Operations Emergency Response |
| IRM | Interim Remedial Measure |
| MNA | Monitored Natural Attenuation |
| NOC | Notice of Completion |
| NYS DEC | New York State Department of Environmental Conservation |
| NYC DEP | New York City Department of Environmental Protection |
| NYC DOHMH | New York State Department of Health and Mental Hygiene |
| NYC OER | New York City Office of Environmental Remediation |
| NYC VCP | New York City Voluntary Cleanup Program |
| NYCRR | New York Codes Rules and Regulations |
| NYS DEC | New York State Department of Environmental Conservation |
| NYS DEC DER | New York State Department of Environmental Conservation Division of |

| | |
|---------|---|
| | Environmental Remediation |
| NYS DOH | New York State Department of Health |
| NYS DOT | New York State Department of Transportation |
| ORC | Oxygen-Release Compound |
| OSHA | United States Occupational Health and Safety Administration |
| PCBs | Polychlorinated Biphenyls |
| PE | Professional Engineer |
| PID | Photo Ionization Detector |
| QEP | Qualified Environmental Professional |
| QHHEA | Qualitative Human Health Exposure Assessment |
| RAOs | Remedial Action Objectives |
| RAR | Remedial Action Report |
| RAWP | Remedial Action Work Plan or Plan |
| RCA | Recycled Concrete Aggregate |
| RD | Remedial Design |
| RI | Remedial Investigation |
| RMZ | Residual Management Zone |
| SCOs | Soil Cleanup Objectives |
| SCG | Standards, Criteria and Guidance |
| SMP | Site Management Plan |
| SPDES | State Pollutant Discharge Elimination System |
| SSDS | Sub-Slab Depressurization System |
| SVOC | Semi-Volatile Organic Compound |
| TAL | Target Analyte List |
| TCL | Target Compound List |
| USGS | United States Geological Survey |
| UST | Underground Storage Tank |
| VCA | Voluntary Cleanup Agreement |
| VOC | Volatile Organic Compound |

CERTIFICATION

I, Tarek Z. Khouri, P.E, am currently a registered professional engineer licensed by the State of New York. I performed professional engineering services and had primary direct responsibility for designing the remedial program for the 64 North 8th Street, Brooklyn, NY site, site number 20CVCP038K. I certify to the following:

- I have reviewed this document and the Stipulation List, to which my signature and seal are affixed.
- Engineering Controls developed for this remedial action were designed by me or a person under my direct supervision and designed to achieve the goals established in this Remedial Action Work Plan for this site.
- The Engineering Controls to be constructed during this remedial action are accurately reflected in the text and drawings of the Remedial Action Work Plan and are of sufficient detail to enable proper construction.
- This Remedial Action Work Plan (RAWP) has a plan for handling, transport and disposal of soil, fill, fluids and other materials removed from the property in accordance with applicable City, State and Federal laws and regulations. Importation of all soil/fill and other material from off-Site will be in accordance with all applicable City, State and Federal laws and requirements. This RAWP has provisions to control nuisances during the remediation and all invasive work, including dust and odor suppression.

Name: Tarek Z. Khouri

PE License Number: 086611

Signature

Date 2020-02-05



I, Mark E. Robbins, am a qualified Environmental Professional. I will have primary direct responsibility for implementation of the remedial program for the 64 North 8th Street, Brooklyn, NY site, site number 20CVCP038K. I certify to the following:

- This Remedial Action Work Plan (RAWP) has a plan for handling, transport and disposal of soil, fill, fluids and other materials removed from the property in accordance with applicable City, State and Federal laws and regulations. Importation of all soil/fill and other material from off-Site will be in accordance with all applicable City, State and Federal laws and requirements. This RAWP has provisions to control nuisances during the remediation and all invasive work, including dust and odor suppression.

QEP Name: Mark E. Robbins

QEP Signature

Date 2020-02-05

EXECUTIVE SUMMARY

Bill Lika is working with the NYC Office of Environmental Remediation (OER) in the New York City Voluntary Cleanup Program to investigate and remediate a 2,500-square foot site located at 64 North 8th Street in Brooklyn, New York. A remedial investigation (RI) was performed to compile and evaluate data and information necessary to develop this Remedial Action Work Plan (RAWP). The remedial action described in this document provides for the protection of public health and the environment consistent with the intended property use, complies with applicable environmental standards, criteria and guidance and conforms with applicable laws and regulations.

Site Location and Background

The Site is located at 64 North 8th Street in the Williamsburg section in Brooklyn, New York and is identified as Block 2317 and Lot 12 on the New York City Tax Map. The Site is 2,500-square feet and is bounded by North 8th Street and a 6-story mixed residential and commercial building to the north, 7-story residential building to the south, 5-story residential (under construction - OER project # 12EHAZ451K) to the east, and 3-story mixed residential and commercial to the west. Currently, the Site is partially occupied by a vacant 2-story residential building in the southern portion of the property. The remaining portion of the property consists of brick walkway and landscaped area.

Summary of Redevelopment Plan

The proposed future use of the Site will consist of a 4-story walk-up residential building with a full basement covering approximately 52.5% of the site and a front yard and a rear yard covering the remaining 47.5% of the site. There will be 5 dwelling units. The basement will be utilized as sprinkler and boiler room, meter room, storage space, egress stairs and accessory use for the 2-level apartment on 1st floor. The 1st floor will consist of the garage, lobby, egress stairs and the upper level of the 2-level apartment. There will be 1 apartment on each floor from the 2nd through the 4th floor. A front yard will be located in the northern portion of the Site. Approximately 30% of the front yard might be partially utilized as landscaped area but will be further determined during the construction. The building will be approximately 50 feet high. A

rear yard will be located in the southern portion of the Site. The current zoning designation is M1-2/R6B. The proposed use is consistent with existing zoning for the property.

The excavation for the foundation of the new building will be performed to approximately 10 feet below sidewalk grade and to approximately 2 feet below sidewalk grade in the rear yard area. The total amount of soil to be removed from the site will be approximately 600 cubic yards. Approximately 85 cubic yards of clean stone will be required in the front and rear yard. After the construction, the rear yard will be capped with clean stone and the front yard will be capped with clean stone and concrete slab. If part of the front yard will be developed as landscaped area, the clean stone and concrete slab in this portion will be replaced with clean soil and plant.

Groundwater was not encountered during this RI. The water table is expected between 19.37 feet and 23.57 feet below sidewalk grade based upon the investigation results from the eastern adjacent property at 66 North 8th Street. Thus, groundwater is not anticipated to be encountered during the proposed excavation.

Summary of Surrounding Property

The Site is located in a residential and commercial neighborhood. North 8th Street and a 6-story mixed residential and commercial building are located to the north of the Site; a 7-story residential building is located to the south of the Site; Jerome Street and a 3-story mixed residential and commercial building is located to the west of the Site; and a 5-story residential building (under construction) is located to the east of the Site.

Within a 500 feet radius of the Site, there are a variety of land uses including residential (multi-family residential, 1&2 family residential), mixed use, commercial, institutional, transportation/utilities, green spaces, parking and industrial. Properties located within a 1/4-mile radius of the Site are zoned R6B (general residential district), M1-2/R6A and MX-8. There is no sensitive receptor located within a 250-foot radius of the Site.

Summary of Past Site Uses and Areas of Concern

Based upon the review of the Phase I Environmental Site Assessment (ESA) report prepared by HydroTech in June 2019, a site history was established. According to the Sanborn Maps and regulatory agency documents, it appears that the Subject Property was partially developed with the existing 2-story building prior to 1900s for residential use. A 1-story shed was constructed in

the mid-eastern portion and was removed at some time prior to 2019. The Site was partially operated by Hi Gloss Chemical Company during 1928.

The AOCs identified for this site include:

1. The historic use of the Subject Property for chemical manufacturing in 1928;
2. The presence of VCP site with ongoing remediation at the eastern adjacent property;
3. The presence of PVEC related to the eastern adjacent VCP site.
4. The presence of suspect lead-based peeling paint.

Summary of Work Performed under the Remedial Investigation

HydroTech performed the following scope of work:

1. Conducted a Site inspection to identify AOCs and physical obstructions (i.e. structures, buildings, etc.);
2. Performed Ground-Penetration Radar (GPR) Survey to find any anomaly and clear out all the sampling locations;
3. Installed three (3) soil borings across the entire project Site, and collected six (6) soil samples for chemical analysis from the soil borings to evaluate soil quality;
4. Installed two (2) temporary monitoring wells in the front yard to depths of 14 feet and 18 feet below sidewalk grade to establish groundwater flow; however, no groundwater could be recovered for chemical analysis to evaluate groundwater quality;
5. Installed two (2) soil vapor probes around Site perimeter and one (1) sub-slab vapor probe and collected three (3) vapor samples for chemical analysis.

Summary of Findings of Remedial Investigation

1. The elevation of the Subject Property is approximately 21 feet above mean sea level (USGS 7 ½-Minute Brooklyn, New York Quadrangle, 2013). The surface elevation of the front yard is approximately 2-3 feet higher than the sidewalk grade and slightly increases to the south in the direction from the sidewalk toward the building. The elevation of the basement slab is approximately 4.5 feet below the ground surface of the front yard (approximately 1.5 feet below sidewalk grade). The topography of the surrounding property slight decreases from east to west along North 8th Street.

2. Groundwater was not encountered during this RI. Based upon the RI performed at the eastern adjacent property at 66 North 8th Street, depth to groundwater ranges from 19.37 to 23.57 feet below sidewalk grade.
3. Groundwater flow direction was not determined during this RI but was assumed to be from east to west beneath the Site.
4. Bedrock was not encountered during this RI. Drilling refusal was encountered at depths between 9 feet and 18 feet below sidewalk grade during the installation of soil probes and temporary groundwater monitoring wells.
5. There is at least 4 feet of silt layer underneath the basement slab. In the front yard, from the ground surface down to 2 to 6 feet, soil stratigraphy consists of topsoil mixed with stones. The topsoil is underlain by a 2-foot layer of soil mixed with historic fill material such as porcelains and bricks. Compacted sand with stones or silty/clayey sand was observed beneath the fill layer.
6. Soil/fill samples collected during the RI were compared to the NYSDEC Title 6 of the official New York Codes, Rules, and Regulations (NYCRR) Part 375 Unrestricted Use and Restricted Residential Soil Cleanup Objectives (UUSCOs and RRSCOs).

Investigation results indicated:

- a. Acetone was detected at a concentration of 0.072 milligrams per kilogram (mg/kg). No other VOCs were detected in any samples at concentrations exceeding their respective Unrestricted Use SCOs.
- b. SVOCs, commonly categorized as Polycyclic Aromatic Hydrocarbons (PAHs), were detected in the majority of the samples at concentrations less than their respective Unrestricted Use SCOs.
- c. No pesticides or PCBs were detected at concentrations exceeding their respective Method Detection Limits (MDLs).
- d. Metals including lead (max. 221 mg/kg) and mercury (max. 0.55 mg/kg) were detected at concentrations exceeding their respective Unrestricted Use SCOs; zinc was detected in one (1) shallow sample at a concentration of 142 mg/kg, which exceeds its respective Unrestricted Use SCO; chromium, trivalent was detected at a maximum concentration of 51.7 mg/kg, which exceeds its respective Unrestricted Use SCO.

- e. The presence of metals and PAHs in samples are commonly related to the presence of historic fill materials, which is consistent with the on-site soil screening results.
7. Groundwater samples were not collected during the RI.
 8. Soil vapor samples collected during the RI show low to moderate concentrations of petroleum related VOCs and low to moderate levels of chlorinated VOCs (CVOCs). The concentrations of total VOCs range from 107.4 $\mu\text{g}/\text{m}^3$ to 1,123.3 $\mu\text{g}/\text{m}^3$. Concentrations of petroleum related VOCs (BTEX) range from 3.6 $\mu\text{g}/\text{m}^3$ to 20.2 $\mu\text{g}/\text{m}^3$. CVOCs including chloroform (2.1 $\mu\text{g}/\text{m}^3$), dichlorodifluoromethane (Freon-12) (max. 580 $\mu\text{g}/\text{m}^3$), methylene chloride (max. 2.5 $\mu\text{g}/\text{m}^3$), tetrachloroethylene (PCE) (max. 2.4 $\mu\text{g}/\text{m}^3$), trichloroethylene (0.68 $\mu\text{g}/\text{m}^3$) and trichlorofluoromethane (Freon-11) (max. 400 $\mu\text{g}/\text{m}^3$) were detected individually or collectively in the sub-slab vapor/soil vapor samples. Based upon the comparison to NYSDOH Decision Matrices, no further action is recommended to address potential human exposure. The presence of Freon-11 and Freon-12 are typically attributed to the on-site usage and/or storage of refrigerant and aerosol spray. Based upon the Site history, the presence of these compounds underneath the building may be related to the historic refrigerator usage while the building was occupied.

Summary of the Remedial Action

The proposed remedial action achieves protection of public health and the environment for the intended use of the property. The proposed remedial action achieves all of the remedial action objectives established for the project and addresses applicable standards, criterion, and guidance; is effective in both the short-term and long-term and reduces mobility, toxicity and volume of contaminants; is cost effective and implementable; and uses standards methods that are well established in the industry.

The proposed remedial action will consist of:

1. Preparation of a Community Protection Statement and performance of all required NYC VCP Citizen Participation activities according to an approved Citizen Participation Plan.
2. Performance of a Community Air Monitoring Program for particulates and volatile organic carbon compounds.

3. Selection of NYSDEC Part 375 Restricted Residential (Track 2) Soil Cleanup Objectives (SCOs).
4. Site mobilization involving Site security setup, equipment mobilization, utility mark outs and marking & staking excavation areas.
5. Completion of a Waste Characterization Study prior to excavation activities. Waste characterization soil samples will be collected at a frequency dictated by disposal facility(s).
6. Excavation and removal of soil/fill exceeding Restricted Residential SCOs. The excavation will be performed to approximately 10 feet below sidewalk grade for the foundation of the new building and to approximately 2 feet below sidewalk grade in the proposed front and rear yard. The total amount of soil to be removed from the site will be approximately 600 cubic yards.
7. Screening of excavated soil/fill during intrusive work for indications of contamination by visual means, odor, and monitoring with a PID.
8. Management of excavated materials including temporarily stockpiling and segregating in accordance with defined material types and to prevent co-mingling of contaminated material and non-contaminated materials.
9. Removal of all UST's that are encountered during soil/fill removal actions. Registration of tanks and reporting of any petroleum spills associated with UST's and appropriate closure of these petroleum spills in compliance with applicable local, State and Federal laws and regulations.
10. Transportation and off-Site disposal of all soil/fill material at licensed or permitted facilities in accordance with applicable laws and regulations for handling, transport, and disposal, and this plan. Sampling and analysis of excavated media as required by disposal facilities.
11. Collection and analysis of three (3) end-point samples to determine the performance of the remedy with respect to attainment of Restricted Residential Use SCOs.
12. Demarcation of residual soil/fill is not required.
13. Dewatering is not anticipated during the excavation.
14. Import of approximately 85 cubic yards of clean stone to be used for backfilling in the front and rear yard in compliance with this plan and in accordance with applicable laws

and regulations. If it is confirmed during the construction that 30% of the front yard will be developed as landscape area, approximately 8 cubic yards of stone will be replaced by clean soil.

15. As part of new development, construction of an engineered composite cover over the entire footprint of the Site, comprised of 1) 2-foot clean stone on top of native soil in the rear yard; 2) 4-inch concrete basement slab; 3) 2-foot clean stone and 4-inch concrete slab in the front yard to prevent human exposure to residual soil/fill material. Approximately 30% of the front yard might be utilized as landscaped area but will be further determined during the construction. If confirmed, a 2-foot clean soil with plant will be placed in this portion instead of clean stone and concrete slab.
16. As part of new development, installation of a vapor barrier system consisting of vapor barrier beneath the building slab and inside of sub-grade foundation sidewalls to mitigate potential soil vapor migration into the building. The vapor barrier system will consist of a 20-mil Stego Wrap by Stego Industries and will be installed beneath the building's foundation slab and inside the foundation sidewalls up to grade. The vertical vapor barrier will be fully covered by sheetrock panel to prevent from being torn, penetrated or scratched after the building is occupied. The brand and model of the sheetrock panel is not determined and will be reported and reviewed during the construction. The vapor barrier system is an Engineering Control for the remedial action. The remedial engineer will certify in the RAR that the vapor barrier system was designed and properly installed to mitigate soil vapor migration into the building.
17. Performance of all activities required for the remedial action, including acquisition of required permits and attainment of pretreatment requirements, in compliance with applicable laws and regulations.
18. Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.
19. Submission of a RAR that describes the remedial activities, certifies that the remedial requirements have been achieved, defines the Site boundaries, lists any changes from this RAWP, and describes all Engineering and Institutional Controls to be implemented at the Site.

20. If Track 2 Restricted Residential Use SCOs are not achieved, submission of an approved Site Management Plan (SMP) in the Remedial Action Plan (RAR) for long-term management of residual contamination, including plans for operation, maintenance, monitoring, inspection and certification of Engineering and Institutional Controls and reporting at a specified frequency.
21. If Track 2 Restricted Residential Use SCOs are not achieved, the property will continue to be registered with an E-Designation at the NYC Buildings Department. Establishment of Engineering Controls and Institutional Controls in this RAWP and a requirement that management of these controls must be in compliance with an approved SMP. Institutional Controls will include prohibition of the following: (1) vegetable gardening and farming; (2) use of groundwater without treatment rendering it safe for the intended use; (3) disturbance of residual contaminated material unless it is conducted in accordance with the SMP; and (4) higher level of land usage without OER-approval.

COMMUNITY PROTECTION STATEMENT

The NYC Office of Environmental Remediation (OER) provides governmental oversight for the cleanup of contaminated property in NYC. This Remedial Action Work Plan (“cleanup plan”) describes the findings of prior environmental studies, shows the location of identified contamination at the site, and describes the plans to clean up the site to protect public health and the environment.

This cleanup plan provides a very high level of protection for neighboring communities and also includes many other elements that address common community concerns, such as community air monitoring, odor, dust and noise controls, hours of operation, good housekeeping and cleanliness, truck management and routing, and opportunities for community participation. The purpose of this Community Protection Statement is to explain these community protection measures in non-technical language to simplify community review.

Project Information:

- Site Address: 64 North 8th Street, Brooklyn, New York
- NYC Voluntary Cleanup Program Project Number: 20CVCP038K

Project Contacts:

- OER Project Manager: Noel Anderson, 212-788-8841
- Site Project Manager: Ruijie Xu, 631-229-7090
- Site Safety Officer: To be assigned by the general contractor after the start of the project
- Online Document Repository:

<https://a002-epic.nyc.gov/app/workspace/9343/docrepository>

Remedial Investigation and Cleanup Plan: Under the oversight of the NYC OER, a thorough study of this property (called a remedial investigation) has been performed to identify past property usage, to sample and test soils, groundwater and soil vapor, and to identify contaminant sources present on the property. The cleanup plan has been designed to address all contaminant sources that have been identified during the study of this property.

Identification of Sensitive Land Uses: Prior to selecting a cleanup, the neighborhood was evaluated to identify sensitive land uses nearby, such as schools, day care facilities, hospitals and residential areas. The cleanup program was then tailored to address the special conditions of this community.

Qualitative Human Health Exposure Assessment: An important part of the cleanup planning for the Site is a study to find all of the ways that people might come in contact with contaminants at the Site now or in the future. This study is called a Qualitative Human Health Exposure Assessment (QHHEA). A QHHEA was performed for this project. This assessment has considered all known contamination at the Site and evaluated the potential for people to come in contact with this contamination. All identified public exposures will be addressed under this cleanup plan.

Health and Safety Plan: This cleanup plan includes a Construction Health and Safety Plan (CHASP) that is designed to protect community residents and on-Site workers. The elements of this RAWP are in compliance with applicable safety requirements of the United States Occupational Safety and Health Administration (OSHA). This RAWP includes many protective elements including those discussed below.

Site Safety Coordinator: This project has a designated Site safety coordinator to implement the CHASP. The safety coordinator maintains an emergency contact sheet and protocol for management of emergencies. The Site safety coordinator is identified at the beginning of this Community Protection Statement.

Worker Training: Workers participating in cleanup of contaminated material on this project are required to be trained in a 40-hour hazardous waste operators training course and to take annual refresher training. This pertains to workers performing specific tasks including removing contaminated material and installing cleanup systems in contaminated areas.

Community Air Monitoring Plan: Community air monitoring will be performed during this cleanup project to ensure that the community is properly protected from contaminants, dust and odors. Air samples will be tested in accordance with a detailed plan called the Community Air Monitoring Plan or CAMP. Results will be regularly reported to the NYC Office of Environmental Remediation. This cleanup plan also has a plan to address any unforeseen problems that might occur during the cleanup (called a ‘Contingency Plan’).

Odor, Dust and Noise Control: This cleanup plan includes actions for odor and dust control. These actions are designed to prevent off-Site odor and dust nuisances and includes steps to be taken if nuisances are detected. Generally, dust is managed by application of physical covers and by water sprays. Odors are controlled by limiting the area of open excavations, physical covers, spray foams and by a series of other actions (called operational measures). The project is also required to comply with applicable NYC noise control standards. If you observe problems in these areas, please contact the onsite Project Manager or NYC Office of Environmental Remediation Project Manager listed on the first page of this Community Protection Statement document.

Quality Assurance: This cleanup plan requires that evidence be provided to illustrate that all cleanup work required under the plan has been completed properly. This evidence will be summarized in the final report, called the Remedial Action Report. This report will be submitted to the NYC Office of Environmental Remediation and will be thoroughly reviewed.

Stormwater Management: To limit the potential for soil erosion and discharge, this cleanup plan has provisions for stormwater management. The main elements of the stormwater management include physical barriers such as tarp covers and erosion fencing, and a program for frequent inspection.

Hours of Operation: 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. For this cleanup project, the hours of operation will conform to requirements of the NYC Department of Buildings.

Signage: While the cleanup is in progress, a placard will be prominently posted at the main entrance of the property with a laminated project Fact Sheet that states that the project is in the NYC Voluntary Cleanup Program and provides project contact names and numbers, and a link to the document repository where project documents can be viewed.

Complaint Management: The contractor performing this cleanup is required to address all complaints. If you have any complaints, you can call the facility Project Manager or the NYC Office of Environmental Remediation Project Manager listed on the first page of this Community Protection Statement document or call 311 and mention the Site is in the NYC Voluntary Cleanup Program.

Utility Mark-outs: To promote safety during excavation in this cleanup, the contractor is required to first identify all utilities and must perform all excavation and construction work in compliance with NYC Department of Buildings regulations.

Soil and Liquid Disposal: All soil and liquid material removed from the Site as part of the cleanup will be transported and disposed of in accordance with all applicable City, State and Federal regulations, and required permits will be obtained.

Soil Chemical Testing and Screening: All excavations will be supervised by a trained and properly qualified environmental professional. In addition to extensive sampling and chemical testing of soils on the Site, excavated soil will be screened continuously using hand-held instruments, by sight, and by smell to ensure proper material handling and management, and community protection.

Stockpile Management: Soil stockpiles will be kept covered with tarps to prevent dust, odor and erosion. Stockpiles will be frequently inspected. Damaged tarp covers will be promptly replaced. Stockpiles will be protected with silt fences. Hay bales will be used, as needed, to protect storm water catch basins and other discharge points.

Trucks and Covers: Loaded trucks leaving the Site will be covered in compliance with applicable laws and regulations to prevent dust and odor. Trucks will be properly recorded in logs and records and placarded in compliance with applicable City, State and Federal laws, including those of the New York State Department of Transportation. If loads contain wet material that can leak, truck liners will be used. All transport of materials will be performed by licensed truckers and in compliance with applicable laws and regulations.

Imported Material: All fill materials proposed to be brought onto the Site will comply with rules outlined in this cleanup plan and will be inspected and approved by a qualified worker located on the Site. Waste materials will not be brought onto the Site. Trucks entering the Site with imported clean materials will be covered in compliance with applicable laws and regulations.

Equipment Decontamination: All equipment used for cleanup work will be inspected and washed, if needed, before it leaves the Site. Trucks will be cleaned at a truck inspection station on the property before leaving the Site.

Housekeeping: Locations where trucks enter or leave the Site will be inspected every day and cleaned regularly to ensure that they are free of dirt and other materials from the Site.

Truck Routing: Truck routes have been selected to: (a) limit transport through residential areas and past sensitive nearby properties; (b) maximize use of city-mapped truck routes; (c) limit total distance to major highways; (d) promote safety in entry to highways; (e) promote overall safety in trucking; and (f) minimize off-Site line-ups (queuing) of trucks entering the property. Operators of loaded trucks leaving the Site will be instructed not to stop or idle in the local neighborhood.

Final Report: The results of all cleanup work will be fully documented in a final report (called the Remedial Action Report) that will be available for public review online. A link to the online document repository and the public library with Internet access nearest the Site are listed on the first page of this Community Protection Statement document

Long-Term Site Management: If long-term protection is needed after the cleanup is complete, the property owner will be required to comply with an ongoing Site Management Plan that calls for continued inspection of protective controls, such as Site covers. The Site Management Plan is evaluated and approved by the NYC Office of Environmental Remediation. Requirements that the property owner must comply with are defined either in the property's deed or established through a city environmental designation registered with the Department of Buildings. A certification of continued protectiveness of the cleanup will be required from time to time to show that the approved cleanup is still effective.

REMEDIAL ACTION WORK PLAN

1.0 Project Background

Bill Lika is working with the NYC Office of Environmental Remediation (OER) in the New York City Voluntary Cleanup Program and/or in the “E” Designation Program to investigate and remediate a property located at 64 North 8th Street in the Williamsburg section of Brooklyn, New York (the “Site”). A Remedial Investigation (RI) was performed to compile and evaluate data and information necessary to develop this Remedial Action Work Plan (RAWP) in a manner that will render the Site protective of public health and the environment consistent with the contemplated end use. This RAWP establishes remedial action objectives, provides a remedial alternatives analysis that includes consideration of a permanent cleanup, and provides a description of the selected remedial action. The remedial action described in this document provides for the protection of public health and the environment, and complies with applicable environmental standards, criteria and guidance and applicable laws and regulations.

1.1 Site Location and Background

The Site is located at 64 North 8th Street in the Williamsburg section in Brooklyn, New York and is identified as Block 2317 and Lot 12 on the New York City Tax Map. **Figure 1** shows the Site location. The Site is 2,500-square feet and is bounded by North 8th Street and a 6-story mixed residential and commercial building to the north, 7-story residential building to the south, 5-story residential (under construction - OER project # 12EHAZ451K) to the east, and 3-story mixed residential and commercial to the west. A map of the site boundary is shown in **Figure 2**. Currently, the Site is partially occupied by a vacant 2-story residential building with a shallow basement in the southern portion. The remainder area consists of brick walkway and landscaped area of uneven surface elevation.

1.2 Redevelopment Plan

The proposed future use of the Site will consist of a 4-story walk-up residential building with a full basement covering approximately 52.5% of the site and a front yard and a rear yard covering the remaining 47.5% of the site. There will be 5 dwelling units. The basement will be utilized as sprinkler and boiler room, meter room, storage space, egress stairs and accessory use

for the 2-level apartment on 1st floor. The 1st floor will consist of the garage, lobby, egress stairs and the upper level of the 2-level apartment. There will be 1 apartment on each floor from the 2nd through the 4th floor. A front yard will be located in the northern portion of the Site.

Approximately 30% of the front yard might be utilized as landscaped area but will be further determined during the construction. The building will be approximately 50 feet high. A rear yard will be located in the southern portion of the Site. The current zoning designation is M1-2/R6B. The proposed use is consistent with existing zoning for the property. Layout of the proposed site development is presented in **Figure 3**.

The excavation for the foundation of the new building will be performed to approximately 10 feet below sidewalk grade and to approximately 2 feet below sidewalk grade in the rear yard area. The total amount of soil to be removed from the site will be approximately 600 cubic yards. Approximately 85 cubic yards of clean stone will be required in the front and rear yard. After the construction, the rear yard will be capped with clean stone and the front yard will be capped with clean stone and concrete slab. If part of the front yard will be developed as landscaped area, the clean stone and concrete slab in this portion will be replaced with clean soil and plant.

Groundwater was not encountered during this RI. The water table is expected between 19.37 feet and 23.57 feet below sidewalk grade based upon the investigation results from the eastern adjacent property at 66 North 8th Street. Thus, groundwater is not anticipated to be encountered during the proposed excavation.

The remedial action contemplated under this RAWP may be implemented independently of the proposed redevelopment plan.

1.3 Description of Surrounding Property

The Site is located in a residential and commercial neighborhood. North 8th Street and a 6-story mixed residential and commercial building are located to the north of the Site; a 7-story residential building is located to the south of the Site; Jerome Street and a 3-story mixed residential and commercial building is located to the west of the Site; and a 5-story residential building (under construction) is located to the east of the Site.

Within a 500 feet radius of the Site, there are a variety of land uses including residential (multi-family residential, 1&2 family residential), mixed use, commercial, institutional, transportation/utilities, green spaces, parking and industrial. Properties located within a 1/4-mile

radius of the Site are zoned R6B (general residential district), M1-2/R6A and MX-8. There is no sensitive receptor located within a 250-foot radius of the Site. **Figure 4** shows the surrounding land use.

1.4 Summary of Past Site Uses and Areas of Concern

Based upon the review of the Phase I Environmental Site Assessment (ESA) report prepared by HydroTech in June 2019, a site history was established. According to the Sanborn Maps and Regulatory Agency documents, it appears that the Subject Property was partially developed with the existing 2-story building prior to 1900s for residential use. A 1-story shed was constructed in the mid-eastern portion and was removed prior to the Phase I. It was also noted in the City Directory Records that in 1928, the Site was partially operated by Hi Gloss Chemical Co.

The AOCs identified for this site include:

1. The historic use of the Subject Property for chemical manufacturing in 1928;
2. The presence of VCP site with ongoing remediation at the eastern adjacent property;
3. The presence of PVEC related to the eastern adjacent VCP site.
4. The presence of suspect lead-based peeling paint.

1.5 Summary of Work Performed under the Remedial Investigation

HydroTech performed the following scope of work:

1. Conducted a Site inspection to identify AOCs and physical obstructions (i.e. structures, buildings, etc.);
2. Performed Ground-Penetration Radar (GPR) Survey to find any anomaly and clear out all the sampling locations;
3. Installed three (3) soil borings across the entire project Site, and collected six (6) soil samples for chemical analysis from the soil borings to evaluate soil quality;
4. Installed two (2) temporary monitoring wells in the front yard to depths of 14 feet and 18 feet below sidewalk grade to establish groundwater flow; however, no groundwater could be recovered for chemical analysis to evaluate groundwater quality;
5. Installed two (2) soil vapor probes around Site perimeter and one (1) sub-slab vapor probe and collected three (3) vapor samples for chemical analysis.

1.6 Summary of Findings of Remedial Investigation

A remedial investigation was performed, and the results are documented in a companion document called “Remedial Investigation Report, 64 North 8th Street”, dated September 2019 (RIR).

1. The elevation of the Subject Property is approximately 21 feet above mean sea level (USGS 7 ½-Minute Brooklyn, New York Quadrangle, 2013). The surface elevation of the front yard is approximately 2-3 feet higher than the sidewalk grade and slightly increases in the direction from sidewalk towards the building. The elevation of the basement slab is approximately 4.5 feet below the ground surface of front yard (approximately 1.5 feet below sidewalk grade). The topography of the surrounding property slightly decreases from east to west along North 8th Street.
2. Groundwater was not encountered during this RI. Based upon the RI performed at eastern adjacent property at 66 North 8th Street, depth to groundwater ranges from 19.37 to 23.57 feet below sidewalk grade.
3. Groundwater flow direction was not determined during this RI but was assumed to be from east to west beneath the Site.
4. Bedrock was not encountered during this RI. Refusals were encountered at different depths between 9 feet and 18 feet below sidewalk grade during the installation of soil probes and temporary groundwater monitoring wells at several locations of Subject Property.
5. In the basement area, there are at least 4 feet of silt layer underneath the basement slab. In the front yard, from the ground surface down to 2 to 6 feet, consists of topsoil mixed with stones. The topsoil layer is underlain by a 2-foot layer of soil mixed with historic fill materials such as porcelains and bricks. Underneath the fill layer, compacted sand with stones or silty/clayey sand were observed.
6. Soil/fill samples collected during the RI were compared to the NYSDEC Title 6 of the official New York Codes, Rules, and Regulations (NYCRR) Part 375 Unrestricted Use and Restricted Residential Soil Cleanup Objectives (UUSCOs and RRSCOs).

Investigation results indicated:

- a. The only VOC detected at a concentration of 0.072 mg/kg was acetone. No other VOCs were detected in any samples exceeding their respective UUSCOs.

- b. SVOCs, commonly categorized as Polycyclic Aromatic Hydrocarbons (PAHs), were detected in most of the samples but at trace levels less than their respective UUSCOs.
 - c. No pesticides or PCBs were detected at concentrations exceeding their respective Method Detection Limits (MDLs).
 - d. Metals including lead (max. 221 mg/kg) and mercury (max. 0.55 mg/kg) were detected at concentrations exceeding their respective UUSCOs; zinc was detected in one (1) shallow sample at a concentration of 142 mg/kg exceeding its respective UUSCO; and chromium, trivalent was detected at a maximum concentration of 51.7 mg/kg at concentrations exceeding its respective UUSCO.
 - e. The presence of metals and PAHs in samples are commonly related to the presence of historic fill materials, which is consistent with the on-site soil screening results.
7. Groundwater samples were not collected during the RI.
8. Soil vapor samples collected during the RI showed low to moderate levels of petroleum related compounds and low to moderate levels of chlorinated VOCs (CVOCs). The total concentrations of VOCs range from 107.4 $\mu\text{g}/\text{m}^3$ to 1,123.3 $\mu\text{g}/\text{m}^3$ in soil vapor/sub-slab vapor samples. Concentrations of petroleum related VOCs (BTEX) ranged from 3.6 $\mu\text{g}/\text{m}^3$ to 20.2 $\mu\text{g}/\text{m}^3$ in the soil vapor/sub-slab samples. Chlorinated VOCs including chloroform (2.1 $\mu\text{g}/\text{m}^3$), dichlorodifluoromethane (Freon-12) (max. 580 $\mu\text{g}/\text{m}^3$), methylene chloride (max. 2.5 $\mu\text{g}/\text{m}^3$), tetrachloroethylene (PCE) (max. 2.4 $\mu\text{g}/\text{m}^3$), trichloroethylene (0.68 $\mu\text{g}/\text{m}^3$) and trichlorofluoromethane (Freon-11) (max. 400 $\mu\text{g}/\text{m}^3$) were detected individually or collectively in the sub-slab vapor/soil vapor samples. Based upon the comparison to NYSDOH Decision Matrices, no further action is recommended to address human exposure. The presence of Freon-11 and Freon-12 are typically attributed to the on-site usage and/or storage of refrigerant and aerosol spray. Based upon the Site history, the presence of elevated levels of these compounds underneath the building should be related to the of historic refrigerator usage while the building was occupied.

For more detailed results, consult the RIR. Based on an evaluation of the data and information from the RIR and this RAWP, disposal of significant amounts of hazardous waste is not suspected at this site.

2.0 Remedial Action Objectives

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

Soil

- Prevent direct contact with contaminated soil.
- Prevent exposure to contaminants volatilizing from contaminated soil.
- Prevent migration of contaminants that would result in groundwater or surface water contamination.

Groundwater

- Remove contaminant sources causing impact to groundwater.

Soil Vapor

- Prevent exposure to contaminants in soil vapor.
- Prevent migration of soil vapor into dwelling and other occupied structures.

3.0 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 Track 1 Unrestricted Use scenario and a Track 2 Restricted Residential 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 Unrestricted Use (Track 1) Soil Cleanup Objectives (SCOs).
- Removal of all soil/fill exceeding Track 1 Unrestricted Use SCOs throughout the Site and confirmation that Track 1 Unrestricted Use SCOs have been achieved with post-excavation endpoint sampling. Based on the results of the Remedial Investigation, it is expected that current front yard (approximately 70% of the Site) should be excavated down to at least 8 feet below sidewalk grade to remove the historic fill layer between 6 and 8 feet. No historic fill was observed to at least 4 feet beneath the existing cellar slab (approximately 30% of the Site). Track 1 exceedances were observed in soil from 3.5-9

feet below sidewalk grade. Therefore, this alternative would be achieved by excavating entire Site to at least 10 feet to remove all historic fill and to construct the new foundation. If soil/fill containing analytes at concentrations above Unrestricted Use 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 Unrestricted Use SCOs.

- No Engineering or Institutional Controls are required for a Track 1 cleanup. However, as part of development, a vapor barrier and a composite cover system would be installed to prevent potential exposures from soil vapor in the future.

Alternative 2:

- Selection of NYSDEC Part 375 Section 6.8(b) Restricted Residential (Track 2) SCOs;
- Removal of all soil/fill exceeding Track 2 Restricted Residential SCOs and confirmation that Track 2 Restricted Residential SCOs have been achieved with post-excavation end point sampling. Based on the results of the Remedial Investigation, it is expected that this alternative would be achieved by excavating the foundation of the new building to a depth of 10 feet and to approximately 2 feet below sidewalk grade in the proposed front and rear yard area. If soil/fill containing analytes at concentrations above Track 2 Restricted Residential SCOs is still present at the base of the excavation, additional excavation would be performed to meet Track 2 Restricted Residential SCOs. Data collected during Remedial Investigation indicates that soils already meets Restricted Residential Use SCOs.
- Placement of a composite cover system over the entire Site to prevent exposure to remaining soil/fill;
- Installation of a vapor barrier system beneath the building slab and inside foundation walls to prevent potential exposures from soil vapor;
- Establishment of use restrictions including prohibitions on the use of groundwater from the Site; prohibitions of restricted Site uses, such as farming or vegetable gardening, to prevent future exposure pathways; and prohibition of a higher level of land use without OER approval;

- Establishment of an approved Site Management Plan (SMP) to ensure long-term management of these Engineering and Institutional Controls including the performance of periodic inspections and certification that the controls are performing as they were intended. The SMP will note that the property owner and property owner's successors and assigns must comply with the approved SMP; and

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 Engineering Controls or Institutional Controls. 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 SCO's 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 most of the historic fill at the Site and by ensuring that remaining soil/fill on-Site meets Track 2 Restricted Residential SCO's, as well as by placement of Institutional and Engineering Controls, including a composite cover system. The composite cover system would prevent direct contact with any remaining on-Site soil/fill. Implementing Institutional Controls including a Site Management Plan and continuing the E-designation on the property would ensure that the composite cover system remains intact and protective of public health. Establishment of Track 2 Restricted Residential SCO's would minimize the risk of contamination leaching into groundwater.

For both Alternatives, potential exposure to contaminated soils or groundwater during construction would be minimized by implementing a Construction Health and Safety Plan, an approved Soil/Materials Management Plan, and Community Air Monitoring Plan (CAMP). Potential contact with contaminated groundwater would be prevented as its use is prohibited by city laws and regulations. Potential future migration of off-Site soil vapors into the new building

would be prevented by installing a vapor barrier below the building slab and outside foundations walls below grade.

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.

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 Use SCO's and Protection of Groundwater SCO's. Compliance with SCGs for soil vapor would also be achieved by installing a vapor barrier system below the new building's basement slab and continuing the vapor barrier outside of subgrade foundation walls, as part of development.

Alternative 2 would achieve compliance with the remedial goals, chemical-specific SCG's and RAOs for soil through removal of soil to meet Track 2 Restricted Residential SCO's. Compliance with SCG's for soil vapor would also be achieved by installing a vapor barrier system below the new building's basement slab and continuing the vapor barrier outside of subgrade foundation walls. A Site Management Plan would ensure that these controls remained protective for the long term.

Health and safety measures contained in the CHASP and Community Air Monitoring Plan (CAMP) will be implemented during Site redevelopment under this RAWP. For both Alternatives, 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.

Both **Alternative 1** and **2** have similar short-term effectiveness during their implementation, as each requires excavation of historic fill material. Both alternatives would result in short-term dust generation impacts associated with excavation, handling, load out of materials, and truck traffic. 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.

An additional short-term adverse impact and risk to the community associated with both remedial alternatives is increased truck traffic. 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 both alternatives would be minimized through implementation of control plans including a Construction Health and Safety Plan, a Community Air Monitoring Plan (CAMP) and a Soil/Materials Management Plan (SMMP), during all on-Site soil disturbance activities and would minimize the release of contaminants into the environment. Both 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 Construction Health and Safety Plan (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.

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 Engineering Controls/Institutional Controls (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 Use SCO's. Removal of on-Site contaminant sources will also prevent future groundwater contamination.

Alternative 2 would provide long-term effectiveness by removing most on-Site contamination and attaining Track 2 Restricted Residential SCOs; installing a composite cover system across the Site; maintaining use restrictions; establishing an SMP to ensure long-term management of ICs and ECs; and maintaining registration as an E-designated property to memorialize these controls for the long term. The SMP would ensure long-term effectiveness of all ECs and ICs by requiring periodic inspection and certification that these controls and restrictions continue to be in place and are functioning as they were intended, assuring that protections designed into the remedy continue to provide the required level of protection.

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 Unrestricted Use SCO's.

Alternative 2 would remove most of the historic fill at the Site, and all remaining on-Site soil/fill beneath the new building will meet Track 2 Restricted Residential SCO's.

Alternative 1 would remove a greater total mass of contaminants from the Site. The removal of soil to ten feet for the entire Site in both scenarios would lessen the difference in contaminant mass removal between these two alternatives.

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 both **Alternatives 1** and **2** 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. There are no special difficulties associated with any of the activities proposed.

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.

Historic fill at the Site was found between 6 and 8 feet below sidewalk grade during the RI, and the new building requires excavation of the basement to a depth of 10 feet and excavation of the front and rear yard to a depth of 2 feet, below sidewalk grade respectively. Costs associated with **Alternative 1** would be significantly higher than **Alternative 2** to remove all soils and fill from front and rear yard area that exceeded Track 1 Unrestricted Use SCOs below the excavation depth required for development. Additional costs would include installation of additional shoring/underpinning, disposal of additional soil, and import of clean stone/soil for backfill. However, long-term costs for **Alternative 2** are likely higher than **Alternative 1** based on implementation of a Site Management Plan as part of **Alternative 2**.

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 NYC VCP and will provide the opportunity for detailed public input on the remedial alternatives and the selected remedy. This public comment will be considered by OER prior to approval of this plan. The Citizen Participation Plan for the project is provided in **Appendix 2**. 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 includes a 4-story walk-up residential building with four dwelling units and a full basement covering approximately 55% of the site. Following remediation, the Site will meet either Track 1 Unrestricted Use or Track 2 Restricted Residential 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 a residential and commercial neighborhood. There are a variety of

land uses including residential (multi-family residential, 1&2 family residential), mixed use, commercial, institutional, transportation/utilities, green spaces, parking and industrial. The development would remediate a vacant contaminated residential building and provide a modern residential building. The proposed development would clean up the property and make it safer, create new employment opportunities, living space 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 Restricted Residential SCOs, both of which are protective of public health and the environment 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. Both alternatives are equally protective of natural resources and cultural resources. Improvements in the current environmental condition of the property achieved by both 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 **Alternative 2** 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 NYC VCP is included in a Sustainability Statement in **Appendix 3**.

Selection of the Preferred Remedy

The preferred remedy for the site is **Alternative 2**, Restricted Residential Use Cleanup. Data generated during the site investigation indicates that this Site already meets Restricted Residential Use SCOs. Data also support the conclusion that **Alternative 1** is not achievable without additional excavations in front and rear yard areas. New development does not require excavating these areas.

The **Alternative 2** remedy will remove all soil/fill exceeding Track 2 Restricted Residential Use SCOs throughout the Site, which will be confirmed with post-excavation sampling. If soil/fill containing analytes at concentrations above Track 2 SCOs is still present at the base or walls of the excavation after removal of all soil required for construction of the new building's cellar level and slab are complete, additional excavation would be performed to ensure complete removal of soil/ fill that does not meet Restricted Residential Use SCOs.

No Engineering Controls are required for a Track 1 or Track 2 cleanups. However, a concrete slab covering the entire site and vapor barrier membrane would be installed as part of standard building development and are not considered part of the remedy. Additional soil vapor management would not be required in areas on the first constructed floor where high volume air exchange is required by NYC Building Code to address indoor vehicle parking.

Use restrictions will not be imposed on the site (including prohibitions on any use higher than Restricted Residential, e.g. the use of groundwater from the Site; prohibitions of restricted Site uses, such as farming or vegetable gardening, to prevent future exposure pathways; and prohibition of a higher level of land use without NYSDEC approval). If Unrestricted Use or Restricted Residential Use SCOs are achieved, the E-designation for hazardous material would be lifted at the completion of building.

4.0 Remedial Action

4.1 Summary of Preferred Remedial Action

The preferred remedial action alternative is Alternative 2, the Track 2 remedial action. The preferred remedial action achieves protection of public health and the environment for the intended use of the property. The preferred remedial action will achieve all remedial action objectives established for the project and addresses applicable SCGs. The preferred remedial action is effective in both the short-term and long-term and reduces mobility, toxicity and volume of contaminants. The preferred remedial action alternative is cost effective and implementable and uses standards methods that are well established in the industry.

The proposed remedial action will consist of:

1. Preparation of a Community Protection Statement and performance of all required NYC VCP Citizen Participation activities according to an approved Citizen Participation Plan.
2. Performance of a Community Air Monitoring Program for particulates and volatile organic carbon compounds.
3. Selection of NYSDEC Part 375 Restricted Residential (Track 2) Soil Cleanup Objectives (SCOs).
4. Site mobilization involving Site security setup, equipment mobilization, utility mark outs and marking & staking excavation areas.
5. Completion of a Waste Characterization Study prior to excavation activities. Waste characterization soil samples will be collected at a frequency dictated by disposal facility(s).
6. Excavation and removal of soil/fill exceeding Restricted Residential SCOs. The excavation will be performed to approximately 10 feet below sidewalk grade for the foundation of the new building and to approximately 2 feet below sidewalk grade in the proposed front and rear yard. The total amount of soil to be removed from the site will be approximately 600 cubic yards.
7. Screening of excavated soil/fill during intrusive work for indications of contamination by visual means, odor, and monitoring with a PID.

8. Management of excavated materials including temporarily stockpiling and segregating in accordance with defined material types and to prevent co-mingling of contaminated material and non-contaminated materials.
9. Removal of all UST's that are encountered during soil/fill removal actions. Registration of tanks and reporting of any petroleum spills associated with UST's and appropriate closure of these petroleum spills in compliance with applicable local, State and Federal laws and regulations.
10. Transportation and off-Site disposal of all soil/fill material at licensed or permitted facilities in accordance with applicable laws and regulations for handling, transport, and disposal, and this plan. Sampling and analysis of excavated media as required by disposal facilities.
11. Collection and analysis of three (3) end-point samples to determine the performance of the remedy with respect to attainment of Restricted Residential Use SCOs.
12. Demarcation of residual soil/fill is not required.
13. Dewatering is not anticipated during the excavation.
14. Import of approximately 85 cubic yards of clean stone to be used for backfilling in the front and rear yard in compliance with this plan and in accordance with applicable laws and regulations. If it is confirmed during the construction that 30% of the front yard will be developed as landscape area, approximately 8 cubic yards of stone will be replaced by clean soil.
15. As part of new development, construction of an engineered composite cover over the entire footprint of the Site, comprised of 1) 2-foot clean stone on top of native soil in the rear yard; 2) 4-inch concrete basement slab; 3) 2-foot clean stone and 4-inch concrete slab in the front yard to prevent human exposure to residual soil/fill material.
Approximately 30% of the front yard might be utilized as landscaped area but will be further determined during the construction. If confirmed, a 2-foot clean soil with plant will be placed in this portion instead of clean stone and concrete slab.
16. As part of new development, installation of a vapor barrier system consisting of vapor barrier beneath the building slab and inside of sub-grade foundation sidewalls to mitigate potential soil vapor migration into the building. The vapor barrier system will consist of a 20-mil Stego Wrap by Stego Industries and will be installed beneath the building's

foundation slab and inside the foundation sidewalls up to grade. The vertical vapor barrier will be fully covered by sheetrock panel to prevent from being torn, penetrated or scratched after the building is occupied. The brand and model of the sheetrock panel is not determined and will be reported and reviewed during the construction. The vapor barrier system is an Engineering Control for the remedial action. The remedial engineer will certify in the RAR that the vapor barrier system was designed and properly installed to mitigate soil vapor migration into the building.

17. Performance of all activities required for the remedial action, including acquisition of required permits and attainment of pretreatment requirements, in compliance with applicable laws and regulations.
18. Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.
19. Submission of a RAR that describes the remedial activities, certifies that the remedial requirements have been achieved, defines the Site boundaries, lists any changes from this RAWP, and describes all Engineering and Institutional Controls to be implemented at the Site.
20. If Track 2 Restricted Residential Use SCOs are not achieved, submission of an approved Site Management Plan (SMP) in the Remedial Action Plan (RAR) for long-term management of residual contamination, including plans for operation, maintenance, monitoring, inspection and certification of Engineering and Institutional Controls and reporting at a specified frequency.
21. If Track 2 Restricted Residential Use SCOs are not achieved, the property will continue to be registered with an E-Designation at the NYC Buildings Department. Establishment of Engineering Controls and Institutional Controls in this RAWP and a requirement that management of these controls must be in compliance with an approved SMP. Institutional Controls will include prohibition of the following: (1) vegetable gardening and farming; (2) use of groundwater without treatment rendering it safe for the intended use; (3) disturbance of residual contaminated material unless it is conducted in accordance with the SMP; and (4) higher level of land usage without OER-approval.

4.2 Soil Cleanup Objectives and Soil/ Fill Management

Track 2 Restricted Residential SCOs are proposed for this project and SCO's are defined in 6 NYCRR Part 375, Table 6.8 Track 2 Restricted Residential Use.

Soil and materials management on-Site and off-Site, including excavation, handling and disposal, will be conducted in accordance with the Soil/Materials Management Plan in **Appendix 4**. 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 Remedial Action Report.

Soil/Fill Excavation and Removal

The excavation will be performed to approximately 10 feet below sidewalk grade for the foundation of the new building and to approximately 2 feet below sidewalk grade in the proposed front and rear yard area. **Figure 5** shows proposed excavation plan. The total quantity of soil/fill expected to be excavated and disposed off-Site is approximately 600 cubic yards. For each disposal facility to be used in the remedial action, a letter from the developer/QEP to the receiving facility requesting approval for disposal and a letter back to the developer/QEP providing approval for disposal will be submitted to OER prior to any transport and disposal of soil at a facility. Disposal facilities will be reported to OER when they are identified and prior to the start of remedial action.

End-point Sampling

End-point 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; and
- Pesticides/PCBs by EPA Method 8081/8082.

New York State ELAP certified labs will be used for all end-point sample analyses. Labs performing end-point sample analyses will be reported in the RAR. The RAR will provide a tabular and map summary of all end-point sample results and will include all data including non-detects and applicable standards and/or guidance values.

Confirmation End-point Sampling

Removal actions for development purposes under this plan will be performed in conjunction with confirmation end-point soil sampling. Three (3) confirmation samples will be collected from the base of the excavation at locations to be determined by OER. Specifically, one sample will be collected from the proposed rear yard, one sample will be collected from the proposed front yard and one sample will be collected from the proposed basement area. To evaluate attainment of Track 2 SCOs, analytes will include those for which SCOs have been developed, including TAL Metals, VOCs, SVOCs, Pesticides and PCBs, according to analytical methods described above. **Figure 6** shows the proposed endpoint sampling plan.

Hotspot End-point Sampling

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 end-point 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 Tasks 1-3 above.

Post-remediation end-point sample locations and depth 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 “fingerprint analysis” and required regulatory reporting (i.e. spills hotline) will be performed.

Quality Assurance/Quality Control

The fundamental QA objective with respect to accuracy, precision, and sensitivity of analysis for laboratory analytical data is to achieve the QC acceptance of the analytical protocol. The laboratory will address the accuracy, precision and completeness requirements for all data generated.

Field QA/QC will include the following procedures:

- Calibration of field equipment, including PID, on a daily basis;
- Use of dedicated and/or disposable field sampling equipment;
- Proper sample handling and preservation;
- Proper sample chain of custody documentation; and
- Completion of report logs.

The above procedures will be executed as follows:

- Disposable sampling equipment will be used to minimize cross-contamination between samples;
- For each of the parameters analyzed, a sufficient sample volume will be collected to adhere to the specific analytical protocol, and provide sufficient sample for reanalysis if necessary;
- Because plasticizers and other organic compounds inherent in plastic containers may contaminate samples requiring organic analysis, samples will be collected in glass containers;
- Appropriate sample preservation techniques, including cold temperature storage at 4° C, will be utilized to ensure that the analytical parameters concentrations do not change between the time of sample collection and analysis; and

Samples will be analyzed prior to the expiration of the respective holding time for each analytical parameter to ensure the integrity of the analytical results.

Import of Soils

Import of 85 cubic yards of clean stone and placing in the front and rear yard to form a 2-foot clean stone cover will be performed in conformance with the Soil/Materials Management Plan in **Appendix 4**. Approximately 30% of the front yard might be developed as landscaped but will be further determined during the construction. If confirmed, approximately 8 cubic yards of stone will be replaced by clean soil to form the landscape area. Imported stone and soil will meet the lower of:

- Track 2 Restricted Residential Use SCO's, and
- Groundwater Protection Standards in Part 375-6.8.

The estimated quantity of stone to be imported for backfill is 85 cubic yards. The related documents for the proposed materials including at least license/permit of the facility, sieve test report and clean source letter will be reviewed and approved by OER prior to import. **Figure 7** shows the backfill plan.

Reuse of Onsite Soils

Soil reuse is not planned on this project.

4.3 Engineering Controls

Engineering Controls are not required for Restricted Residential Use remedies. However, two protective elements are built into new development. If Restricted Residential SCOs are not achieved, these protective construction elements will constitute Engineering controls. The Site has following two (2) protective construction elements:

- (1) Composite Cover System
- (2) Soil Vapor Barrier System

Composite Cover System

Exposure to residual soil/fill will be prevented by an engineered, composite cover system to be built on the Site. The composite cover system will be comprised of 1) 2-foot clean stone in the backyard; 2) 4-inch concrete basement slab; 3) 2-foot clean stone with 4-inch concrete slab on

top to prevent human exposure to residual soil/fill material. Approximately 30% of the front yard might be utilized as landscaped area but will be further determined during the construction. If confirmed, a 2-foot clean soil with plant will be placed in this portion instead of clean stone and concrete slab.

Figure 8A shows the design and detail of composite cover system.

The composite cover system will be a permanent engineering control. The system will be inspected, and its performance certified at specified intervals as required by this RAWP and the Site Management Plan. A Soil and Materials Management Plan will be included in the Site Management Plan and will outline the procedures to be followed in the event that the composite cover system and underlying residual soil/fill is disturbed after the remedial action is complete. Maintenance of this composite cover system will be described in the Site Management Plan in the Remedial Action Report.

Vapor Barrier System

Migration of soil vapor from onsite or offsite sources into the building will be mitigated with a combination of building slab and vapor barrier. A 20-mil Stego Wrap by Stego Industries will be installed beneath the building's foundation slab and inside the foundation sidewalls up to grade. All welds, seams and penetrations will be properly sealed with Stego Tape to prevent preferential pathways for vapor migration. The installer of the vapor barrier system shall be assigned by the general contractor. The vapor barrier will extend throughout the area occupied by the footprint of the new building and up the foundation sidewalls and will be installed in accordance with manufacturer specifications. **Figure 8B** provides the design and detail of the vapor barrier system. Product cut sheets are provided in **Appendix 6**. The Remedial Action Report will include as-built drawings and diagrams; manufacturer documentation; and photographs.

The Vapor Barrier System is a permanent engineering control and will be inspected and its performance certified at specified intervals as required by this RAWP and the Site Management Plan. A Soil and Materials Management Plan will be included in the Site Management Plan and will outline the procedures to be followed in the event that the composite cover system and underlying vapor barrier system is disturbed after the remedial action is complete. Maintenance of these systems will be described in the Site Management Plan in the Remedial Action Report.

4.4 Institutional Controls

Institutional Controls are not required for Restricted Residential Use remedies. If Restricted Residential SCOs are not achieved, a series of Institutional Controls (IC's) will be required under this Remedial Action to assure permanent protection of public health by elimination of exposure to residual materials. These IC's define the program to operate, maintain, inspect and certify the performance of Engineering Controls and Institutional Controls on this property. Institutional Controls would be implemented in accordance with a Site Management Plan included in the final Remedial Action Report (RAR). Institutional Controls would be:

- Continued registration of the E-Designation for the property. This RAWP includes a description of all ECs and ICs and summarizes the requirements of the SMP which will note that the property owner and property owner's successors and assigns must comply with the approved SMP;
- Submittal of a SMP in the RAR for approval by OER that provides procedures for appropriate operation, maintenance, inspection, and certification of ECs and IC's. SMP will require that the property owner and property owner's successors and assigns will submit to OER a periodic written statement that certifies that: (1) controls employed at the Site are unchanged from the previous certification or that any changes to the controls were approved by OER; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. OER retains the right to enter the Site in order to evaluate the continued maintenance of any controls. This certification shall be submitted at a frequency to be determine by OER in the SMP and will comply with RCNY §43-1407(l)(3).
- Vegetable gardens and farming on the Site are prohibited in contact with residual soil materials;
- Use of groundwater underlying the Site is prohibited without treatment rendering it safe for its intended use;
- All future activities on the Site that will disturb residual material must be conducted pursuant to the soil management provisions in an approved SMP;

- The Site will be used for residential use and will not be used for a higher level of use without prior approval by OER.

4.5 Site Management Plan

Site Management is not required for Restricted Residential Use remedies. However, if Restricted Residential SCOs are not achieved, SMP will be required.

Site Management is the last phase of remediation and begins with the approval of the Remedial Action Report and issuance of the Notice of Completion (NOC) for the Remedial Action. The Site Management Plan (SMP) describes appropriate methods and procedures to ensure implementation of all ECs and ICs that are required by this RAWP. The Site Management Plan is submitted as part of the RAR but will be written in a manner that allows its use as an independent document. Site Management continues until terminated in writing by OER. The property owner is responsible to ensure that all Site Management responsibilities defined in the Site Management Plan are implemented.

The SMP will provide a detailed description of the procedures required to manage residual soil/fill left in place following completion of the remedial action in accordance with the Voluntary Cleanup Agreement with OER. This includes a plan for: (1) implementation of EC's and ICs; (2) operation and maintenance of EC's; (3) inspection and certification of IC's and EC's.

Site management activities and EC/IC certification will be scheduled by OER on a periodic basis to be established in the RAR and the SMP and will be subject to review and modification by OER. The Site Management Plan will be based on a calendar year and certification reports will be due for submission to OER by July 30 of the year following the reporting period.

4.6 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 Remedial Investigation Report (RIR) are sufficient to complete a Qualitative Human Health Exposure Assessment (QHHEA) for this project. As part

of the VCP 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:

- Acetone was detected in 1 shallow sample exceeding its respective Track 1 SCO.
- Several metals including lead, mercury and zinc exceeded their respective Track 1 SCOs, however, all results were below Restricted Residential Use SCOs.
- No SVOCs, PCBs or pesticides were detected exceeding their respective Track 1 SCOs.

Groundwater:

- No groundwater sample was collected due to presence of refusal at 9-18 feet below sidewalk grade.

Soil/Sub-Slab Vapor:

- Petroleum related VOCs including BTEX compounds and their derivatives were detected at trace to moderate levels in all soil vapor samples.
- Chlorinated VOCs were detected at low levels.

Nature, Extent, Fate and Transport of Contaminants

Soil:

- Multiple Track 1 exceedances (VOC and metals) present in shallow soil throughout the Site between zero- and 2-feet layer. One metal was found exceeding its Track 1 SCO in deep soil from 3.5- and 5.5-feet layer in southern portion and from 7- and 9-feet layer in central portion. No further evaluation can be made if contaminants are migrating into groundwater as groundwater was not encountered during the investigation.

Groundwater:

- No groundwater sample was collected due to presence of refusal at 9-18 feet below sidewalk grade.

Soil/Sub-Slab Vapor:

- Vapor samples exhibited low levels of both petroleum-related compounds and CVOCs. The concentrations of CVOCs shall require no further action based upon the comparison to NYSDOH Decision Matrices. The presence of elevated levels of Freons might be related to past usage of refrigerator.

Receptor Populations

On-Site Receptors: The site is currently vacant and partially occupied by a vacant 2-story residential building in the southern portion. Access to the Site is restricted by an 8-foot-high, chained and locked, perimeter plywood fence. Onsite receptors are limited to trespassers, 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 adult and child 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
5. Schools – 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 is currently vacant and partially occupied by a vacant residential building. The remainder area consists of brick walkway and landscaped area. Groundwater is not exposed at the site. The site is served by the public water supply and groundwater is not used at the site for potable supply and there is no potential for exposure. The basement floor is covered with vinyl tiles and the concrete basement walls were partially covered with porcelain tiles. No major cracks were observed in the floor or walls. Soil vapor shall not accumulate in the vacant basement.

Construction/ Remediation Conditions: During the remedial action, onsite 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 exposed impacted soil and fill. Similarly, off-Site receptors could be exposed to dust and vapors from on-Site activities. Due to the depth of groundwater, direct contact with groundwater is not expected. During construction, on-Site and off-Site exposures to contaminated dust from on-Site will be addressed through the Soil/Materials Management Plan, dust controls, and through the implementation of the Community Air-Monitoring Program and a Construction Health and Safety Plan.

Proposed Future Conditions: Under future remediated conditions, all soils in excess of Track 2 SCOs will be removed. The Site will be fully capped, preventing potential direct exposure to soil and groundwater remaining in place, and the vapor barrier engineering control will prevent any potential exposure due to inhalation by preventing soil vapor intrusion. 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 no 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 4-story residential building, site-wide surface cover, and a subsurface vapor barrier system for the building. Under current conditions, no 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 Community Air Monitoring Program, the Soil/Materials Management Plan, and a Construction Health and Safety Plan. 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.

| Environmental Media & Exposure Route | Human Exposure Assessment for Proposed Remedial Action |
|--|---|
| Direct contact with surface and subsurface soils | There is no direct contact with soil because the site will be completely covered with an engineered composite cover. Future contact with soil will be prevented by the implementation of a Site Management Plan and Soil and Materials Management Plan for any future ground intrusive work |
| Ingestion of groundwater | The area is served by an upstate water supply and groundwater is not being used for potable water supply. Groundwater use for potable supply onsite is prohibited by municipal law. |
| Direct contact with groundwater | There is no direct contact with groundwater because the site will be completely covered with an engineered composite cover. Future contact with groundwater will be prevented by the implementation of a Site Management Plan and Soil and Materials Management Plan for any future ground intrusive work |
| Direct contact with soil vapor | Contact with impacted soil vapor will be prevented by a soil vapor barrier and composite cover |

5.0 Remedial Action Management

5.1 Project Organization and Oversight

Principal personnel who will participate in the remedial action include Ruijie Xu who is the manager for this project. The Professional Engineer (PE) and Qualified Environmental Professionals (QEP) for this project are Tarek Z. Khouri and Mark E. Robbins, respectively.

5.2 Site Security

Site access will be controlled through gated entrances to the fenced property.

5.3 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 OER during the pre-construction meeting.

5.4 Construction Health and Safety Plan

The Construction Health and Safety Plan (CHASP) is included in **Appendix 5**. The Site Safety Coordinator will be assigned by the general contractor. Remedial work performed under this RAWP will be in full compliance with applicable health and safety laws and regulations, including Site and OSHA worker safety requirements and HAZWOPER requirements. Confined space entry, if any, will comply with OSHA requirements and industry standards and will address potential risks. The parties performing the remedial construction work will ensure that performance of work is in compliance with the CHASP and applicable laws and regulations. The CHASP pertains to remedial and invasive work performed at the Site until the issuance of the Notice of Completion.

All field personnel involved in remedial activities will participate in training required under 29 CFR 1910.120, such as 40-hour hazardous waste operator training and annual 8-hour refresher training. Site Safety Officer will be responsible for maintaining workers training records.

Personnel entering any exclusion zone will be trained in the provisions of the CHASP and will comply with all requirements of 29 CFR 1910.120. Site-specific training will be provided to field personnel. Additional safety training may be added depending on the tasks performed.

Emergency telephone numbers will be posted at the site location before any remedial work begins. A safety meeting will be conducted before each shift begins. Topics to be discussed include task hazards and protective measures (physical, chemical, environmental); emergency procedures; PPE levels and other relevant safety topics. Meetings will be documented in a logbook or specific form.

An emergency contact sheet with names and phone numbers is included in the CHASP. That document will define the specific project contacts for use in case of emergency.

5.5 Community Air Monitoring Plan

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. Exceedances of action levels observed during performance of the Community Air Monitoring Plan (CAMP) will be reported to the OER Project Manager and included in the Daily Report.

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 be available for OER personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.

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/m³) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m³ above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m³ 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/m³ of the upwind level and in preventing visible dust migration.

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

5.6 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 OER does not constitute satisfaction of these requirements and will not be a substitute for any required permit.

5.7 Site Preparation

Pre-Construction Meeting

OER 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 in compliance 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 also 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 not anticipated during remediation and construction.

Equipment and Material Staging

Equipment and materials will be stored and staged in a manner that complies with applicable laws and regulations.

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 OER 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 NYS DEC within 2 hours of identification and consistent with State regulations. Emergency and spill conditions will also be reported to OER. 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 OER will be notified and corrective measure plan designed to remove, and clean dislocated material will be submitted to OER and implemented following approval by OER and granting of site access by the property owner. Impacted offsite areas may require characterization based on site conditions, at the discretion of OER. If onsite petroleum spills are identified, a qualified environmental professional will determine the nature and extent of the spill and report to NYS DEC's spill hotline at DEC 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 NYS DEC.

Storm Response Reporting

A site inspection report will be submitted to OER at the completion of site inspection. An inspection report established by OER is available on OER's website (www.nyc.gov/oer) and will

be used for this purpose. 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 OER 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 NYS DEC; description of corrective actions; schedule for corrective actions. This report should be completed and submitted to OER project manager with photographs within 24 hours of the time of safe entry to the property after the storm event.

5.8 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 9**.

5.9 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.

5.10 Reporting and Record Keeping

Daily reports

Daily reports providing a general summary of activities for each day of active remedial work will be emailed to the OER Project Manager by the end of the following business day. Those reports will include:

- Project number and statement of the activities and an update of progress made and locations of excavation and other remedial work performed;
- Quantities of material imported and exported from the Site;
- Status of on-Site soil/fill stockpiles;
- A summary of all citizen complaints, with relevant details (basis of complaint; actions taken; etc.);
- A summary of CAMP results noting all excursions. CAMP data may be reported;
- Photograph of notable Site conditions and activities.

The frequency of the reporting period may be revised in consultation with OER project manager based on planned project tasks. Daily email reports are not intended to be the primary mode of communication for notification to OER of emergencies (accidents, spills), requests for changes to the RAWP or other sensitive or time critical information. However, such information will be included in the daily reports. Emergency conditions and changes to the RAWP will be communicated directly to the OER project manager by personal communication. Daily reports will be included as an Appendix in the Remedial Action Report.

Record Keeping and Photo Documentation

Job-site record keeping for all remedial work will be performed. These records will be maintained on-Site during the project and will be available for inspection by OER staff. Representative photographs will be taken of the Site prior to any remedial activities and during major remedial activities to illustrate remedial program elements and contaminant source areas. Photographs will be submitted at the completion of the project in the RAR in digital format (i.e. jpeg files).

5.11 Complaint Management

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

5.12 Deviations from the Remedial Action Work Plan

All changes to the RAWP will be reported to, and approved by, the OER Project Manager and will be documented in daily reports and reported in the Remedial Action Report. The process to be followed if there are any deviations from the RAWP will include a request for approval for the change from OER 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.

6.0 Remedial Action Report

A Remedial Action Report (RAR) will be submitted to OER following implementation of the remedial action defined in this RAWP. The RAR will document that the remedial work required under this RAWP has been completed and has been performed in compliance with this plan. The RAR 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 all 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 end-point 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 NYC Department of Buildings (if Track 1 remedial action is not achieved);

- The RAWP and Remedial Investigation Report will be included as appendices to the RAR;
- Reports and supporting material will be submitted in digital form and final PDF's will include bookmarks for each appendix.

Remedial Action Report Certification

I, Tarek Z. Khouri, am currently a registered professional engineer licensed by the State of New York. I performed professional engineering services and had primary direct responsibility for implementation of the remedial program for the 64 North 8th Street, Brooklyn, NY site, site number 20CVCP038K. I certify to the following:

- I have reviewed this document, to which my signature and seal are affixed.
- Engineering Controls implemented during this remedial action were designed by me or a person under my direct supervision and achieve the goals established in the Remedial Action Work Plan for this site.
- The Engineering Controls constructed during this remedial action were professionally observed by me or by a person under my direct supervision and (1) are consistent with the Engineering Control design established in the Remedial action Work Plan and (2) are accurately reflected in the text and drawings for as-built design reported in this Remedial Action Report.
- The OER-approved Remedial Action Work Plan dated [date] and Stipulations in a letter dated [date] were implemented and that all requirements in those documents have been substantively complied with. I certify that contaminated soil, fill, liquids or other material from the property were taken to facilities licensed to accept this material in full compliance with applicable laws and regulations.

Name: Tarek Z. Khouri

PE License Number: 086611

Signature

Date

PE Stamp

I, Mark E. Robbins, am a Qualified Environmental Professional. I had primary direct responsibility for implementation of the remedial program for the 64 North 8th Street, Brooklyn, NY site, site number 20CVCP038K. I certify to the following:

- The OER-approved Remedial Action Work Plan dated [date] and Stipulations in a letter dated [Date] were implemented and that all requirements in those documents have been substantively complied with. I certify that contaminated soil, fill, liquids or other material from the property were taken to facilities licensed to accept this material in full compliance with applicable laws and regulations.

QEP Name: Mark E. Robbins

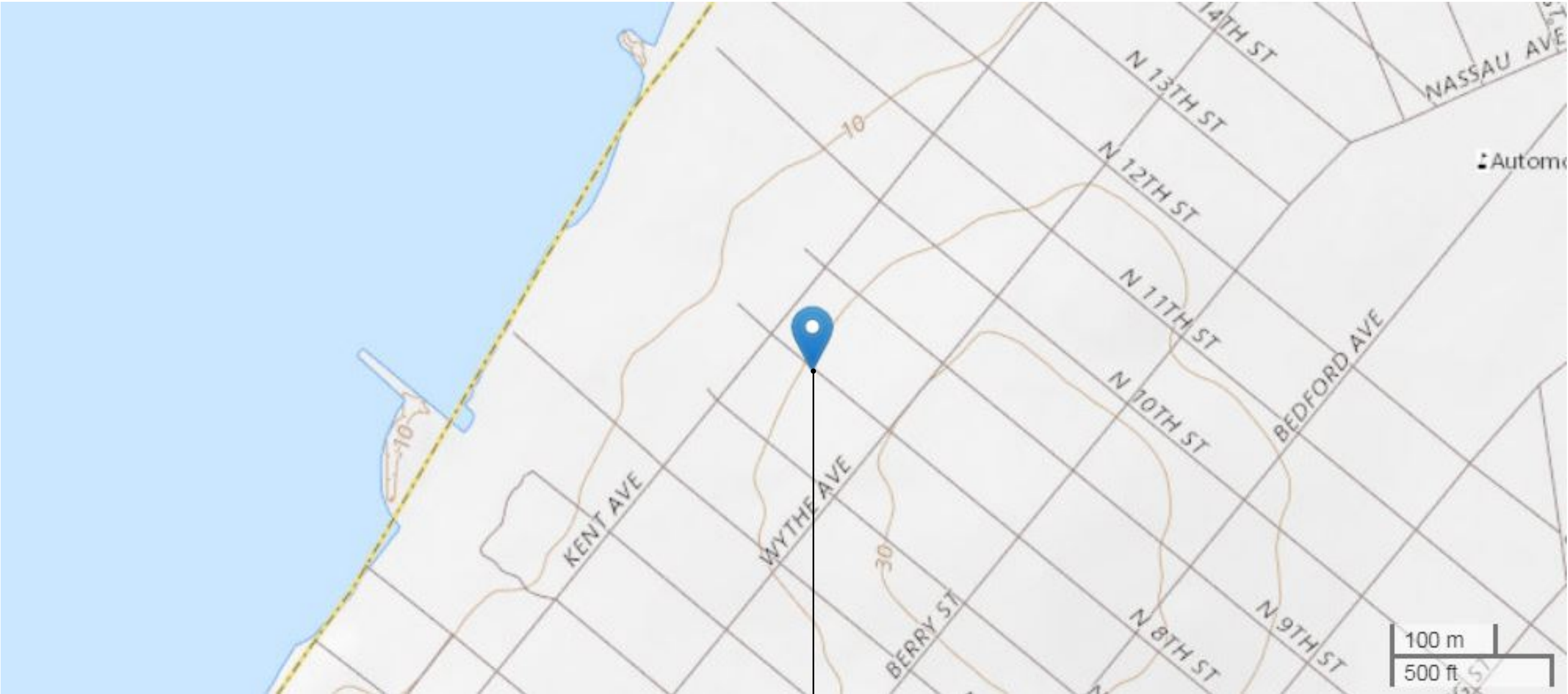
QEP Signature

Date

7.0 Schedule

The table below presents a schedule for the proposed remedial action and reporting. If the schedule for remediation and development activities changes, it will be updated and submitted to OER. Currently, a 7-month remediation period is anticipated.

| Schedule Milestone | Weeks from Remedial Action Start | Duration (weeks) |
|---|---|-------------------------|
| OER Approval of RAWP | 0 | - |
| Fact Sheet 2 announcing start of remedy | 0 | - |
| Mobilization | 1 | 1 |
| Remedial Excavation/Construction | 21 | 20 |
| Demobilization | 23 | 2 |
| Submit Remedial Action Report | 27 | 4 |



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FAX: (631) 462-5877

BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS
64 NORTH 8TH STREET, BROOKLYN

PROJECT FIGURE
FIGURE 1: SITE LOCATION PLAN

| | |
|---------------------------|---------------------|
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| DRAWN BY G.T. | REVIEWED BY R.X. |
| SCALE (11X17) AS NOTED | APPROVED BY T.K. |



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PROJECT FIGURE

FIGURE 2: SITE BOUNDARY PLAN

| | |
|---------------------------|---------------------|
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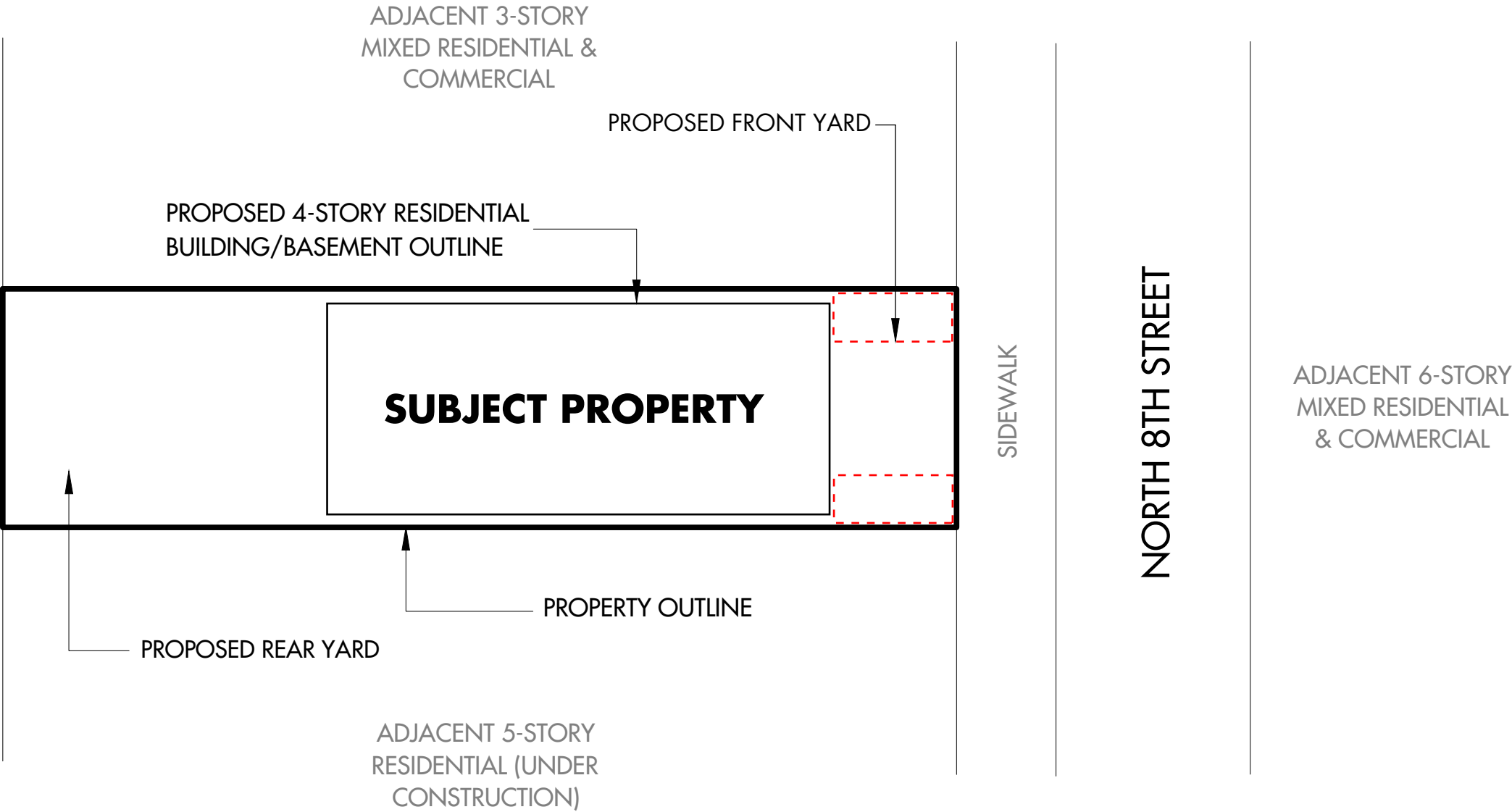
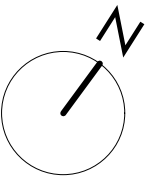
PROJECT NAME AND ADDRESS

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BROOKLYN, NY

PROJECT FIGURE

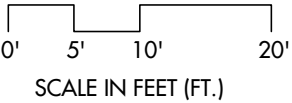
FIGURE 3: PROPOSED
DEVELOPMENT PLAN

| | |
|---------------------------|---------------------|
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LEGEND

POTENTIAL LANDSCAPED AREA TO BE DETERMINED DURING THE CONSTRUCTION



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PROJECT FIGURE

FIGURE 4: SURROUNDING LAND USE

| | |
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Legend

Transit, Roads, Reference Features

Roads, ferries, commuter rail, neighborhood names

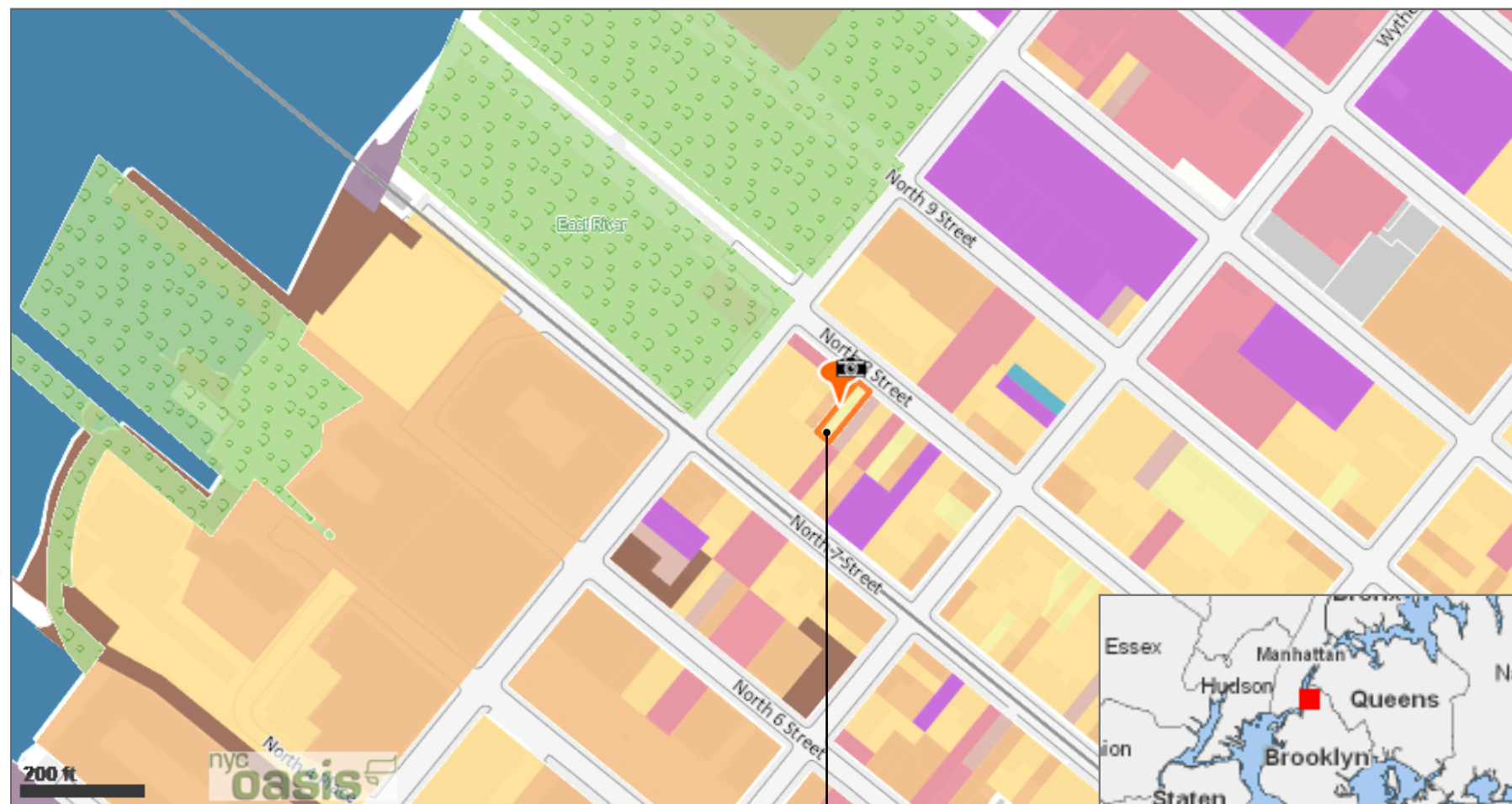
- Roads
- Major Roads
- Interstate Highways
- Tunnels
- NYC subway routes and stations
- Neighborhood/Town Labels
- County Boundaries
- Ferry
- Commuter Rail

Parks, Playgrounds, & Open Space

- Parks & Public Lands
- 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

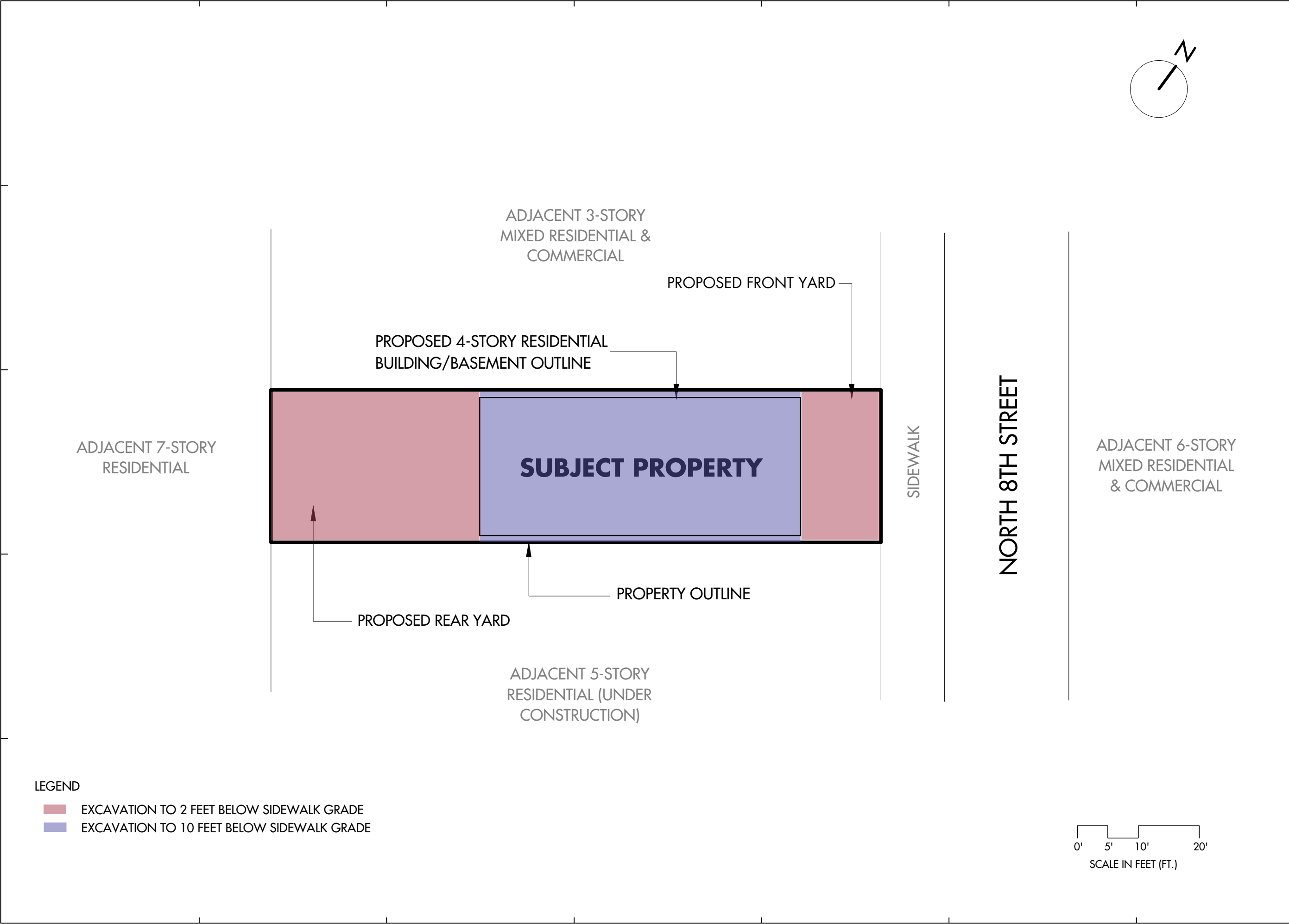
- 1 & 2 Family Residential
- Multi-family Residential
- Mixed Use
- Open space & outdoor recreation
- Commercial
- Institutions
- Industrial
- Parking
- Transportation / Utilities
- Vacant Lots



BY-NC-SA This map was created using the Open Accessible Space Information System (OASIS) website, licensed under a [Creative Commons Attribution-Noncommercial-Share Alike 3.0 United States License](https://creativecommons.org/licenses/by-nc-sa/3.0/). Visit www.oasisnyc.net for the latest information about data sources and notes about how the maps were developed. Contact oasisnyc@gc.cuny.edu with questions or comments. OASIS is developed and maintained by the [Center for Urban Research](https://www.gc.cuny.edu/center-for-urban-research/), CUNY Graduate Center.

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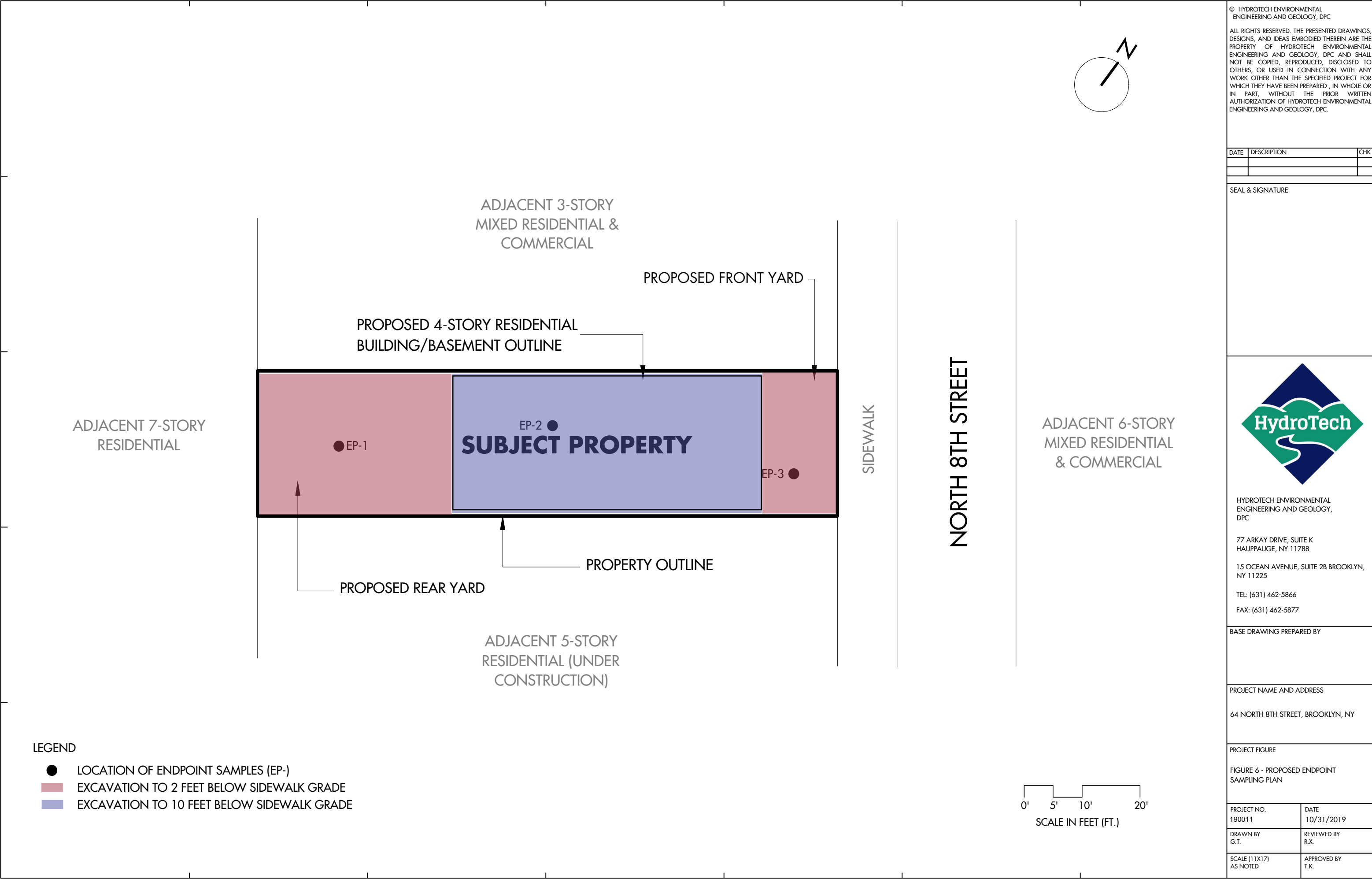
PROJECT NAME AND ADDRESS

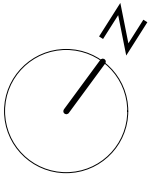
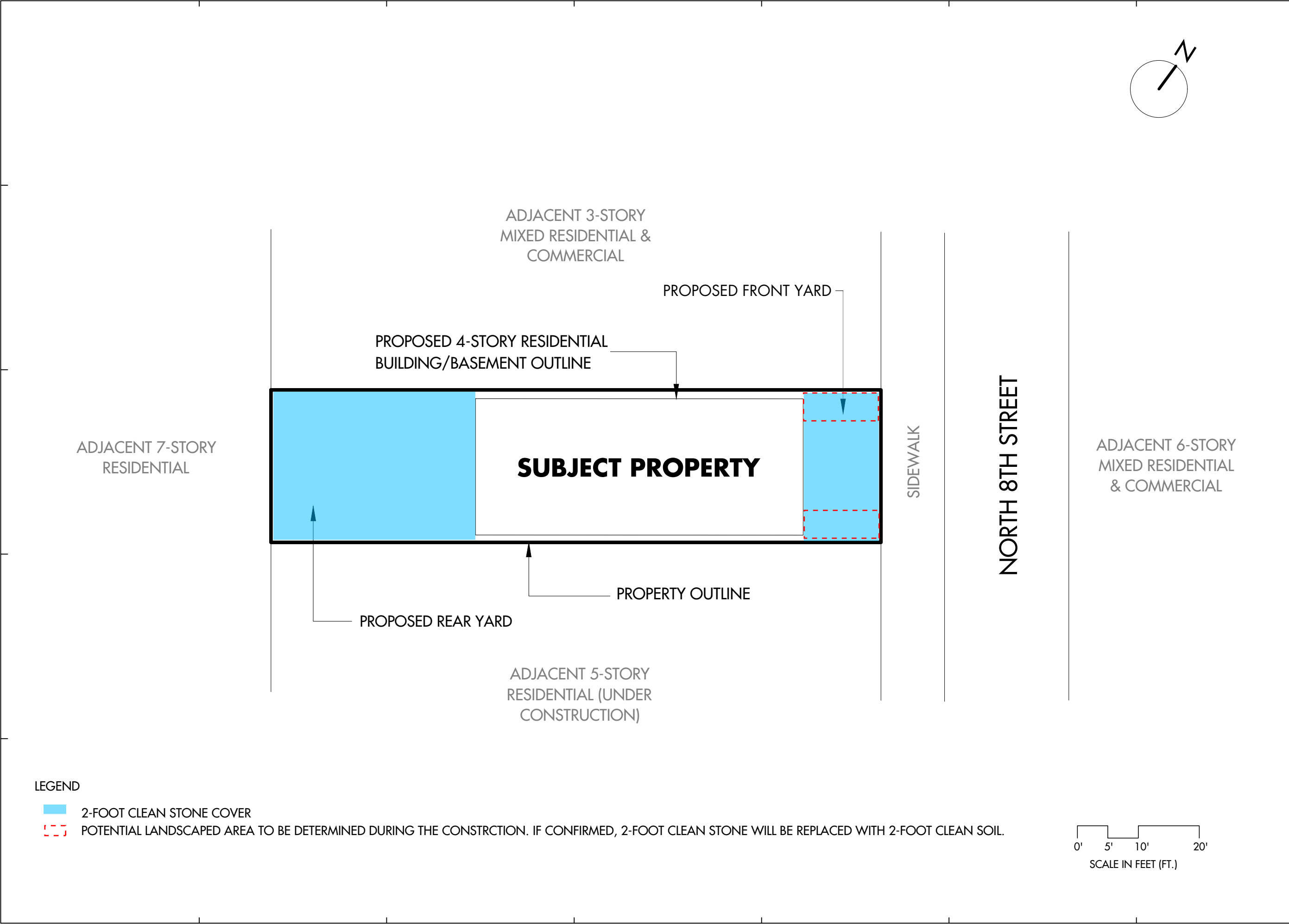
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PROJECT FIGURE

FIGURE 5 - PROPOSED EXCAVATION PLAN

| | |
|---------------------------|---------------------|
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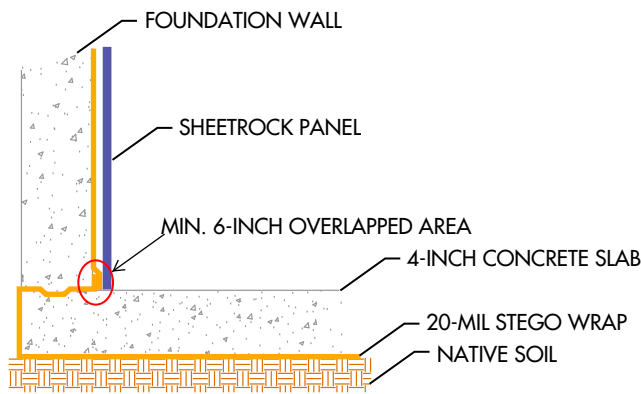
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PROJECT FIGURE

FIGURE 7 - BACKFILL PLAN

| | |
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TYPICAL SLAB TO WALL DETAIL

ADJACENT 3-STORY
MIXED RESIDENTIAL &
COMMERCIAL

PROPOSED FRONT YARD

PROPOSED 4-STORY RESIDENTIAL
BUILDING/BASEMENT OUTLINE

SUBJECT PROPERTY

PROPERTY OUTLINE

PROPOSED REAR YARD

ADJACENT 5-STORY
RESIDENTIAL (UNDER
CONSTRUCTION)

ADJACENT 7-STORY
RESIDENTIAL

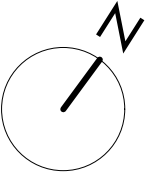
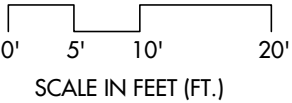
SIDEWALK

NORTH 8TH STREET

ADJACENT 6-STORY
MIXED RESIDENTIAL
& COMMERCIAL

LEGEND

 20-MIL STEGO WRAP UNDERNEATH THE BASEMENT SLAB AND INSIDE THE FOUNDATION WALL



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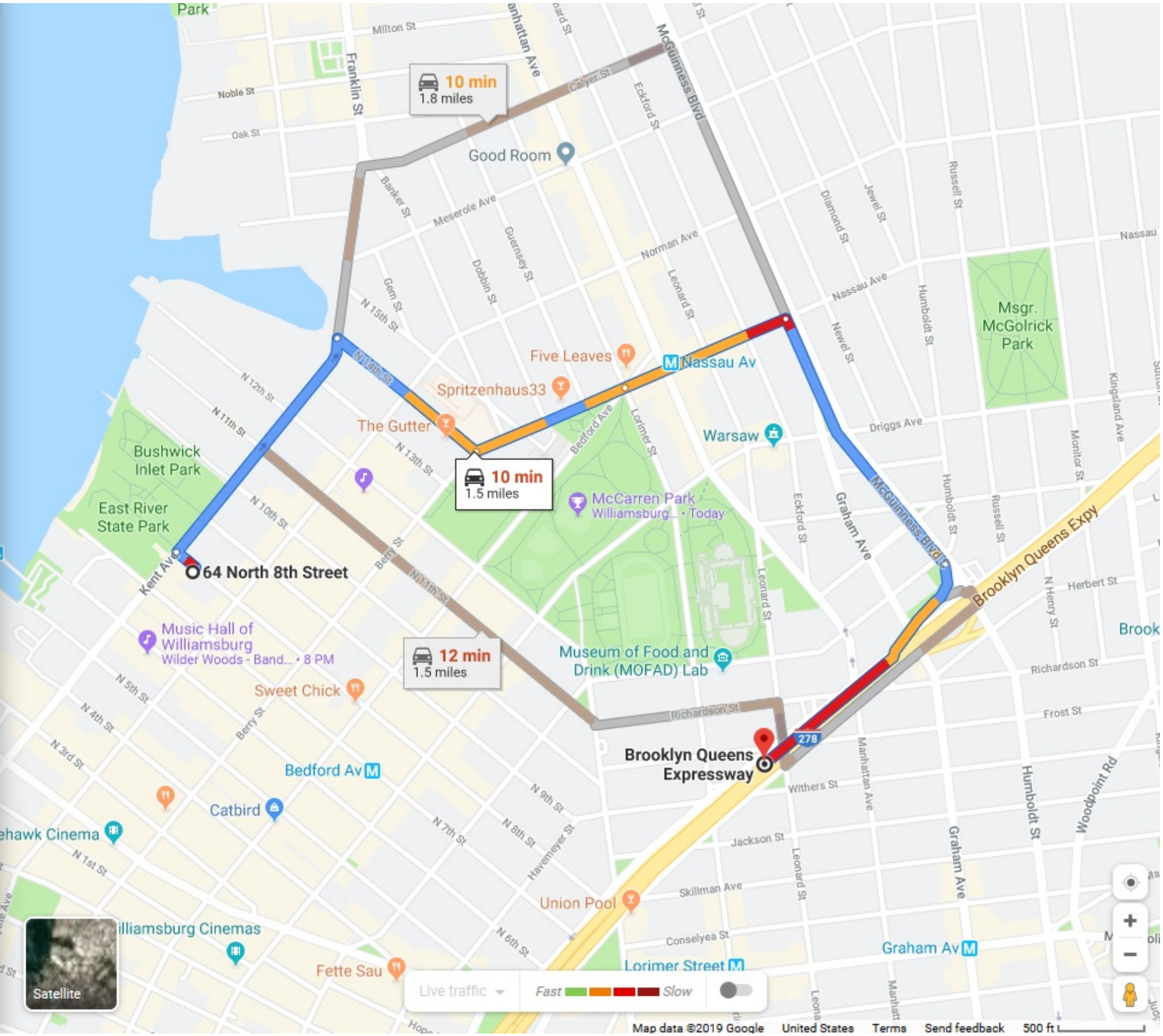
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64 NORTH 8TH STREET, BROOKLYN, NY

PROJECT FIGURE

FIGURE 8B: DESIGN AND DETAIL OF
ENGINEERING CONTROLS - VAPOR BARRIER
SYSTEM

| | |
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PROJECT FIGURE
FIGURE 9: TRUCK ROUTE

| | |
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| SCALE (11X17) AS NOTED | APPROVED BY T.K. |

APPENDIX 1: PROPOSED DEVELOPMENT PLANS

PROJECT INFORMATION

64 NORTH 8TH ST
BROOKLYN, NY 11249
BOROUGH: BROOKLYN
BLOCK: 2317 LOT: 12
ZONING: M1-2/R6B, MX-8
ZONING MAP:12C

COMMUNITY BOARD : 301
FIRE INDEX :1 (TABLE 3-1)
USE GROUP: 2
OCCUPANCY GROUP: R-2 (2014 B.C.)
CONSTRUCTION CLASS: IB (2014 B.C.)
MULTIPLE DWELLING CLASS: HAEA

SCOPE OF WORK:
NEW 4 STORY RESIDENTIAL BUILDING OF 7 UNITS WITH CELLAR

- LOT AREA 2,500 SF SEE PLOT PLAN
- TOTAL CONSTRUCTION FLOOR AREA 5,229.34+1,307.33 (CELLAR) = 6,536.67 SQ. FT.
- TOTAL ZONING FLOOR AREA: 4,968.56 SEE SHEET Z-102 TOTAL GROSS F.A. DEDUCTION TABLE FOR ANALYSIS
- N. 8TH STREET WIDTH: 60'<80' (NARROW STREET).

| ZONING ANALYSIS : | | |
|---|--|--|
| ITEM | PERMITTED / REQUIRED | PROPOSED |
| | USE PERMITTED | USE GROUP 2,4 |
| ZR 123-63 ZR 23-00 ZR 23-153 ZR 23-154 | MAX F.A.R RESIDENTIAL INCLUSIONARY HOUSING DESIGNATED AREAS | 2.0 X 2,500 SF = 5,000 SF BASE FLOOR AREA RATIO 2.0 X 2,500 SF = 5,000 SF |
| | | FLOOR RESIDENTIAL 1ST 889.44 SF 2ND 1,254.19 SF 3RD 1,254.19 SF 4TH 1,254.19 SF PH 254.49 SF TOTAL 4,906.51 RESIDENTIAL (SEE DEDUCTIONS AT SHEET Z-102) F.A.R. 2.00- PROPOSED 1.987- OK |
| ZR 123-63 ZR 23-153 | LOT COVERAGE RESIDENTIAL INTERIOR LOT 60% | 0.60 x 2,500 = 1,500 SF MAX PERMITTED |
| ZR 23-22 ZR 23-32 | DENSITY MINIMUM LOT AREA | PERMITTED RESIDENTIAL FLOOR AREA 5,000 SF 5,000 / 680 ≈7.35 ~ 7 UNITS 2,500 SF THEREFORE OK |
| ZR 23-32 | MINIMUM LOT WIDTH | 18 FT |
| ZR 23-132 | BALCONIES | BALCONIES ARE PERMITTED AT THE FLOOR LEVEL OF THIRD STORY AND UP, NOT EXCEEDING 50% OF THE WIDTH OF BLDG WALL, NOT PROJECT GREATER THEN 7 FEET OF BLDG WALL. |
| ZR 23-62 (B)(1) | PERMITTED OBSTRUCTION STAIR AND ELEVATOR BULKHEAD | SUCH OBSTRUCTIONS SHALL BE LOCATED NOT LESS THAN 10 FT FROM STREET WALL OF BLDG BULKHEAD IS PROPOSED 17'-3" FT FROM STREET WALL THEREFORE OK |

| YARDS | | | |
|-------------------------|------------|----------------|---------------------|
| ZR 123-651 | FRONT YARD | NOT REQUIRED | 8'-0" |
| ZR 123-651 ZR 23-462 | SIDE YARD | 0'-0" OR 8'-0" | 0'-0" |
| ZR 23-47 | REAR YARD | 30'-0" | 39'-6" THEREFORE OK |

HEIGHT AND SETBACK

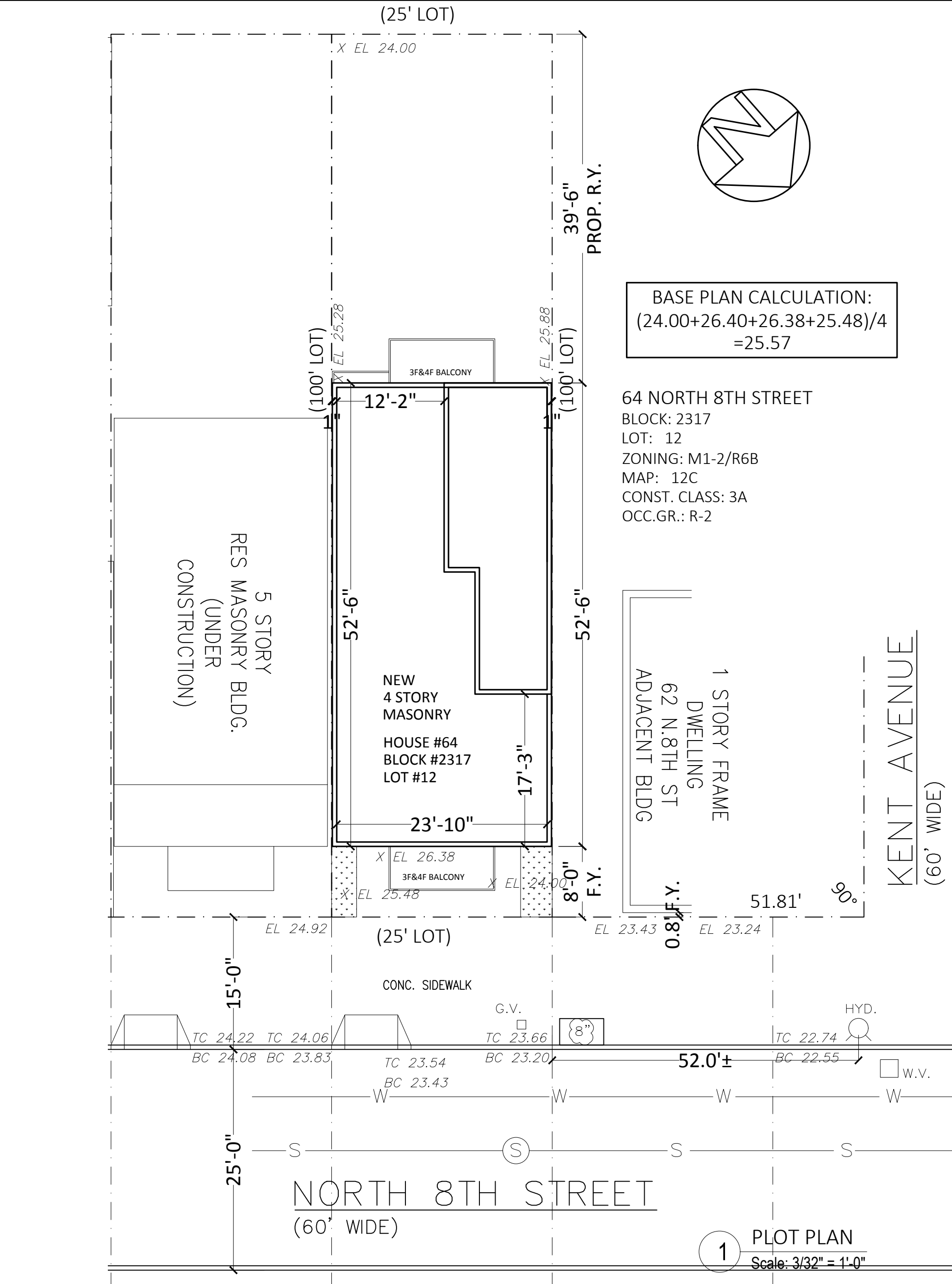
| | | | |
|-------------------------------|--|--|--|
| ZR 123-662(B) | | In the districts indicated, for all buildings, and for Quality Housing buildings on narrow streets in R6 and R7 Districts without a letter suffix, the street wall of a building on a zoning lot with less than 50 feet of frontage along a street line shall be located no closer to the street line than the street wall of an adjacent existing building. | ADJACENT BUILDING IS ON STREET LINE PROPOSED STREET WALL LOCATION IS 13'-0" FURTHER WITH ADJ. BUILDING. |
| ZR 23-661(B)(2) | STREET WALL LOCATION | | |
| ZR 123-662(B) | MINIMUM BASE HEIGHT | 30'-0" | 40'-0" |
| ZR 23-662(A) | MAXIMUM BASE HEIGHT | 40'-0" | 40'-0" |
| | MAXIMUM BUILDING HEIGHT | 50'-0" | 50'-0" |
| ZR 123-662(B) ZR 23-662(C) | SETBACK(NARROW STREET) ABOVE MAX BASE HT. | 15'-0" | NO SET BACK REQUIRED UNDER MAX. BASE HEIGHT |

PARKING REQUIREMENTS

| RESIDENTIAL | | | |
|-------------|-----------------------------|---|-------------------------------|
| ZR 25-23 | REQUIRED PARKING | 50% OF TOTAL PROPOSED UNITS 7 UNITS X 50% = 3.5 CAR PARKING REQUIRED | WAIVED, 1 PROPOSED. |
| ZR 25-261 | WAIVER FOR DEVELOPMENTS | UP TO 5 CAR PARKING SPACED WAIVED FOR ZONE R6B | |
| ZR 25-811 | BICYCLE PARKING RESIDENTIAL | 1 PER 2 DWELLING UNITS 7 UNITS / 2 = 3.5 BICYCLE PARKING REQUIRED. | WAIVED, 0 PROPOSED. |
| | | (A) BUILDINGS# OR BUILDING SEGMENTS CONTAINING 10 DWELLING UNITS OR LESS; PROPOSED 7 UNIT | |
| ZR 23-03 | STREET TREE PLANTING | 1 PER 25' OF STREET FRONTAGE ~ 25'-0"/ 25' =1 REQ'D | 1 TREE PROPOSED TO TREE FUND. |

QUALITY HOUSING REQUIREMENTS

| | REGULATIONS | CONFORMING CONDITIONS |
|----------|--|---|
| ZR 28-12 | REFUSE DISPOSAL ROOM - REQ'D FOR 9 UNIT AND MORE PROP'D 7 UNITS, NO REFUSE STORAGE AND DISPOSAL ROOM PROVIDED | WAIVED, 0 PROPOSED |
| ZR 28-13 | LAUNDRY FACILITY 1 WASHING PER 20 UNITS 1 DRYER PER 40 UNITS | NON REQUIRED |
| ZR 28-14 | DAYLIGHT IN CORRIDORS | FIFTY PERCENT OF THE SQUARE FOOTAGE OF A CORRIDOR MAY BE EXCLUDED FROM F.A. IF A WINDOW IS PROVIDED |
| ZR 28-21 | REQUIRED RECREATION SPACE OF 3.3% OF RESIDENTIAL FLOOR AREA WITH 9 OR MORE #DWELLING UNITS | PROPOSED 7 UNITS, NO RECREATION SPACE REQUIRED AND PROPOSED |
| ZR 28-23 | PLANTING AREA - BETWEEN STREET LINE AND STREET WALL OF BUILDING | FRONT YARD EXCEPT ENTRANCE IS PLANTED AT GROUND LEVEL (SEE PLOT PLAN) |
| ZR 28-31 | DENSITY PER CORRIDOR - IF LESS THAN 11 UNITS PER CORRIDOR, 50% OF THE S.F. OF A CORRIDOR MAY BE EXCLUDED FROM F.A. | CORRIDORS ARE SERVING LESS THAN 11 UNITS PER FLOOR |
| ZR 28-40 | PARKING FOR QUALITY HOUSING | NO PARKING REQUIREMENT, SEE PARKING REQUIREMENT ANALYSIS ABOVE |



ITEMS SUBJECT TO CONTROLLED INSPECTION THE FOLLOWING PROCEDURES SHALL BE SUBJECT TO SPECIAL INSPECTION:

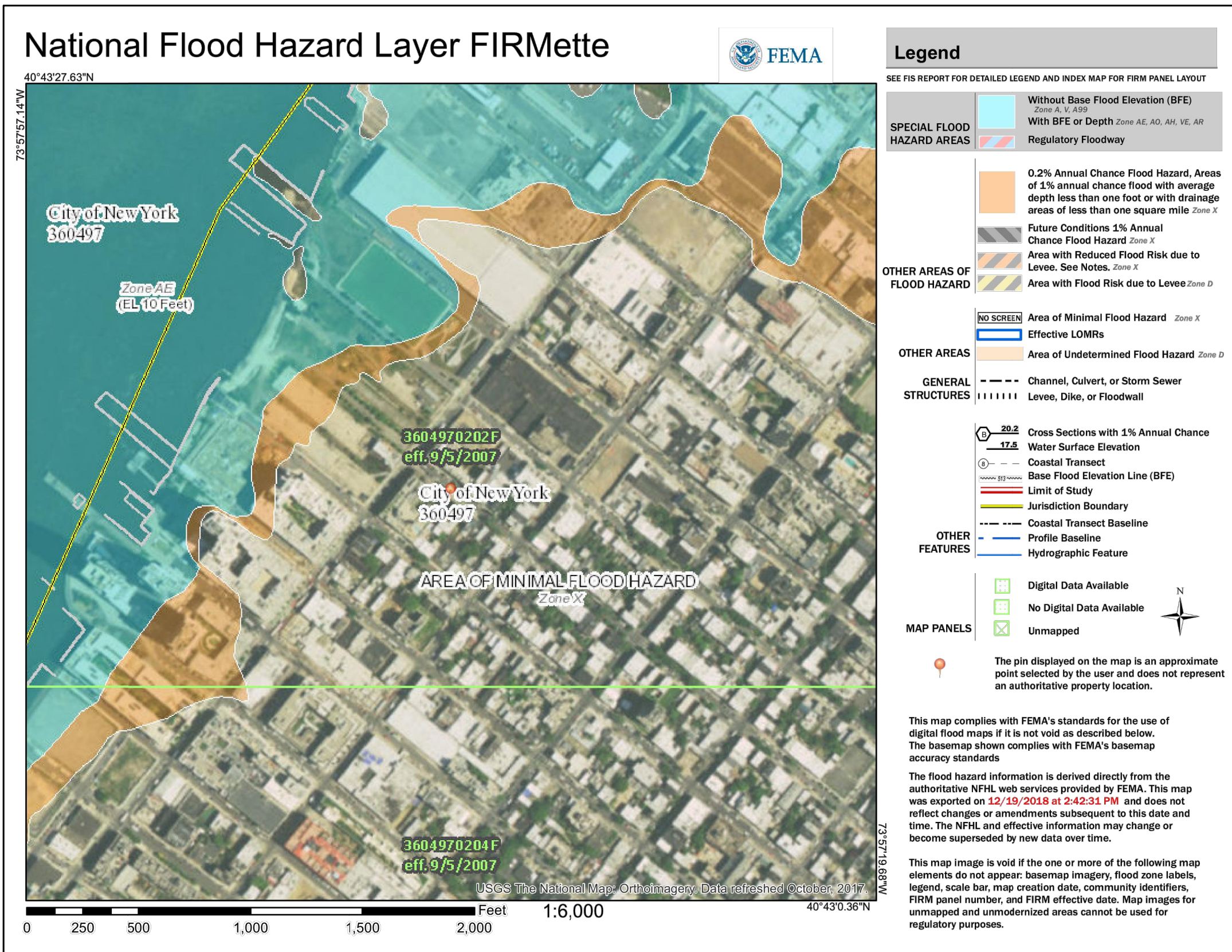
- SPECIAL INSPECTIONS:
- STRUCTURAL STEEL - WELDING
 - STRUCTURAL STEEL - DETAILS
 - STRUCTURAL STEEL - HIGH STRENGTH BOLTING
 - STRUCTURAL COLD - FORMED STEEL
 - CONCRETE CAST IN PLACE
 - MASONRY
 - SUBGRADE INSPECTION
 - MECHANICAL SYSTEMS
 - EXCAVATION - SHEETING SHORING AND BRACING
 - PRIVATE ON-SITE STORM WATER DRAINAGE DISPOSAL SYSTEMS, AND DETENTION FACILITIES INSTALLATION
 - SPRINKLER SYSTEMS
 - FIRE-RESISTANT PENETRATIONS AND JOINTS
 - CONCRETE DESIGN MIX
 - CONCRETE SAMPLING AND TESTING

- PROGRESS INSPECTIONS:
- PRELIMINARY
 - FOOTING AND FOUNDATION
 - ENERGY CODE COMPLIANCE INSPECTION TR8
 - FIRE RESISTANCE RATED CONSTRUCTION

DRAWING LIST

- | | |
|--------|--|
| Z-001 | PLOT PLAN, BUILDING INFORMATION, ZONING ANALYSIS, ZONING, TAX & FLOODING MAP |
| Z-002 | GENERAL NOTES, BUILDING ENVELOPE & ISOMETRIC DIAGRAM |
| Z-003 | FLOOR AREA & AREA DEDUCTION DIAGRAMS |
| A-101 | CELLAR, FIRST FLOOR PLAN, DOOR & WINDOW SCHEDULE |
| A-102 | SECOND, THIRD & FOURTH FLOOR PLAN |
| A-103 | 5TH, ROOF & BULKHEAD FLOOR PLAN |
| A-201 | ELEVATIONS |
| A-301 | SECTIONS |
| A-500 | DETAILS |
| A-501 | WALL TYPES |
| SP-100 | 1ST/2ND/3RD SPRINKLER PLAN, SPRINKLER DETAILS AND NOTES |
| SP-101 | 4TH/5TH/ROOF SPRINKLER PLAN, SPRINKLER DETAILS AND NOTES |
| P-100 | PLUMBING NOTES, RISER DIAGRAMS |
| E-100 | REFLECTED CEILING PLAN |
| E-101 | LIGHTING TABLE CHATS & ENERGY RELATED DATA |
| EN-100 | COMCHECK |
| EN-101 | COMCHECK |
| EN-102 | COMCHECK |
| EN-103 | TR8 INSPECTIONS ITEMS, ENERGY RELATED DATA |
| M-100 | MECHANICAL GENERAL NOTES & DETAILS |
| M-101 | MECHANICAL FLOOR PLAN |
| M-102 | MECHANICAL NOTES |

4 FLOODING MAP
Scale: N.T.S.



2 ZONING MAP
Scale: N.T.S.



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| | |
|-----------------|----------------|
| TAX BLOCK | 2317 |
| TAX LOT | 12 |
| ZONING DISTRICT | M1-2/R6B, MX-8 |
| ZONING MAP # | 12C |

PROJECT LOCATION: 64 NORTH 8TH ST
BROOKLYN, NY 11249

DRAWING
TITLE:

CELLAR, FIRST TO
THIRD FLOOR PLANS

| | | |
|-------------------|-------------------|---------|
| SEAL & SIGNATURE: | DATE : 08.07.2019 | |
| | PROJECT NO.: | |
| | DRAWN BY : RV | |
| | CHECK BY : LL | |
| | SHEET NO.: | |
| | A-101.00 | |
| CAD LOCATION: | | 5 OF 23 |

DOB STAMP:

| | | |
|----------|--|---|
| | | NEW INTERIOR PARTITION = 3-5/8" METAL STUDS @ 16" O.C. (1) LAYER 5/8" THK. SHEETROCK ON BOTH SIDES, NON-FIRE RATED. |
| P1 | | NEW INTERIOR PARTITION = 3-5/8" METAL STUDS @ 16" O.C. (2) LAYERS FC #60 5/8" THK. SHEETROCK ON BOTH SIDES, (2) HR. FIRE RATED. |
| W1 | | NEW, STUD EXTERIOR WALL W/FACE BRICK= 3-5/8" FACE BRICK, 1" AIR SPACE, 1" RIGID INSUL.(R-5), TYVEK WRAP & EXTERIOR SHEATHING ON 3-5/8" METAL STUD @ 16" O.C. WITH R-15 BATT INSUL., (1) LAYER 5/8" TYPE "X" GYP BD. (1) HR. FIRE RATED. |
| W2 | | NEW, STUD EXTERIOR WALL = TYVEK WRAP & EXTERIOR SHEATHING ON 3-5/8" METAL STUD @ 16" O.C. WITH R-15 BATT INSUL., (1) LAYER 5/8" TYPE "X" GYP BD ON BOTH SIDES, (1) HR. FIRE RATED. |
| W3 | | NEW CMU EXTERIOR WALL = 1" STUCCO RENDERING, 1" RIGID INSUL.(R-5), 6" LOAD BEARING CONCRETE MASONRY UNIT, 3-5/8" MTL. STUD, (1) LAYER 5/8" TYPE "X" GYP. BD. (1) HR. RATED. |
| W5 | | NEW REINFORCED CONCRETE FOUNDATION WALL = #4 REBARS @ 12" O.C. + 3-5/8" MTL. STUD WITH R-15 BATT INSUL + (1) LAYER 5/8" TYPE "X" GYP. BD. INSIDE, (2) HR. RATED. |
| | | SMOKE DETECTOR CARBON MONOXIDE DETECTOR HARDWIRED AND TO BE INTERCONNECTED |
| | | (FD) FLOOR DRAIN (AD) AREA DRAIN (RD) ROOF DRAIN |
| | | DOOR TAG |
| | | WINDOW TAG |
| | | WALL TAG |
| F.P.S.C. | | FIRE PROOF SELF CLOSE DOOR |
| | | EXIT SIGN & EMERGENCY LIGHTING |
| | | INTERCOMM. SYSTEM |

| | | |
|----------------------------------|--|--|
| RESIDENTIAL APT.1 | BEDROOM : 147 SF | LIVING ROOM : 173 SF |
| OCCUPANCY LOAD | REQ'D LIGHT : 14.7 SF | REQ'D LIGHT : 17.3 SF |
| TABLE 1004.1.2 | REQ'D AIR : 7.35 SF | REQ'D AIR : 8.65 SF |
| RESIDENTIAL : 200 GROSS | PRO'D LIGHT : (5'-0" X 6'-0") | PRO'D LIGHT : (5'-0" X 6'-0") |
| WITHIN THE DWELLING UNITS | =30 SF | =54 SF |
| AREA 701 / 200 = 3.51 USE | PRO'D AIR : (5'-0" X 6'-0") / 2 | PRO'D AIR : (9'-0" X 6'-0") / 2 |
| 3 PERSONS | = 15 SF | = 37 SF |
| RESIDENTIAL APT.2A | BEDROOM : 98 SF | LIVING ROOM : 182 SF |
| OCCUPANCY LOAD | REQ'D LIGHT : 9.8 SF | REQ'D LIGHT : 18.2 SF |
| TABLE 1004.1.2 | REQ'D AIR : 5.9 SF | REQ'D AIR : 9.1 SF |
| RESIDENTIAL : 200 GROSS | PRO'D LIGHT : (5'-0" X 6'-0") | PRO'D LIGHT : (5'-0" X 6'-0") |
| WITHIN THE DWELLING UNITS | =30 SF | =30 SF |
| AREA 546 / 200 = 2.78 USE | PRO'D AIR : (5'-0" X 6'-0") / 2 | PRO'D AIR : (5'-0" X 6'-0") / 2 |
| 2 PERSONS | = 15 SF | = 15 SF |
| RESIDENTIAL APT.2B | BEDROOM : 156 SF | LIVING ROOM : 179 SF |
| OCCUPANCY LOAD | REQ'D LIGHT : 15.6 SF | REQ'D LIGHT : 17.9 SF |
| TABLE 1004.1.2 | REQ'D AIR : 7.8 SF | REQ'D AIR : 8.95 SF |
| RESIDENTIAL : 200 GROSS | PRO'D LIGHT : (5'-0" X 6'-0") | PRO'D LIGHT : (5'-0" X 6'-0") |
| WITHIN THE DWELLING UNITS | =30 SF | + (3'-0" X 6'-0") = 48 SF |
| AREA 596 / 200 = 2.97 USE | PRO'D AIR : (5'-0" X 6'-0") / 2 | PRO'D AIR : (5'-0" X 6'-0") |
| 2 PERSONS | = 15 SF | + (3'-0" X 6'-0") / 2 = 24 SF |

BC 1009.1 - 2014 NYC CONSTRUCTION CODE

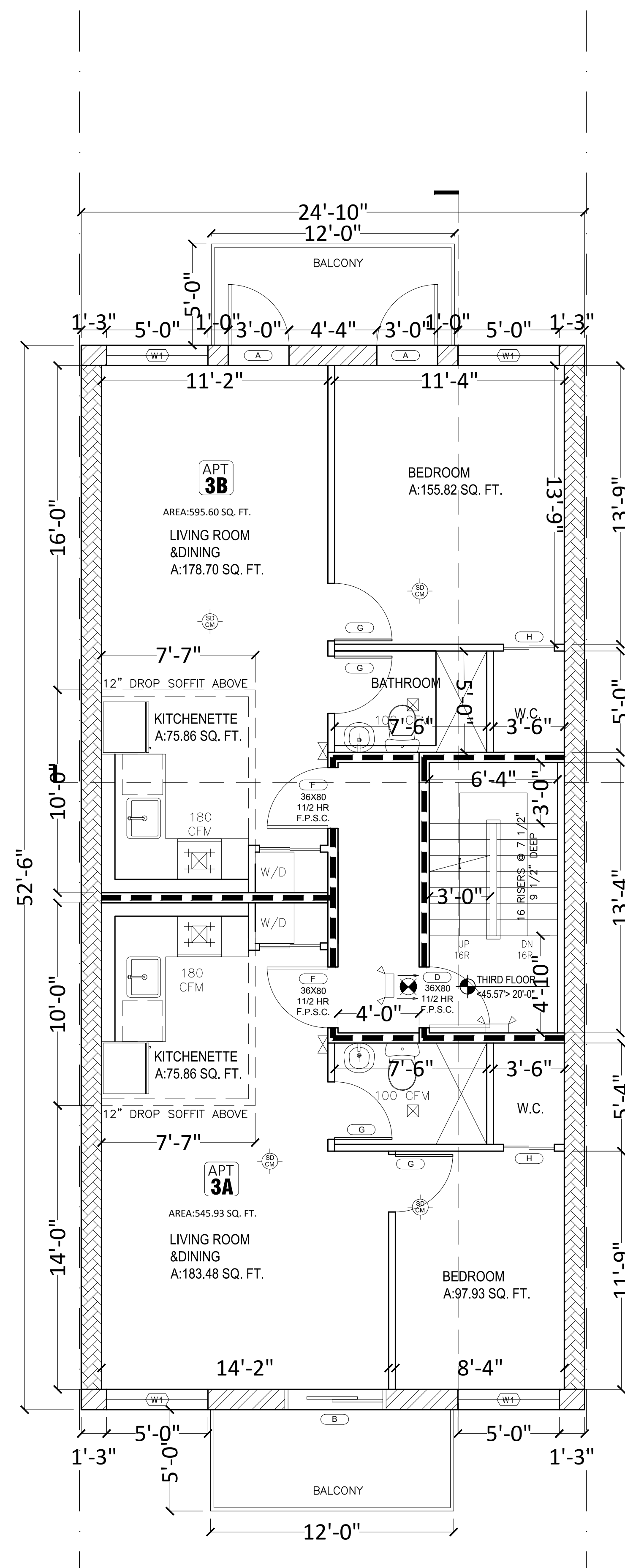
STAIRWELL WIDTH, NOT LESS THAN 44" BUT, EXCEPTIONS:

1. A WIDTH OF NOT LESS THAN 36 INCHES (914 MM) SHALL BE PERMITTED IN:
 - 1.1. A STAIRWAY THAT SERVES AN OCCUPANT LOAD OF 50 OR LESS CUMULATIVE FOR ALL STORIES; OR
 - 1.2. A STAIRWAY THAT PROVIDES EGRESS TO THE EXIT DISCHARGE SOLELY FOR THE USE OF GROUP R-2 OCCUPANCIES, PROVIDED THE BUILDING IT SERVES IS 125 FEET (38 100 MM) OR LESS IN HEIGHT, AND PROVIDED SUCH A STAIRWAY SERVES NOT MORE THAN 30 OCCUPANTS PER FLOOR.

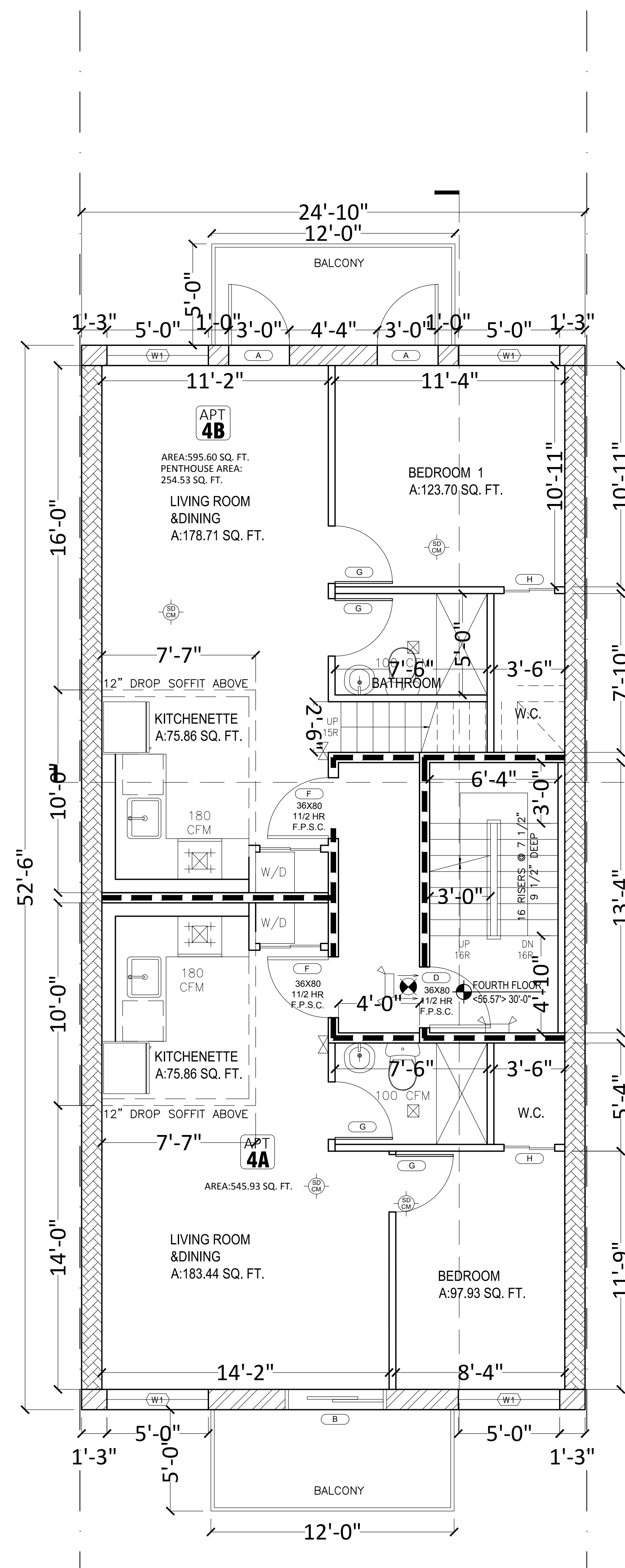
Scale: 1/4" = 1'-0"

Scale: $1/4" = 1'-0"$

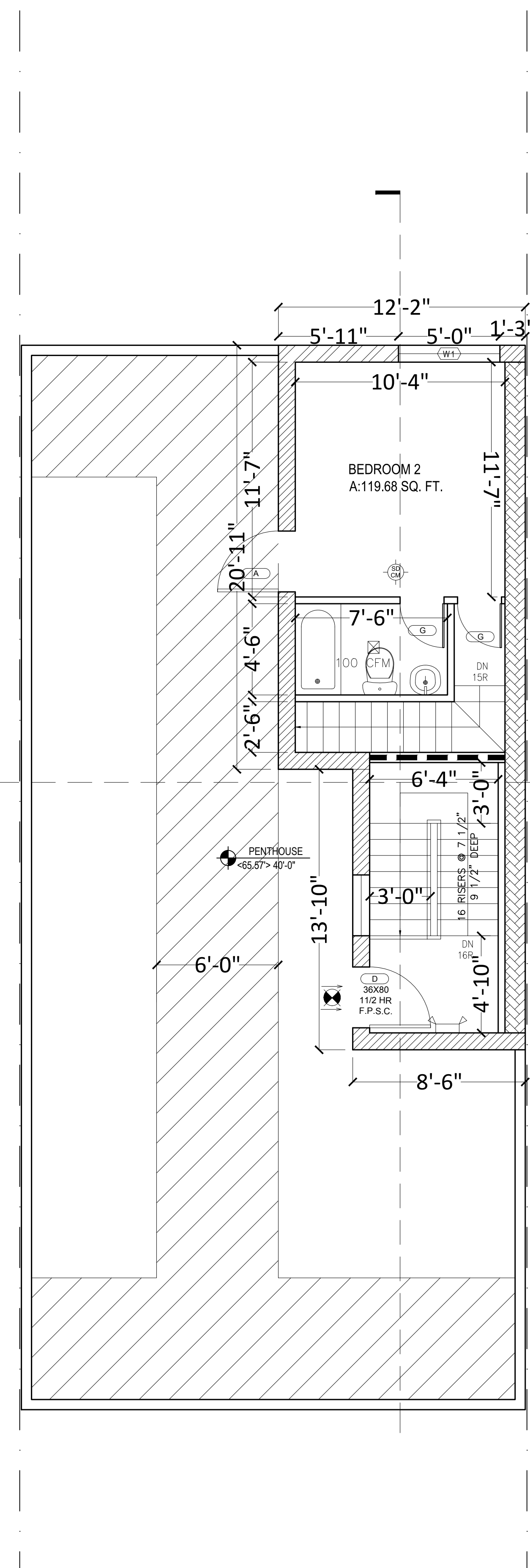
Scale: 1/4" = 1'-0"



1 3RD FLOOR PLAN
Scale: 1/4" = 1'-0"



1 4TH FLOOR PLAN
Scale: 1/4" = 1'-0"



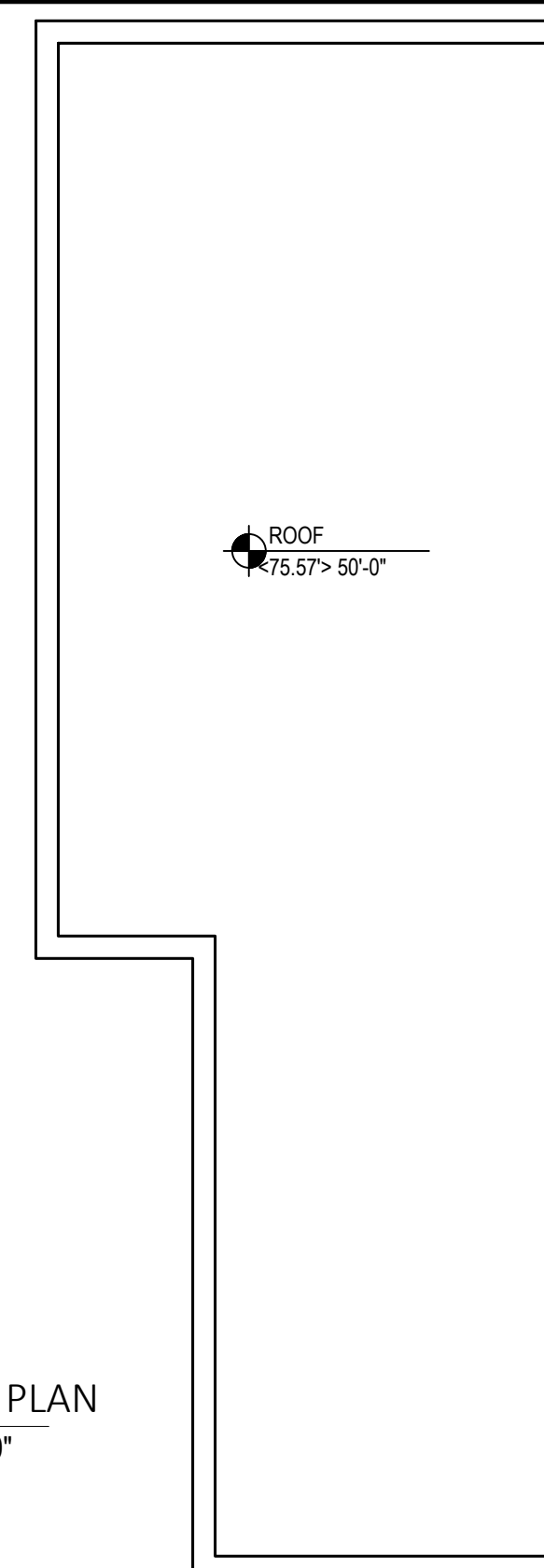
2 PENTHOUSE FLOOR PLAN
Scale: 1/4" = 1'-0"



| | | |
|--|--|--|
| | | NEW INTERIOR PARTITION = 3-5/8" METAL STUDS @ 16" O.C., (1) LAYER 5/8" THK. SHEETROCK ON BOTH SIDES, NON-FIRE RATED. |
| | | NEW INTERIOR PARTITION = 3-5/8" METAL STUDS @ 16" O.C., (2) LAYERS FC #60 5/8" THK. SHEETROCK ON BOTH SIDES, (2) HR. FIRE RATED. |
| | | NEW. STUD EXTERIOR WALL W/FACE BRICK= 3-5/8" FACE BRICK, 1" AIR SPACE, 1" RIGID INSUL(R-5), TYVEK WRAP & EXTERIOR SHEATHING ON 3-5/8" METAL STUD @ 16" O.C. WITH R-15 BATT INSUL., (1) LAYER 5/8" TYPE "X" GYP BD, (1) HR. FIRE RATED. |
| | | NEW. STUD EXTERIOR WALL = TYVEK WRAP & EXTERIOR SHEATHING ON 3-5/8" METAL STUD @ 16" O.C. WITH R-15 BATT INSUL., (1) LAYER 5/8" TYPE "X" GYP BD ON BOTH SIDES, (1) HR. FIRE RATED. |
| | | NEW CMU, EXTERIOR WALL = 1" STUCCO RENDERING, 1" RIGID INSUL(R-5), 6" LOAD BEARING CONCRETE MASONRY UNIT, 3-5/8" MTL. STUD, (1) LAYER 5/8" TYPE "X" GYP. BD. (1) HR. RATED. |
| | | NEW REINFORCED CONCRETE FLOOR SLAB = #4 REBARS @ 12" O.C. + 3-5/8" MTL. STUD WITH R-15 BATT INSUL + (1) LAYER 5/8" TYPE "X" GYP. BD. INSIDE, (2) HR. RATED. |
| | | SMOKE DETECTOR CARBON MONOXIDE DETECTOR HARDWIRED AND TO BE INTERCONNECTED |
| | | (FD) FLOOR DRAIN (AD) AREA DRAIN (RD) ROOF DRAIN F.P.S.C. FIRE PROOF SELF CLOSED DOOR |
| | | DOOR TAG |
| | | WINDOW TAG |
| | | WALL TAG |
| | | EXIT SIGN & EMERGENCY LIGHTING |
| | | |
| | | INTERCOMM. SYSTEM |

LIGHT AND AIR CALCULATIONS

| | | |
|--|---|--|
| <u>RESIDENTIAL APT.3A</u> <u>OCCUPANCY LOAD</u> TABLE 1004.1.2 RESIDENTIAL : 200 GROSS WITHIN THE DWELLING UNITS AREA 546 / 200 = 2.73 USE 2 PERSONS | <u>BEDROOM</u> : 98 5F REQ'D LIGHT : 9.8 5F REQ'D AIR : 4.9 5F PRO'D LIGHT : (5'-0" X 6'-0") =30 5F PRO'D AIR : (5'-0" X 6'-0") /2 =15 5F | <u>LIVING ROOM</u> : 183 5F REQ'D LIGHT : 18.3 5F REQ'D AIR : 9.15 5F PRO'D LIGHT : (5'-0" X 6'-0") =30 5F PRO'D AIR : (5'-0" X 6'-0") /2 =15 5F |
| | | |
| | | |
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| | | |
| <u>RESIDENTIAL APT.3B</u> <u>OCCUPANCY LOAD</u> TABLE 1004.1.2 RESIDENTIAL : 200 GROSS WITHIN THE DWELLING UNITS AREA 596 / 200 = 2.98 USE 2 PERSONS | <u>BEDROOM</u> : 156 5F REQ'D LIGHT : 15.6 5F REQ'D AIR : 7.8 5F PRO'D LIGHT : (5'-0" X 6'-0") =30 5F PRO'D AIR : (5'-0" X 6'-0") /2 =15 5F | <u>LIVING ROOM</u> : 179 5F REQ'D LIGHT : 17.9 5F REQ'D AIR : 8.95 5F PRO'D LIGHT : (5'-0" X 6'-0") =30 5F PRO'D AIR : (5'-0" X 6'-0") /2 =15 5F |
| | | |
| | | |
| | | |
| | | |
| <u>RESIDENTIAL APT.4A</u> <u>OCCUPANCY LOAD</u> TABLE 1004.1.2 RESIDENTIAL : 200 GROSS WITHIN THE DWELLING UNITS AREA 546 / 200 = 2.73 USE 2 PERSONS | <u>BEDROOM</u> : 98 5F REQ'D LIGHT : 9.8 5F REQ'D AIR : 4.9 5F PRO'D LIGHT : (5'-0" X 6'-0") =30 5F PRO'D AIR : (5'-0" X 6'-0") /2 =15 5F | <u>LIVING ROOM</u> : 183 5F REQ'D LIGHT : 18.3 5F REQ'D AIR : 9.15 5F PRO'D LIGHT : (5'-0" X 6'-0") =30 5F PRO'D AIR : (5'-0" X 6'-0") /2 =15 5F |
| | | |
| | | |
| | | |
| | | |
| <u>RESIDENTIAL APT.4B</u> <u>OCCUPANCY LOAD</u> TABLE 1004.1.2 RESIDENTIAL : 200 GROSS WITHIN THE DWELLING UNITS AREA 851 / 200 = 4.26 USE 4 PERSONS | <u>BEDROOM 1</u> : 124 5F REQ'D LIGHT : 12.4 5F REQ'D AIR : 6.2 5F PRO'D LIGHT : (5'-0" X 6'-0") =30 5F PRO'D AIR : (5'-0" X 6'-0") /2 =15 5F | <u>LIVING ROOM</u> : 179 5F REQ'D LIGHT : 17.9 5F REQ'D AIR : 8.95 5F PRO'D LIGHT : (5'-0" X 6'-0") =30 5F PRO'D AIR : (5'-0" X 6'-0") /2 =15 5F |
| | | |
| | | |
| | | |
| | | |
| | <u>BEDROOM 2</u> : 120 5F REQ'D LIGHT : 12.0 5F REQ'D AIR : 6.0 5F PRO'D LIGHT : (5'-0" X 6'-0") =30 5F PRO'D AIR : (5'-0" X 6'-0") /2 =15 5F | |



5 BULKHEAD PLAN
Scale: 3/16" = 1'-0"



**LI ARCHITECT
ASSOCIATES, PLLC**

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eMail: info@liarch.com

OWNER'S INFORMATION:

WILLIAM LIKA

CONSULTANT INFORMATION:

[illegible]

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PROPERTY INFORMATION

| | |
|-----------------|----------------|
| TAX BLOCK | 2317 |
| TAX LOT | 12 |
| ZONING DISTRICT | M1-2/R6B, MX-8 |
| ZONING MAP # | 12C |

DOB JOB #: 321597624

| | |
|-------------------|---------------------------------------|
| PROJECT LOCATION: | 64 NORTH 8TH ST BROOKLYN, NY 11249 |
|-------------------|---------------------------------------|

DRAWING
TITLE:

| | |
|-------------------|-----------------------|
| SEAL & SIGNATURE: | DATE : 08.07.2019 |
| | PROJECT NO.: |
| | DRAWN BY : RV |
| | CHECK BY : LL |
| | SHEET NO.: |
| | A-102.00 |
| | CAD LOCATION: 6 OF 23 |

DOB STICKER

DOB STAMP:

NOTE: ALL LOCKSETS TO BE GRAND MASTERED TO BUILDING MASTER

| DOOR & FRAME TYPE | | | | | | | |
|---|---|--|---|---|--|---|--|
| A | B | C | D | E | F | G | H |
| | | | | | | | |
| BALCONY DOOR 3/4" THICK ALUMINUM / GLASS (SAFETY GL) DOOR W/ CLOSER AND WEATHER STRIPPING SELF LOCKING U = 0.31, SHGC = 0.32 MAXIMUM AIR INFILTRATION RATE: 0.20 MAX.(CFM/FT2) | BALCONY DOOR 3/4" THICK ALUMINUM / GLASS (SAFETY GL) DOOR W/ CLOSER AND WEATHER STRIPPING SELF LOCKING SELF CLOSING U = 0.30, SHGC = 0.26 MAXIMUM AIR INFILTRATION RATE: 0.20 MAX.(CFM/FT2) | BUILDING ENTRANCE DOOR 3/4" THICK ALUMINUM / GLASS (SAFETY GL) DOOR W/ CLOSER AND WEATHER STRIPPING SELF LOCKING SELF CLOSING U = 0.30, SHGC = 0.26 MAXIMUM AIR INFILTRATION RATE: 0.20 MAX.(CFM/FT2) W/SELF CLOSING HARDWARE | STAIR EXIT/EGRESS DOOR 1-3/4" THICK, 1-1/2 HR RATED ("B" LABEL) H.M. DOOR W/ WELODED FRAME & SELF CLOSER (3'-0" X 6'-8") U FACTOR:0.16 R FACTOR:6.35 (ASTM C518) MAXIMUM AIR INFILTRATION RATE: 0.20 MAX.(CFM/FT2) W/SELF CLOSING HARDWARE | MECHANICAL ROOMS 1-3/4" THICK, 1-1/2 HR RATED ("B" LABEL) H.M. DOOR W/ WELODED FRAME & SELF CLOSER (3'-0" X 6'-8") U FACTOR:0.16 R FACTOR:6.35 (ASTM C518) MAXIMUM AIR INFILTRATION RATE: 0.20 MAX.(CFM/FT2) W/SELF CLOSING HARDWARE | APARTMENT ENTRANCE 1-3/4" THICK, 1-1/2 HR RATED ("B" LABEL) H.M. DOOR (3'-0" X 6'-8") W/ WELODED FRAME & CLOSER & BSA APPROVED PEEP HOLES WITH BELL | INTERIOR WOOD DOOR T.B.D. 1-3/4" THICK WOOD DOOR ADA ACCESSIBLE (1'-6" X 6'-8") W/ WD. FRAME. MANF. & HARDWARE T.B.D. 3/2" UNDERCUT FOR INT. ROOM | INTERIOR WOOD DOOR T.B.D. 1-3/4" THICK WOOD DOOR (VARIES X 6'-8") W/ WD. FRAME MANF. & HARDWARE T.B.D. 3/2" UNDERCUT FOR INT. ROOM |

| WINDOW TYPE | | WINDOW TYPE | | WINDOW TYPE | | WINDOW TYPE | | WINDOW TYPE | | WINDOW TYPE | |
|--|---------------|--|---------------|--|---------------|--|---------------|--|---------------|--|---------------|
| NUMBER (W1) | | (W2) | | (W3) | | (W4) | | (W5) | | (W6) | |
| ELEVATIONS | | ELEVATIONS | | ELEVATIONS | | ELEVATIONS | | ELEVATIONS | | ELEVATIONS | |
| | | | | | | | | | | | |
| FINISHED FLOOR | | FINISHED FLOOR | | FINISHED FLOOR | | FINISHED FLOOR | | FINISHED FLOOR | | FINISHED FLOOR | |
| MODEL # | T.B.D. | MODEL # | T.B.D. | MODEL # | T.B.D. | MODEL # | T.B.D. | MODEL # | T.B.D. | MODEL # | T.B.D. |
| OPERATION | HINGED | OPERATION | HINGED | OPERATION | HINGED | OPERATION | HINGED | OPERATION | HINGED | OPERATION | HINGED |
| EXTERIOR | T.B.D. | EXTERIOR | T.B.D. | EXTERIOR | T.B.D. | EXTERIOR | T.B.D. | EXTERIOR | T.B.D. | EXTERIOR | T.B.D. |
| COLOR | REFER TO PLAN | COLOR | REFER TO PLAN | COLOR | REFER TO PLAN | COLOR | REFER TO PLAN | COLOR | REFER TO PLAN | COLOR | REFER TO PLAN |
| MAXIMUM AIR INFILTRATION RATE: 0.20 MAX.(CFM/FT2) U = 0.29, SHGC = 0.32 | | MAXIMUM AIR INFILTRATION RATE: 0.20 MAX.(CFM/FT2) U = 0.29, SHGC = 0.32 | | MAXIMUM AIR INFILTRATION RATE: 0.20 MAX.(CFM/FT2) U = 0.29, SHGC = 0.32 | | MAXIMUM AIR INFILTRATION RATE: 0.20 MAX.(CFM/FT2) U = 0.29, SHGC = 0.32 | | MAXIMUM AIR INFILTRATION RATE: 0.20 MAX.(CFM/FT2) U = 0.29, SHGC = 0.32 | | MAXIMUM AIR INFILTRATION RATE: 0.20 MAX.(CFM/FT2) U = 0.29, SHGC = 0.32 | |

| GARAGE DOOR | |
|--|--|
| | |
| GARAGE DOOR 2" THICK, 1-1/2 HR RATED (8'-0" X 7'-0") SECTIONAL STEEL DOORS W/ STANDARD WEATHER STRIPING MAXIMUM AIR INFILTRATION RATE: 0.20 MAX.(CFM/FT2) W/INTERIOR MOUNTED SLIDE LOCK U FACTOR:0.136 R FACTOR:7.35 | |

ENVELOPE NOTES

- [C402.4] AIR LEAKAGE (MANDATORY).
A CONTINUOUS AIR BARRIER WILL BE PROVIDED THROUGHOUT THE BUILDING THERMAL ENVELOPE. AIR BARRIER SEAMS, EXTERIOR LIGHT FIXTURE PENETRATIONS WILL BE CAULKED BY DOW CORNING 795 OR EQUIVALENT.
PERIMETERS OF WINDOWS AND DOORS WILL BE TAPED BY HENRY BLUESKIN SA OR EQUIVALENT. UTILITY AND DUCT PENETRATIONS WILL BE GASKETED BY C.R.L. PRODUCT OR EQUIVALENT.
- [C303.1.3] FENESTRATION PRODUCTS ARE CERTIFIED AS TO PERFORMANCE LABELS OR CERTIFICATES PROVIDED.
- [C402.5.5, C403.2.4.3] OUTDOOR AIR AND EXHAUST SYSTEMS HAVE MOTORIZED DAMPERS THAT AUTOMATICALLY SHUT WHEN NOT IN USE AND MEET MAXIMUM LEAKAGE RATES.

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phone: 718.359.8982
fax: 718.939.8070
eMail: info@liarch.com

| OWNER'S INFORMATION: | |
|----------------------|--|
| WILLIAM LIKA | |

| CONSULTANT INFORMATION: | |
|-------------------------|--|
| | |

| NO. | REVISION | DATE |
|-----|----------------|----------|
| | DOB SUBMISSION | 11.21.19 |
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NOTE:

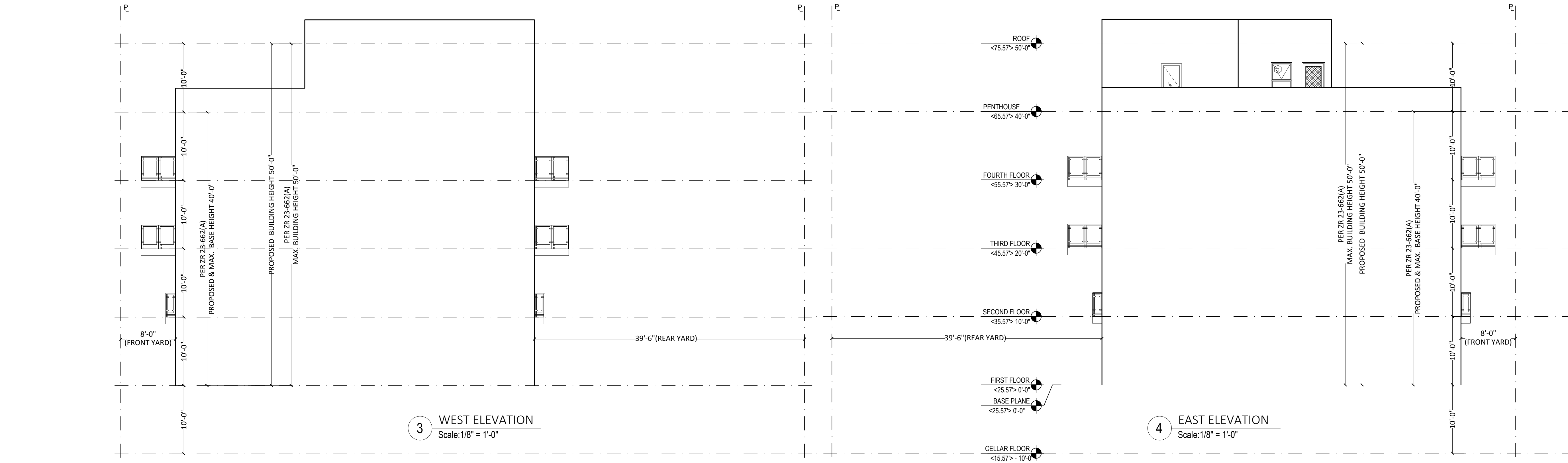
ALL IDEAS, DESIGNS, ARRANGEMENTS AND PLANS INDICATED OR REPRESENTED BY THIS DRAWINGS ARE OWNED BY AND THE PROPERTY OF LI ARCHITECT ASSOCIATES, LLC. NONE OF SUCH IDEAS, DESIGNS, ARRANGEMENTS OR PLANS SHALL BE USED BY OR DISCLOSED TO ANY PERSON, FIRM OR CORPORATION FOR ANY PURPOSE WHATSOEVER WITHOUT THE WRITTEN PERMISSION OF THE LI ARCHITECT. WRITTEN DIMENSIONS ON THESE DRAWINGS SHALL HAVE PRECEDENCE OVER SCALED DIMENSIONS. CONTRACTORS SHALL HAVE VERIFY AND BE RESPONSIBLE FOR ALL DIMENSIONS AND CONDITIONS ON THE JOB, AND THE LI ARCHITECT MUST BE NOTIFIED OF ANY DISCREPANCY FROM THE DIMENSIONS AND CONDITIONS SHOWN BY THIS DRAWINGS.

| PROPERTY INFORMATION | |
|----------------------|----------------|
| TAX BLOCK | 2317 |
| TAX LOT | 12 |
| ZONING DISTRICT | M1-2/R6B, MX-8 |
| ZONING MAP # | 12C |

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|---|---------------------|
| DOB JOB #: 321597624 | |
| PROJECT LOCATION: 64 NORTH 8TH ST BROOKLYN, NY 11249 | |
| DRAWING TITLE: ELEVATIONS, WINDOW AND DOOR SCHEDULE | |
| SEAL & SIGNATURE: | DATE: 08.07.2019 |
| | PROJECT NO.: |
| | DRAWN BY: RV |
| | CHECK BY: LL |
| | SHEET NO.: A-201.00 |
| CAD LOCATION: 7 OF 23 | |

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| DOB STICKER |
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| DOB STAMP: |
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APPENDIX 2: CITIZEN PARTICIPATION PLAN

The NYC Office of Environmental Remediation and Bill Lika have established this Citizen Participation Plan because the opportunity for citizen participation is an important component of the NYC Voluntary Cleanup Program. This Citizen Participation Plan describes how information about the project will be disseminated to the Community during the remedial process. As part of its obligations under the NYC VCP, Bill Lika 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 Citizen Participation Plan, 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 NYC Office of Environmental Remediation (OER) 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 OER's project manager assigned to this Site, Noel Anderson, who can be contacted about these issues or any others questions, comments or concerns that arise during the remedial process at (212) 788-8841.

Project Contact List: OER 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 OER's project manager. If you would like to be added to the Project Contact List, contact NYC OER at (212) 788-8841 or by email at brownfields@cityhall.nyc.gov.

Repositories: A document repository is maintained online. Internet access to view OER'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:

Greenpoint Library
107 Norman Avenue at Leonard Street, Brooklyn, NY 11222
718-349-8504
Monday 10AM–6PM
Tuesday 10AM–8PM
Wednesday 10AM–6PM
Thursday 10AM–8PM
Friday 10AM–6PM
Saturday 10AM–5PM
Sunday Closed

Digital Documentation: NYC OER 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: There are no known issues of public concern associated with this project.

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 OER. 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 OER prior to distribution and mailed by the Enrollee. Public comment is solicited in public notices for all work plans developed under the NYC Voluntary Cleanup Program. Final review of all work plans by OER 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 NYC VCP 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 and Remedial Action Work Plan 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 OER 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 3: 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 reduce 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 RAR.

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 Remedial Action Report (RAR). 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/electricity will be utilized for HVAC system and/or boiler in the new building. An estimate of the volume of clean fuels used during remedial activities will be quantified and reported in the RAR.

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.

An estimate of the area of the Site that utilizes recontamination controls under this plan will be reported in the RAR 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 RAR.

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 RAR. 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: Bill Lika is participating in OER's Paperless Voluntary 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: Bill Lika is participating in OER'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.

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 RAR.

APPENDIX 4: SOIL/MATERIALS MANAGEMENT PLAN

1.1 Soil Screening Methods

Visual, olfactory and PID soil screening and assessment will be performed under the supervision of a Qualified Environmental Professional and will be reported in the final remedial report. Soil screening will be performed during invasive work performed during the remedy and development phases prior to issuance of final signoff by OER.

1.2 Stockpile Methods

Excavated soil from suspected areas of contamination (e.g., hot spots, 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 OER. 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.

1.3 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.

1.4 Materials Excavation, Load-Out, and Departure

The PE/QEP overseeing the remedial action will:

- oversee remedial work and the excavation and load-out of excavated material;
- ensure that there is a party responsible for the safe execution of invasive and other work performed under this 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;
- ensure that all egress points for truck and equipment transport from the Site will be kept clean of Site-derived materials during Site remediation.

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

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

1.5 Off-Site Materials Transport

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

1.6 Materials Disposal Off-Site

The following documentation will be established and reported by the PE/QEP 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 PE/QEP 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 PE/QEP 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 final remedial report.

The Remedial Action Report 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 OER 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.

1.7 Materials Reuse On-Site

No soil or fill that is derived from the property will be reused on-Site. 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.

1.8 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 RAR.

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.

1.9 Import of Backfill Soil from Off-Site Sources

This Section presents the requirements for imported fill materials to be used below the cover layer and within the clean soil cover layer. All imported soils will meet OER-approved backfill and cover soil quality objectives for this Site. Imported soils will not exceed groundwater protection standards established in Part 375. Imported soils for Track 1 remedial action projects will not exceed Track 1 SCO's.

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

The following potential sources may be used pending attainment of backfill and cover soil quality objectives:

- Clean soil from construction projects at non-industrial sites in compliance with applicable laws and regulations;
- Clean soil from roadway or other transportation-related projects in compliance with applicable laws and regulations;
- Clean recycled concrete aggregate (RCA) from facilities permitted or registered by the regulations of NYS DEC.
- All materials received for import to the Site will be approved by a PE/QEP and will be in compliance with provisions in this remedial plan. The final remedial report 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.
- All material will be subject to source screening and chemical testing.
- Inspection of imported fill material will include visual, olfactory and PID screening for evidence of contamination. Materials imported to the Site will be subject to inspection, as follows:
 - Trucks with imported fill material will be in compliance with applicable laws and regulations and will enter the Site at designated locations;
 - The PE/QEP is responsible to ensure that every truck load of imported material is inspected for evidence of contamination; and

- Fill material will be free of solid waste including pavement materials, debris, stumps, roots, and other organic matter, as well as ashes, oil, perishables or foreign matter.

Composite samples of imported material will be taken at a minimum frequency of one sample for every 500 cubic yards of material. Once it is determined that the fill material meets imported backfill or cover soil chemical requirements and is non-hazardous, and lacks petroleum contamination, the material will be loaded onto trucks for delivery to the Site.

Recycled concrete aggregate (RCA) will be imported from facilities permitted or registered by NYSDEC. Facilities will be identified in the final remedial report. A PE/QEP is responsible to ensure that the facility is compliant with 6NYCRR Part 360 registration and permitting requirements for the period of acquisition of RCA. RCA imported from compliant facilities will not require additional testing, unless required by NYSDEC under its terms for operation of the facility. RCA imported to the Site must be derived from recognizable and uncontaminated concrete. RCA material is not acceptable for and will not be used as cover material.

1.10 Fluids Management

All liquids to be removed from the Site, 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.

1.11 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 OER. 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.

1.12 Contingency Plan for Unknown Contamination Sources

This contingency plan is developed for the remedial construction to address the discovery of unknown structures or contaminated media during excavation. Identification of unknown contamination source areas during invasive Site work will be promptly communicated to OER's Project Manager. Petroleum spills will be reported to the NYS DEC Spill Hotline. These findings will be included in the daily report. If previously unidentified contaminant sources are found during on-Site remedial excavation or development-related excavation, sampling will be performed on contaminated source material and surrounding soils and reported to OER. Chemical analytical testing will be performed for TAL metals, TCL volatiles and semi-volatiles, TCL pesticides and PCBs, as appropriate.

1.13 Odor, Dust, and Nuisance Control

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.

This odor control plan is capable of controlling emissions of nuisance odors. If nuisance odors are identified, work will be halted, and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. OER will be notified of all odor complaint events. Implementation of all odor controls, including halt of work, will be the responsibility of the PE/QEP's certifying this remedial plan.

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 all nuisance dust emissions have been abated. OER will be notified of all dust complaint events. Implementation of all dust controls, including halt of work, will be the responsibility of the PE/QEP's responsible for certifying this remedial plan.

Other Nuisances

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

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

APPENDIX 5: CONSTRUCTION HEALTH AND SAFETY PLAN

CONSTRUCTION HEALTH & SAFETY PLAN

64 North 8th Street
E-138; Block 2317, Lot 12
Brooklyn, New York

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1.0 INTRODUCTION

This Construction Health & Safety Plan (CHASP) has been prepared by HydroTech Environmental Engineering and Geology, DPC (HydroTech) as a part of the Remedial Action Work Plan (RAWP) for 64 North 8th Street (Block 2317, Lot 12) and situated in the borough of Brooklyn, New York.

This CHASP will conform to applicable regulations, safe work practices and the project's requirements, and addresses those activities associated with the development of a 4-story walk-up residential building with a full basement covering approximately 55% of the site and a front yard and a rear yard covering the remaining 45% of the site.

The HydroTech Project Manager (PM), Site Safety Officer (SSO) and field staff (when necessary) will implement the Plan during construction. Compliance with this HASP is required of all persons and third parties who perform the scope of work documented for this project. Assistance in implementing this CHASP can be obtained from the SSO. The content of this CHASP may change or undergo revisions based upon additional information that is made available to health and safety personnel, monitoring results, or changes in the technical scope of work.

It should be noted that this CHASP does not apply to any other scopes of work that may be performed at the Site that are not specifically outlined in this report. Through preparation of this HASP, HydroTech and all Subcontractors (if any) do not guarantee the health or safety of any person entering this Site. Due to the nature of this Site and the activities occurring thereon, it is not possible to discover, evaluate and provide protection for all possible hazards that may be encountered. Only those portions of this CHASP that specifically apply to authorized personnel of HydroTech will enact the activities at the Site. Strict adherence to the applicable portions of these health and safety guidelines set forth herein will reduce, but not eliminate the potential for injury at this Site. The health and safety guidelines in this CHASP were prepared specifically for this Site and should not be utilized for any other site without prior research and evaluation by trained health and safety specialists and approval by HydroTech.

2.0 SCOPE OF WORK

This Construction HASP has been prepared as a part of the RAWP to be implemented during the upcoming development of the Site. Prior environmental assessments identified acetone and metals including lead, mercury, zinc and chromium, trivalent in soil/fill beneath the Site at concentrations exceeding their respective Unrestricted Use Soil Cleanup Objectives (SCOs). A range of vapors associated with organic chlorinated solvents and petroleum constituents were also detected beneath the Site.

The portions of the construction activities specifically addressed in this Construction HASP will include the following and will be performed in the following sequence:

- Supervision of the excavation of soil/fill and other material
- Supervision of the installation of concrete foundations
- Supervision of the installation of vapor barrier system

Prior to any fieldwork, the New York City One-Call Unit will be contacted so that all public utilities can be marked out. The proposed schedule of fieldwork will be coordinated with the developer and the OER.

3.0 STAFFING

This section briefly describes the personnel involved in Site remedial activities, their contact information and their health and safety responsibilities. This section also provides directions to hospital in the case of a health emergency.

EMERGENCY NUMBERS

| <u>Contact</u> | <u>Phone Number</u> |
|---------------------------|---------------------|
| Woodhull Medical Center | 718-963-8000 |
| New York City EMS | 911 |
| NYPD | 911 |
| NYFD | 911 |
| National Response Center | (800) 424-8802 |
| Poison Information Center | (800) 562-8816 |
| Chemtree | (800) 424-9555 |

Project Management/Health and Safety Personnel

| <u>Title</u> | <u>Contact</u> | <u>Phone Number</u> | <u>Cell Phone</u> |
|---------------------|----------------------|---------------------|-------------------|
| Site Safety Officer | To be assigned by GC | Not available | Not available |
| Project Manager | Ruijie Xu | (718) 636-0800 | (631) 229-7090 |

Directions to Woodhull Medical Center (See Attached Figure 1)

Head northwest on North 8th Street toward Kent Avenue and turn right onto Kent Avenue. Then turn right onto North 9th Street. Make a left onto Withers Street and then make a right onto Union Avenue. Make a right onto Lincoln Avenue. Continue onto Harrison Avenue and make a left turn onto Flushing Avenue. The hospital will be on the right.

PROJECT MANAGER

As necessary, the Project Manager will perform the following:

- Has the overall responsibility for the health and safety of site personnel
- Ensures that adequate resources are provided to the field staff to carry out their responsibilities as outlined below.
- Ensures that fieldwork is scheduled with adequate personnel and equipment resources to complete the job in a safe manner.
- Ensures that adequate communication between field crews and emergency response personnel is maintained.
- Ensures that field site personnel are adequately trained and qualified to work at the Site.

SITE SAFETY OFFICER

As necessary, the Site Safety Officer will perform the following:

- Directs and coordinates health and safety monitoring activities.
- Ensures that field teams utilize proper personal protective equipment (PPE).
- Conducts initial on-Site, specific training prior to personnel and/or subcontractors proceeding to work.
- Conducts and documents periodic safety briefings; ensures that field team members comply with this Construction HASP.
- Completes and maintains Accident/Incident Report Forms.

- Notifies corporate administration of all accidents/incidents.
- Determines upgrade or downgrade of PPE based on site conditions and/or downgrade of PPE based on site conditions and/or real-time monitoring results.
- Ensures that monitoring instruments are calibrated daily or as determined by manufacturer's suggested instructions.
- Maintains health and safety field log books.
- Develops and ensures implementation of the Construction HASP.
- Approves revised or new safety protocols for field operations.
- Coordinates revisions of this Construction HASP with field personnel and the SSO Division Contracting Officer.
- Responsible for the development of new company safety protocols and procedures and resolution of any outstanding safety issues which may arise during the conduction of site work.
- Reviews personnel and subcontractors current and up-to-date medical examination and acceptability of health and safety training.

FIELD PERSONNEL AND SUBCONTRACTORS (IF ANY)

- Reports any unsafe or potentially hazardous conditions to the SSO
- Maintains knowledge of the information, instructions, and emergency response actions contained in this Construction HASP.
- Comply with rules, regulations and procedures as set forth in this Construction HASP and any revisions that are instituted.
- Prevents admittance to work sites by unauthorized personnel.

4.0 CHEMICAL & WASTE DESCRIPTION/CHARACTERIZATION

The following list of compounds is based on the results of the recent subsurface investigation:

Volatile Organic Compounds in soil:

- Acetone

Heavy Metals in soil:

- Lead
- Mercury
- Zinc
- Chromium, trivalent

Volatile Organic Compounds in soil vapors:

- BTEX and associated petroleum related compounds
- TCE
- PCE
- Methylene chloride
- Acetone

Appendix A contains Material Safety Data Sheets

The following information references are presented in order to identify the properties, characteristics and hazards of the compounds and metals that may/will be encountered at the Site.

- * Dangerous Properties of Industrial Materials - Sax
- * Chemical Hazards of the Workplace - Proctor/Hughes
- * Condensed Chemical Dictionary - Hawley
- * Rapid Guide to Hazardous Chemical in the Workplace - Lewis 1990.
- * NIOSH Guide to Chemical Hazards - 1990.
- * ACGIH TLV Values and Biological Exposure Indices - 1991-1992.

5.0 HAZARD ASSESSMENT AND MITIGATION

The potential hazards associated with planned site activities include chemical, physical and biological hazards associated with the construction. This section discusses those hazards that are anticipated to be encountered during the activities listed in the scope of work.

The potential to encounter chemical hazards is dependent upon the work activity performed (invasive or non-invasive), the duration, and location of the work activity. Such hazards could include inhalation or skin contact with chemicals that could cause: dermatitis, skin burn, being overcome by vapors, or asphyxiation. In addition, the handling of contaminated materials and chemicals could result in fire and/or explosion.

The potential to encounter physical hazards during site work includes: heat stress, exposure to excessive noise, loss of limbs, being crushed, head injuries, cuts and bruises, and other physical hazards due to motor vehicle operation, heavy equipment and power tools.

CHEMICAL HAZARDS

The potential for personnel and subcontractors to come in contact with chemical hazards may occur during the following tasks:

- Excavation
- Installation of vapor barrier
- Pouring of concrete foundation(s)

Exposure Pathways

Exposure to these compounds during ongoing activities may occur through inhalation of contaminated dust particles, inhalation of volatile vapor fume compounds, by way of dermal absorption, and accidental ingestion of the contaminant by either direct or indirect cross contamination activities (eating, smoking, poor hygiene). Indirectly, inhalation of contaminated dust particles can occur during adverse weather conditions (high or changing wind directions) or during operations that may generate airborne dust such as excavation.

Dust Suppression

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

1. Applying water on haul roads.
2. Wetting equipment and excavation faces.
3. Spraying water on buckets during excavation and dumping.
4. Hauling materials in properly sealed or watertight containers.
5. Restricting vehicle speeds to 10mph.
6. Covering excavated areas and material after excavation activity ceases.
7. Reducing the excavation size and/or number of excavations.
8. Applying a dust suppressant, such as calcium chloride, in high vehicle traffic areas.

To evaluate the effectiveness of the dust suppression measures, air monitoring will be performed utilizing real-time dust-monitoring equipment. The requirements for air monitoring during post-remediation soil disturbance activities are presented in Section 5.0.

Additional Precautions

Dermal absorption or skin contact with chemical compounds is possible during invasive activities at the Site, including the excavation and/or capping of soils. The use of PPE in accordance with Section 9.0 and strict adherence to proper decontamination procedures should significantly reduce the risk of skin contact.

The potential for accidental ingestion of potentially hazardous chemicals is expected to be remote, when good hygiene practices are used. Unauthorized personnel, including all children, will not be allowed access to the Site.

PHYSICAL HAZARDS

A variety of physical hazards may be present during Site activities. These hazards are similar to those associated with any construction type project and include digging or boring operations and excavation activities in the vicinity of underground utility locations. These physical hazards are due to motor vehicles, and heavy equipment operation, the use of improper use of power and hand tools, misuse of pressurized cylinders, walking on objects, tripping over objects, working on surfaces which have the potential to promote falling, mishandling and improper storage of solid and hazardous materials, skin burns, crushing of fingers, toes, limbs, hit on the head by falling objects or hit one's head due to not seeing the object of concern, temporary loss of one's hearing and/or eyesight. These hazards are not unique and are generally familiarly to most hazardous waste site workers at construction sites. Additional task specific safety requirements will be covered during safety briefings.

6.0 SPILL PREVENTION AND CONTROL PLAN

Accidental spill and leaks of hazardous and non-hazardous materials will be properly controlled so that they do not adversely impact storm drain systems or receiving waters. A spill prevention and control plan will include the following:

Spill/Leak Prevention Measures;

- Place any material under cover (tarp) and away from storm drains or sensitive water bodies
- Properly label all containers so that the contents are easily identifiable
- Berm storage areas so that if a spill or leak occur they are easily contained

Spill Response Procedures

- Assessment of the Site and potential impacts by the SSO
- Containment of the material
- Notification of the personnel present at the Site and ensure evacuation procedure if necessary.

Spill Cleanup Procedures

- If small non-hazardous spill, use cleanup materials such as absorbents or rags and damp cloths and dispose of properly;
- If large non-hazardous spill or hazardous spill, a private hazmat team may need to be contacted to assess the situation and conduct the cleanup and proper disposal of the material.

Reporting

- Petroleum spills will be reported immediately to the NYSDEC Spill Hotline.
- If material is unknown or hazardous, contact the local Fire Department.

Training

- The SSO is responsible for providing refreshment training to all employees working on-site about spill prevention, spill response and cleanup on a routine basis.
- The SSO will identify key spill response personnel to assist in the spill control and cleanup procedures.

7.0 TRAINING

GENERAL HEALTH AND SAFETY TRAINING

In accordance with 29 CFR 1910.120, all construction personnel involved with the portions of the scope of work described in Section 2.0 will be briefed by the Project Manager on the potential hazards and the overall requirements in meeting the specifications of this Construction HASP.

The SSO will have the responsibility of ensuring that personnel assigned to this project comply with these requirements. Written certification of completion of any required training, if necessary, will be provided to the SSO.

MANAGER/SUPERVISOR TRAINING

In accordance with 29 CFR 1910.120, on-Site management and supervisors who will be directly responsible for, or who supervise employees engaged in hazardous waste operation shall receive training as required in this Construction HASP and at least eight (8) additional hours of specialized training on managing such operations at the time of job assignment.

ANNUAL 8-HOUR REFRESHER TRAINING

Annual 8-hour refresher training will be required of all hazardous waste site field personnel in order to maintain their qualification for fieldwork. The following topics will be reviewed: toxicology, respiratory protection, including air purifying devices and self-contained breathing apparatus (SCBA), medical surveillance, decontamination procedures and personnel protective clothing. In addition, topics deemed necessary by the SSO may be added to the above list.

SITE SPECIFIC TRAINING

Prior to commencement of field activities, all personnel assigned to the project will be provided training that will specifically address the activities, procedures, monitoring, and equipment for the site operations. It will include Site and facility layout, hazards, and emergency services at the Site, and will highlight all provisions contained within this Construction HASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity.

ON-SITE SAFETY BRIEFINGS

Project personnel and visitors will be given periodic on-site health and safety briefings by the SSO, or their designee, to assist site personnel in safely conducting their work activities. The briefings will include information on new operations to be conducted, changes in work practices, or changes in the Site's environmental conditions. The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety audits.

ADDITIONAL TRAINING

Additional training may be required by the SSO for participation in certain field tasks during the course of the project. Such additional training could be in the safe operation of heavy or power tool equipment or hazard communication training.

HAZWOPER TRAINING

All remedial personnel that will be in direct contact with the native soil/fill materials must complete an initial 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training course and, where necessary, a current 8-hour refresher course

SUBCONTRACTOR TRAINING

Subcontractor personnel working on-site may be exempted from the contents of this Construction HASP. The SSO will determine if this exemption is allowed. In any case, the subcontractor personnel who are exposed to hazards are not exempted from the contents of this Construction HASP.

8.0 MEDICAL SURVEILLANCE

GENERAL

No general or specific medical surveillance or other medical requirements are set forth in this Construction HASP.

9.0 SITE CONTROL, PPE & COMMUNICATIONS

SITE CONTROL

The area where the activities of the scope of work will be performed is considered to be the Exclusion Zone (EZ). All areas where excavation and handling of contaminated materials take place are considered the EZ. This zone will be clearly delineated by cones, tape, or other means. The SSO may establish more than one EZ where different levels of protection may be employed or where different hazards exist. Personnel are not allowed in the EZ without:

- A buddy
- Appropriate personal protective equipment (as necessary)

The remaining portions of the Site outside of the EZ will consist of a Support Zone (SZ) and a Contamination Reduction Zone (CRZ). Appropriate sanitary facilities, safety equipment, packaged/decontaminated and labeled samples will be located in SZ. Potentially contaminated personnel or materials will be allowed in the CRZ for decontamination as necessary.

PERSONAL PROTECTIVE EQUIPMENT

General

The level of protection worn by field personnel will be enforced by the SSO. Levels of protection may be upgraded or downgraded at the discretion of the SSO. The decision shall be based on real-time air monitoring, site history data, and prior site experience. Any changes in the level of protection shall be recorded in the health and safety field logbook.

PPE Specifications

For tasks requiring Level C PPE, the following equipment shall be used:

- Cotton or disposable coveralls
- Disposable outer coveralls (Poly-coated Tyvek)
- Gloves, inner (latex)
- Gloves, outer (Nitrile®)
- Boots (PVC), steel toe/shank
- Boot covers (as needed)
- Hard Hat
- Hearing protection (as needed)
- Splash suit and face shield for decontamination operations (as needed)

For tasks requiring Level D PPE, the following equipment shall be used:

- Cotton or disposable coveralls
- Gloves, inner (latex)
- Gloves, outer (Nitrile®)
- Boots (PVC) steel toe/shank
- Boot covers (as needed)
- Hard hat
- Hearing protection (as needed)
- Safety glasses

For tasks requiring respiratory protection, the following equipment shall be used:

Level D - No respiratory protective equipment necessary except for a dust mask

Level C - A full-face air-purifying respirator equipped with organic vapor/pesticide-HEPA

cartridges

Level B - An air line respirator or a self-contained breathing apparatus (SCBA)

LEVEL OF PERSONAL PROTECTIVE EQUIPMENT REQUIRED

| Activity | Level of Protection Respiratory/PPE |
|-------------------------|--|
| Excavations | C/D |
| Foundation Construction | C/D |

COMMUNICATIONS

Communications is the ability to talk with others. While working in Level C Protection, personnel may find that communication become a more difficult task and process to accomplish. This is further complicated by distance and space. In order to address this problem, electronic instruments, mechanical devices or hand signals will be used as follows:

- Walkie-Talkies - Hand held radios would be utilized as much as possible by field teams for communication between downrange operations and the Command Post base station.
- Telephones - A mobile telephone will be located in the Command Post vehicle in the Support Zone for communication with emergency support services/facilities. If a telephone is demobilized, the nearest public phones will be identified.
- Air Horns - A member of the downrange field team will carry an air horn and another will be evident in the Support Zone to alert field personnel to an emergency situation.
- Hand Signals - Members of the field team using the buddy system will employ this communication method. Signals become especially important when in the vicinity of heavy moving equipment and when using Level B respiratory equipment. The signals shall become familiar to the entire field team before site operations commence and they will be reinforced and reviewed during site-specific training.

HAND SIGNALS FOR ON-SITE COMMUNICATION

| Signal | Meaning |
|----------------------|---|
| Hand gripping throat | Out of air, can't breathe |
| Grip partners' wrist | Leave area immediately; no debate |
| Hands on top of head | Need assistance |
| Thumbs up | OK, I'm all right; I understand |
| Thumbs down | No; negative, unable to understand you. I'm not all right |

10.0 AIR MONITORING PLAN

GENERAL

Continuous air monitoring in the EZ during invasive tasks will accompany site operations, as indicated in this HASP or as required by the SSO. Monitoring will be performed to verify the adequacy of respiratory protection, to aid in site layout and to document work exposure. All monitoring instruments shall be operated by qualified personnel only and will be calibrated daily prior to use, or more often as necessary. For additional references and information, see HydroTech's Site-Specific Air Monitoring Program.

REAL-TIME MONITORING

Instrumentation

A PID (to monitor total volatile organic concentrations) will be used to measure worker breathing zone ambient on-site concentrations during on-site activities. The equipment will be calibrated daily and the results noted in the project field book. A background level will be established, at a minimum, on a daily basis, and recorded in the field book.

The following response actions will be taken based on PID readings in the breathing zone. All work will be performed in level D PPE unless breathing zone volatile organic concentrations exceed 5 ppm. Once levels of 25 ppm are measured, work will be stopped.

| | | | |
|----------------------|-----------------------------------|-------------|---|
| Volatile Organics | Photoionization Detector (PID) | >5ppm | Temporarily halt work activities & monitor until readings decrease to below 5ppm. |
| | | >5ppm<25ppm | Halt work activities, upgrade to level C continue monitoring. |
| | | >25ppm | Shut down work activities |

During soil excavation, particulate monitoring will be performed using a real-time particulate monitor that will monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

Object to be measured: Dust, Mists, Aerosols

Size range: < 0.1 to 10 microns

Sensitivity: 0.001 mg/m³

Overall Accuracy: = 10% as compared to gravimetric analysis of stearic acid or reference dust.

Particulate levels will be monitored immediately downwind at the working site and integrated over a period not to exceed 15 minutes. The action level will be established at 150 ug/m³ over the integrated period not to exceed 15 minutes.

Action Levels

Action levels for upgrading of PPE in this Construction HASP will apply to all site work during the duration of field activities at the Site. The action level is the presence of visible airborne dust. When airborne dust is observed, specific dust-mitigating procedures will be implemented. These dust-mitigating procedures are documented in Section 6.0.

11.0 SAFETY CONSIDERATIONS

GENERAL

In addition to the specific requirements of this HASP, common sense should be used at all times. The general safety rules and practices below will be in effect at the Site at the discretion of the Project Manager, SSO or other authorized personnel.

- The site will be suitably marked or barricaded as necessary to prevent unauthorized visitors but not hinder emergency services if needed.
- As needed, all open holes, trenches, and obstacles will be properly barricaded in accordance with local site requirements. These requirements will be determined by proximity to traffic ways, both pedestrian and vehicular, and site of the hole, trench, or obstacle. If holes are required to be left open during non-working hours, they will be adequately decked over or barricaded and sufficiently lighted.
- Before any digging or boring operations are conducted, underground utility locations will be identified. All boring, excavation, and other site work will be planned and performed with consideration for underground lines. Any excavation work will be performed in accordance with HydroTech's Standard Operating Procedures for Excavations.
- Either workers or other people will enact dust-mitigating procedures when the potential for the inhalation of dust particles is present.
- The act of smoking and/or ignition sources in the vicinity of potentially flammable or contaminated material is strictly prohibited.
- Drilling, boring, and use of cranes and drilling rigs, erection of towers, movement of vehicles and equipment and other activities will be planned and performed with consideration for the location, height, and relative position of aboveground utilities and fixtures, including signs; canopies; building and other structures and construction; and natural features such as trees, boulders, bodies of water, and terrain.
- When working in areas where flammable vapors may be present, particular care shall be exercised with tools and equipment that may be sources of ignition. All tools and equipment provided must be properly bonded and/or grounded. Metal buttons and zippers are prohibited on safety clothing for areas that may contain a flammable or explosive atmosphere.
- Approved and appropriate safety equipment (as specified in this Construction HASP), such as eye protection, hard hats, foot protection, and respirators, must be worn in areas where required. In addition, eye protection must be worn when sampling soil or water that may be contaminated.
- No smoking, eating, chewing tobacco, gum chewing, or drinking will be allowed in the contaminated areas.
- Contaminated tools and hands must be kept away from the face.
- Personnel must use personal hygiene safe guards (washing up) at the end of the shift or as

soon as possible after leaving the Site.

- Each sample must be treated and handled as though it were contaminated.
- Persons with long hair and/or loose fitting clothing that could become entangled in power equipment must take adequate precautions.
- Horseplay is prohibited in the work area.
- Work while under the influence of intoxicants, narcotics, or controlled substances is prohibited.

POSTED SIGNS

Posted danger signs will be used where an immediate hazard exists. Caution signs will be posted to warn against potential hazards and to caution against unsafe practices. Traffic control methods and barricades will be used as needed. Wooden stakes and flagging tape, or equally effective material will be used to demarcate all restricted areas.

Other postings may include the OSHA poster, emergency hospital route, and telephone numbers of contact personnel.

INVASIVE OPERATIONS

The SSO will be present on-Site during all invasive work (e.g. excavations and capping). The SSO will ensure that appropriate monitoring, levels of protection, and safety procedures are followed. No personnel will enter any excavations for any reasons. All non-essential personnel will stay at least 10 feet back from the edge of the excavation and out of the swing radius of the backhoe. No drums or other potential sources will be sampled or removed during this phase without further additions to the Construction HASP.

The proximity of water, sewer, and electrical lines will be identified prior to invasive operations. The possibility of the presence of underground conduits or vessels containing materials under pressure will also be investigated prior to invasive operations. Properly-sized containment systems will be utilized and consideration of the potential volume of liquid or waste released during operations will be discussed with members of the field team to minimize the potential for spills and provide a method for collection of waste materials. Emergency evacuation procedures and the location of safety equipment will be established prior to start up operations. The use of protective clothing, especially hard hats, boots, and gloves will be required during drilling and other heavy equipment work.

SOIL, GROUNDWATER AND LIQUID WASTE SAMPLING

During Site invasive excavation, soil sampling for waste characterization may be required for disposal purposes. No groundwater or liquid waste sampling is anticipated during site remediation.

HEAVY EQUIPMENT DECONTAMINATION

Personnel steam cleaning heavy equipment, if necessary shall use the prescribed level of protection and adhere to the buddy system. Initially this task usually employs Level C. The heavy equipment decontamination shall be restricted to authorized personnel only. Special consideration will be given to wind speed and direction. Downwind areas are to be kept free of personnel to avoid unnecessary exposure to potential airborne contamination.

ADDITIONAL SAFETY CONSIDERATIONS

No other additional safety considerations at this time.

12.0 DECONTAMINATION AND DISPOSAL PROCEDURES

CONTAMINATION PREVENTION

One of the most important aspects of decontamination is the prevention of contamination. Good contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include:

Personnel:

Do not walk through areas of obvious or known contamination.
Do not directly handle or touch contaminated materials.
Make sure that there are no cuts or tears on PPE.
Fasten all closures in suits; cover with tape if necessary.
Particular care should be taken to prevent any skin injuries.
Stay upwind of airborne contaminants.
Do not carry cigarettes, cosmetics, gum, etc. into contaminated areas.

Sampling and Monitoring:

When required by the SSO, cover instruments with clear plastic, leaving openings for sampling ports. Keep all decontaminated sampling materials in bags prior to emplacement of sample matrix.

Heavy Equipment:

Care should be taken to limit the amount of contamination that comes in contact with heavy equipment (tires). Dust control measures may be needed on roads inside the site boundaries.

PERSONNEL DECONTAMINATION

All personnel shall pass through an outlined decontamination procedure when exiting the hot zone at each location. A field wash for equipment and PPE shall be set up at each work location. The system will include a gross wash and rinse for all disposable clothing and boots worn in the EZ. Upon exiting the EZ, all personnel will wash their hands, arms, neck, and face before entering the Support Zone.

EQUIPMENT DECONTAMINATION

Equipment used at the Site that is potentially contaminated shall be decontaminated to prevent hazardous materials from leaving the Site. All heavy equipment will be decontaminated at the decontamination pad and inspected by the SSO and Project Manager before it leaves the Site. The decontamination area will provide for the containment of all wastewater from the decontamination process. Respirators, airline and any other personnel equipment that comes in contact with contaminated soils shall pass through a field wash.

DECONTAMINATION DURING MEDICAL EMERGENCIES

If emergency life-saving first aid and/or medical treatment are required, normal decontamination procedures may need to be abbreviated or omitted. The Site SSO or designee will accompany contaminated victims to the medical facility to provide advice on matters involving decontamination, when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances and /or medical personnel. Outer garments are then removed at the medical facility.

No attempt will be made to wash or rinse the victim, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material that could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, the normal decontamination procedures will be followed. Note that heat stroke requires prompt treatment to prevent irreversible damage or death. Protective clothing must be promptly removed. Less serious forms of heat stress also require prompt attention and removal of protective clothing immediately. Decontamination should be omitted or minimized and treatment begun immediately unless the victim is obviously contaminated.

DISPOSAL PROCEDURES

The SSO and Project Manager will develop a segregating system of non-hazardous waste and hazardous waste. All discarded material, waste materials, or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating sanitary hazards, or causing litter to be left on site. All potentially contaminated materials, e.g. clothing, gloves, etc., will be bagged or drummed as necessary, labeled and segregated for disposal. All non-contaminated materials shall be collected and bagged for appropriate disposal as normal domestic waste.

13.0 EMERGENCY PLAN

The potential for the development of an emergency situation is low considering the low concentrations of hazardous substances at the work site. Nevertheless, an emergency situation could occur. All personnel, prior to the start of work, will know the emergency plan outlined in this section. The emergency plan will be available for use at all times during site work.

Various individual site characteristics will determine preliminary actions taken to assure that this emergency plan is successfully implemented in the event of a site emergency. Careful consideration must be given to the proximity of neighborhood housing or places of employment, and to the relative possibility of site fire, explosion or release of vapors or gases that could affect the surrounding community.

The Project Manager shall make contact with local fire, police, and other emergency units prior to beginning work on site. In these contacts, the Project Manager will inform the emergency units about the nature and duration of work expected to the Site and the type of contaminants and the possible health or safety effects of emergencies involving these contaminants. At this time, the Project Manager and the emergency response units shall make the necessary arrangements to be prepared for any emergencies that could occur.

The Project Manager shall implement the contingency plan whenever conditions at the Site warrant such action. The Project Manager will be responsible for coordination of the evacuation emergency treatment, and transportation of site personnel as necessary, and notification of emergency response units and the appropriate management staff.

EVACUATION

In the event of an emergency situation, such as fire, explosion, or significant release of toxic gases, an air horn or other appropriate device will be sounded for approximately 10 second intervals indicating the initiation of evacuation procedures. All personnel will evacuate and assemble near the entrance to the site. The location shall be upwind of the Site where possible.

For efficient and safe site evacuation and assessment of the emergency situation, the Project Manager will have authority to initiate action if outside services are required. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency signal has been given. The SSO or designated SSO must ensure that access for emergency equipment is provided and that all combustion apparatuses have been shut down once the alarm has been sounded. Once the safety of all personnel is established, the Fire Department and other emergency response groups as necessary will be notified by telephone of the emergency.

POTENTIAL OR ACTUAL FIRE OR EXPLOSION

Immediately evacuate the Site (air horn will sound for 10-second intervals), notify the local fire and police departments, and other appropriate emergency response groups if an actual fire or explosion has taken place.

PERSONNEL INJURY

Emergency first aid shall be applied on site as deemed necessary. If necessary, the individual shall be decontaminated and transported to the nearest medical facility.

The ambulance/rescue squad shall be contacted for transport as necessary in an emergency. However, since some situations may require transport of an injured party by other means, the hospital route is identified below. A map to this facility provided with this HASP in Section 2.2.3.

ACCIDENT/INCIDENT REPORTING

As soon as first aid and/or emergency response needs have been met, the employer of the injured party must be immediately notified of any incident. Written confirmation of verbal reports is to be submitted within 24 hours. A standard report form entitled "Accident Data Report" is to be used for this purpose.

For reporting purposes, the term accident refers to fatalities, lost time injuries, spill, or exposure to hazardous materials (toxic materials, explosive or flammable materials).

Any information released from the health care provider, which is not deemed confidential patient information, is to be attached to the appropriate form. Any medical information that is released by patient consent is to be filed in the individuals' medical records and treated as confidential.

OVERT PERSONNEL EXPOSURE

SKIN CONTACT:

Use copious amounts of soap and water. Wash/rinse affected area thoroughly, and then provide appropriate medical attention. Eyes should be rinsed for 15 minutes upon chemical contamination.

INHALATION:

Move personnel to fresh air and if necessary, decontaminate and transport to hospital.

INGESTION:

Decontamination and transport to emergency medical facility.

PUNCTURE WOUND

OR LACERATION:

Decontaminate and transport to emergency medical facility.

ADVERSE WEATHER CONDITIONS

In the event of adverse weather conditions, the SSO or designee will determine if work can continue without sacrificing the health and safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- * Potential for heat stress and heat-related injuries
- * Potential for cold stress and cold-related injuries
- * Treacherous weather-related conditions
- * Limited visibility
- * Potential for electrical storms

Site activities will be limited to daylight hours and acceptable weather conditions. Inclement working conditions include heavy rain, fog, high winds, and lightning. Observe daily weather reports and evacuate if necessary in case of inclement weather conditions.

EMERGENCY RESPONSE EQUIPMENT LIST

Some or all of the following will either be available on-Site or be able to be brought to the Site within a 2-hour period:

- * 55 Gallon Drums
- * 85 Gallon Drums
- * Absorbent Pads
- * Absorbent Booms
- * Speedy-Dry
- * Plastic Sheeting
- * Hay Bales
- * Pneumatic Nibbler
- * Back Hoe
- * Pressure Washer
- * Air Compressor
- * Wilden Pumps
- * Equipment Storage Trailer
- * Submersible Pumps
- * Miscellaneous Hand Tools
- * Portable Lighting

LARGE EQUIPMENT

If necessary, the following large equipment will be brought to the Site within 2-hours:

- * Large Vacuum Truck
- * Super Sucker
- * Dump Trucks
- * Drill Rig
- * Utility Vehicle

14.0 LOGS, REPORTS AND RECORD KEEPING

Medical and Training Records

The Site Superintendent keeps medical and training records. All subcontractors must provide verification of training and medical qualifications to the Site Superintendent. The Site Superintendent will keep a log of personnel meeting appropriate training and medical qualifications for site work. The log will be kept in the project file. Medical records will be maintained in accordance with 29 CFR 1910.20.

Onsite Log

A log of personnel onsite each day will be kept by the Site Superintendent. Originals will be kept in the project file.

Exposure Records

Any monitoring results, laboratory reports, calculations and air sampling data sheets are part of an employee exposure record. These records will be kept in accordance with 29 CFR 1910.20. The originals will be sent to the HydroTech records coordinator. For subcontractor employees, the original will be sent to the subcontractor employer and a copy kept in the project file.

Accident/Incident Reports

An accident/incident report must be completed for all accidents and incidents. HydroTech will send the originals to the appropriate HydroTech records coordinator for maintenance. Copies will be distributed as stated. A copy of the forms will be kept in the project file.

OSHA Form 200

An OSHA Form 200 (Log of Occupational Injuries and Illnesses) will be kept at the Site. All recordable injuries or illnesses will be recorded on this form. At the end of the project, the original will be sent to the HydroTech corporate records administrator for maintenance. Subcontractor employers must also meet the requirements of maintaining an OSHA 200 form. The HydroTech accident/incident report meets the requirements of the OSHA Form 101 (Supplemental Record) and must be maintained with the OSHA Form 200 for all recordable injuries or illnesses.

Health and Safety Field Log Book

The SSO or designee will maintain the logbook in accordance with standard HydroTech procedures. Daily site conditions, activities, personnel, calibration records, monitoring results and significant events will be recorded. The original logbooks will become part of the exposure records file.

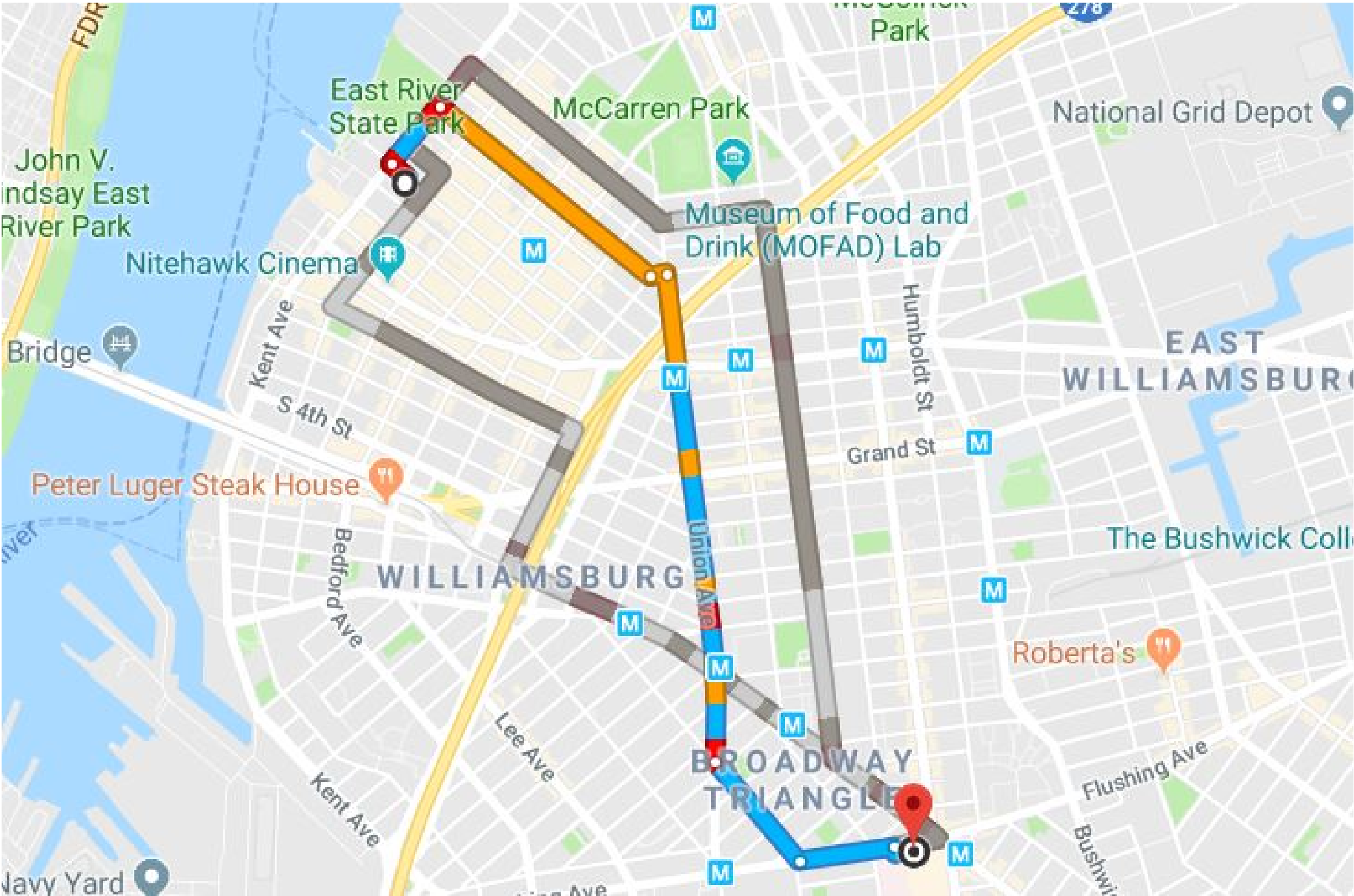
15.0 SANITATION

Since sanitary sewer connection has not been established, provisions shall be made for access to sanitary systems by using nearby public facilities consistent with provisions of governing local ordinance codes. This will include the use of outside firms providing and maintaining “Porta Potties” or similar devices.

If a commercial/industrial laundry is used to clean or launder clothing that is potentially contaminated, they shall be informed of the potential harmful effects of exposure to hazardous substances related to the affected clothing.

Personnel and subcontractors sites shall follow decontamination procedures described in the Construction HASP. This will generally include, when necessary, site-specific training in shower usage and cleanup, personal hygiene requirements and the donning of protective equipment/clothing.

FIGURE 1
DIRECTIONS TO HOSPITAL



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WRITTEN AUTHORIZATION OF HYDROTECH
ENVIRONMENTAL ENGINEERING AND
GEOLOGY, DPC.

| DATE | DESCRIPTION | CHK |
|------|-------------|-----|
| | | |

SEAL & SIGNATURE



HYDROTECH ENVIRONMENTAL
ENGINEERING AND GEOLOGY,
DPC

77 ARKAY DRIVE, SUITE K
HAUPPAUGE, NY 11788
15 OCEAN AVENUE, SUITE 2B
BROOKLYN, NY 11225
TEL: (631) 462-5866
FAX: (631) 462-5877

BASE DRAWING PREPARED BY

PROJECT NAME AND ADDRESS
64 NORTH 8TH
STREET, BROOKLYN

FIGURE NAME
FIGURE 1: DIRECTIONS
TO HOSPITAL

| | |
|-------------------------------|---------------------|
| PROJECT NO. 190011 | DATE 2019-02-19 |
| DRAWN BY A.D | REVIEWED BY R.X. |
| SCALE (11X17) NOT TO SCALE | APPROVED BY T.K. |

ATTACHMENT A
HEALTH AND SAFETY FACT SHEETS

SAFETY DATA SHEET

Creation Date 03-Feb-2010

Revision Date 23-Jan-2018

Revision Number 4

1. Identification

Product Name Trichloroethylene

Cat No. : AC421520000; AC421520025; AC421525000

CAS-No 79-01-6

Synonyms Triclene; Trichloroethene; Ethylene trichloride

Recommended Use Laboratory chemicals.

Uses advised against

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 NumberFor information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11Emergency 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 |
| Skin Sensitization | Category 1 |
| Germ Cell Mutagenicity | Category 2 |
| Carcinogenicity | Category 1A |
| Specific target organ toxicity (single exposure) | Category 3 |
| Target Organs - Central nervous system (CNS). | |
| Specific target organ toxicity - (repeated exposure) | Category 2 |
| Target Organs - Kidney, Liver, Heart, spleen, Blood. | |

Label Elements**Signal Word**

Danger

Hazard Statements

Causes skin irritation

Causes serious eye irritation

May cause an allergic skin reaction

May cause drowsiness or dizziness

Suspected of causing genetic defects
May cause cancer
May cause damage to organs through prolonged or repeated exposure



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
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection

Response

IF exposed or concerned: Get medical attention/advice

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

Skin

IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention

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

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Harmful to aquatic life with long lasting effects

WARNING. Cancer and Reproductive Harm - <https://www.p65warnings.ca.gov/>.

3. Composition/Information on Ingredients

| Component | CAS-No | Weight % |
|-------------------|---------|----------|
| Trichloroethylene | 79-01-6 | >95 |

4. First-aid measures

General Advice

Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Eye Contact

In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

Skin Contact

Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

| | |
|--|--|
| Inhalation | Move to fresh air. If not breathing, give artificial respiration. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required. |
| Ingestion | Do not induce vomiting. Call a physician or Poison Control Center immediately. |
| Most important symptoms and effects | May cause allergic skin reaction. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing |
| Notes to Physician | Treat symptomatically |

5. Fire-fighting measures

| | |
|---|--|
| Suitable Extinguishing Media | Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. |
| Unsuitable Extinguishing Media | No information available |
| Flash Point | No information available |
| Method - | No information available |
| Autoignition Temperature | 410 °C / 770 °F |
| Explosion Limits | |
| Upper | 44.8 vol % |
| Lower | 8 vol % |
| Oxidizing Properties | Not oxidising |
| Sensitivity to Mechanical Impact | No information available |
| Sensitivity to Static Discharge | No information available |

Specific Hazards Arising from the Chemical

Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products

Hydrogen chloride gas Chlorine Phosgene Carbon monoxide (CO) Carbon dioxide (CO₂)

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. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health
2

Flammability
1

Instability
0

Physical hazards
N/A

6. Accidental release measures

| | |
|----------------------------------|---|
| Personal Precautions | Ensure adequate ventilation. Use personal protective equipment. Keep people away from and upwind of spill/leak. Evacuate personnel to safe areas. |
| Environmental Precautions | Should not be released into the environment. Do not flush into surface water or sanitary sewer system. |

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

| | |
|-----------------|---|
| Handling | Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Use only under a chemical fume hood. Do not breathe vapors or spray mist. Do not ingest. |
| Storage | Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from light. Do |

not store in aluminum containers.

8. Exposure controls / personal protection

Exposure Guidelines

| Component | ACGIH TLV | OSHA PEL | NIOSH IDLH | Mexico OEL (TWA) |
|-------------------|-----------------------------|--|----------------|---|
| Trichloroethylene | TWA: 10 ppm STEL: 25 ppm | (Vacated) TWA: 50 ppm (Vacated) TWA: 270 mg/m ³ Ceiling: 200 ppm (Vacated) STEL: 200 ppm (Vacated) STEL: 1080 mg/m ³ TWA: 100 ppm | IDLH: 1000 ppm | TWA: 100 ppm TWA: 535 mg/m ³ STEL: 200 ppm STEL: 1080 mg/m ³ |

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

OSHA - Occupational Safety and Health Administration

NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures

Use only under a chemical fume hood. 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

Long sleeved clothing.

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 | Liquid |
| Appearance | Colorless |
| Odor | Characteristic |
| Odor Threshold | No information available |
| pH | No information available |
| Melting Point/Range | -85 °C / -121 °F |
| Boiling Point/Range | 87 °C / 188.6 °F |
| Flash Point | No information available |
| Evaporation Rate | 0.69 (Carbon Tetrachloride = 1.0) |
| Flammability (solid,gas) | Not applicable |
| Flammability or explosive limits | |
| Upper | 44.8 vol % |
| Lower | 8 vol % |
| Vapor Pressure | 77.3 mbar @ 20 °C |
| Vapor Density | 4.5 (Air = 1.0) |
| Specific Gravity | 1.460 |
| Solubility | Insoluble in water |
| Partition coefficient; n-octanol/water | No data available |
| Autoignition Temperature | 410 °C / 770 °F |
| Decomposition Temperature | > 120°C |

| | |
|-------------------|----------------------------------|
| Viscosity | 0.55 mPa.s (25°C) |
| Molecular Formula | C ₂ H Cl ₃ |
| Molecular Weight | 131.39 |

10. Stability and reactivity

| | |
|----------------------------------|--|
| Reactive Hazard | None known, based on information available |
| Stability | Light sensitive. |
| Conditions to Avoid | Incompatible products. Excess heat. Exposure to light. Exposure to moist air or water. |
| Incompatible Materials | Strong oxidizing agents, Strong bases, Amines, Alkali metals, Metals, |
| Hazardous Decomposition Products | Hydrogen chloride gas, Chlorine, Phosgene, 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 |
|-------------------|--|--|----------------------------|
| Trichloroethylene | LD50 = 4920 mg/kg (Rat) LD50 = 4290 mg/kg (Rat) | LD50 = 29000 mg/kg (Rabbit) LD50 > 20 g/kg (Rabbit) | LC50 = 26 mg/L (Rat) 4 h |

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 | May cause sensitization by skin contact |
| Carcinogenicity | The table below indicates whether each agency has listed any ingredient as a carcinogen. |

| Component | CAS-No | IARC | NTP | ACGIH | OSHA | Mexico |
|-------------------|---------|---------|------------------------------------|-------|------|------------|
| Trichloroethylene | 79-01-6 | Group 1 | Known Reasonably Anticipated | A2 | X | Not listed |

IARC: (International Agency for Research on Cancer)

NTP: (National Toxicity Program)

ACGIH: (American Conference of Governmental Industrial Hygienists)

IARC: (International Agency for Research on Cancer)

Group 1 - Carcinogenic to Humans

Group 2A - Probably Carcinogenic to Humans

Group 2B - Possibly Carcinogenic to Humans

NTP: (National Toxicity Program)

Known - Known Carcinogen

Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

A1 - Known Human Carcinogen

A2 - Suspected Human Carcinogen

A3 - Animal Carcinogen

ACGIH: (American Conference of Governmental Industrial Hygienists)

Mutagenic Effects Mutagenic effects have occurred in humans.

Reproductive Effects No information available.

Developmental Effects No information available.

| | |
|---|--|
| Teratogenicity | No information available. |
| STOT - single exposure | Central nervous system (CNS) |
| STOT - repeated exposure | Kidney Liver Heart spleen Blood |
| Aspiration hazard | No information available |
| Symptoms / effects, both acute and delayed | Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing |
| Endocrine Disruptor Information | No information available |
| Other Adverse Effects | The toxicological properties have not been fully investigated. |

12. Ecological information

Ecotoxicity

Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Do not empty into drains. The product contains following substances which are hazardous for the environment. Contains a substance which is: Harmful to aquatic organisms. Toxic to aquatic organisms.

| Component | Freshwater Algae | Freshwater Fish | Microtox | Water Flea |
|-------------------|--|--|--|--|
| Trichloroethylene | EC50: = 175 mg/L, 96h (Pseudokirchneriella subcapitata) EC50: = 450 mg/L, 96h (Desmodesmus subspicatus) | LC50: 31.4 - 71.8 mg/L, 96h flow-through (Pimephales promelas) LC50: 39 - 54 mg/L, 96h static (Lepomis macrochirus) | EC50 = 0.81 mg/L 24 h EC50 = 115 mg/L 10 min EC50 = 190 mg/L 15 min EC50 = 235 mg/L 24 h EC50 = 410 mg/L 24 h EC50 = 975 mg/L 5 min | EC50: = 2.2 mg/L, 48h (Daphnia magna) |

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

| Component | log Pow |
|-------------------|---------|
| Trichloroethylene | 2.4 |

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 |
|-----------------------------|------------------------|------------------------|
| Trichloroethylene - 79-01-6 | U228 | - |

14. Transport information

DOT

| | |
|-----------------------------|-------------------|
| UN-No | UN1710 |
| Proper Shipping Name | TRICHLOROETHYLENE |
| Hazard Class | 6.1 |
| Packing Group | III |

TDG

| | |
|-----------------------------|-------------------|
| UN-No | UN1710 |
| Proper Shipping Name | TRICHLOROETHYLENE |
| Hazard Class | 6.1 |
| Packing Group | III |

IATA

UN-No UN1710
 Proper Shipping Name TRICHLOROETHYLENE
 Hazard Class 6.1
 Packing Group III

IMDG/IMO

UN-No UN1710
 Proper Shipping Name TRICHLOROETHYLENE
 Hazard Class 6.1
 Packing Group III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

| Component | TSCA | DSL | NDSL | EINECS | ELINCS | NLP | PICCS | ENCS | AICS | IECSC | KECL |
|-------------------|------|-----|------|-----------|--------|-----|-------|------|------|-------|------|
| Trichloroethylene | X | X | - | 201-167-4 | - | | X | X | X | X | X |

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

| Component | TSCA 12(b) |
|-------------------|------------------------|
| Trichloroethylene | Section 5 Section 6 |

SARA 313

| Component | CAS-No | Weight % | SARA 313 - Threshold Values % |
|-------------------|---------|----------|-------------------------------|
| Trichloroethylene | 79-01-6 | >95 | 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 |
|-------------------|----------------------------|-----------------------------|------------------------|---------------------------|
| Trichloroethylene | X | 100 lb | X | X |

Clean Air Act

| Component | HAPS Data | Class 1 Ozone Depletors | Class 2 Ozone Depletors |
|-------------------|-----------|-------------------------|-------------------------|
| Trichloroethylene | X | | - |

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 |
|-------------------|--------------------------|----------------|
| Trichloroethylene | 100 lb 1 lb | - |

California Proposition 65 This product contains the following proposition 65 chemicals

| Component | CAS-No | California Prop. 65 | Prop 65 NSRL | Category |
|-------------------|---------|--|------------------------|-----------------------------|
| Trichloroethylene | 79-01-6 | Carcinogen Developmental Male Reproductive | 14 µg/day 50 µg/day | Developmental Carcinogen |

U.S. State Right-to-Know Regulations

| Component | Massachusetts | New Jersey | Pennsylvania | Illinois | Rhode Island |
|-------------------|---------------|------------|--------------|----------|--------------|
| Trichloroethylene | X | X | X | X | X |

U.S. Department of Transportation

Reportable Quantity (RQ): Y
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

Creation Date 03-Feb-2010
Revision Date 23-Jan-2018
Print Date 23-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

SAFETY DATA SHEET

Creation Date 10-Dec-2009

Revision Date 23-Jan-2018

Revision Number 5

1. Identification

Product Name Tetrachloroethylene

Cat No. : AC445690000; ACR445690010; AC445690025; AC445691000

CAS-No 127-18-4

Synonyms Perchloroethylene

Recommended Use Laboratory chemicals.

Uses advised against Not for 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 |
| Skin Sensitization | Category 1 |
| Carcinogenicity | Category 1B |
| Specific target organ toxicity (single exposure) | Category 3 |
| Target Organs - Central nervous system (CNS). | |
| Specific target organ toxicity - (repeated exposure) | Category 2 |
| Target Organs - Kidney, Liver, Blood. | |

Label Elements

Signal Word

Danger

Hazard Statements

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Causes serious eye irritation

May cause an allergic skin reaction

May cause drowsiness or dizziness

May cause cancer

May cause damage to organs through prolonged or repeated exposure

**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
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection

Response

IF exposed or concerned: Get medical attention/advice

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

Skin

IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention

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

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Toxic to aquatic life with long lasting effects

WARNING. Cancer - <https://www.p65warnings.ca.gov/>.

3. Composition/Information on Ingredients

| Component | CAS-No | Weight % |
|---------------------|----------|----------|
| Tetrachloroethylene | 127-18-4 | >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. If skin irritation persists, call a physician.

Inhalation

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

Ingestion

Clean mouth with water and drink afterwards plenty of water.

Most important symptoms and effects

None reasonably foreseeable. May cause allergic skin reaction. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Notes to Physician

Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable Extinguishing Media No information available

Flash Point No information available

Method - No information available

Autoignition Temperature No information available

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

Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated.

Hazardous Combustion Products

Chlorine Hydrogen chloride gas Phosgene

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
2

Flammability
0

Instability
0

Physical hazards
N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment. Ensure adequate ventilation.

Environmental Precautions Do not flush into surface water or sanitary sewer system.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Ensure adequate ventilation. Avoid ingestion and inhalation.

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

8. Exposure controls / personal protection

Exposure Guidelines

| Component | ACGIH TLV | OSHA PEL | NIOSH IDLH | Mexico OEL (TWA) |
|---------------------|------------------------------|---|---------------|--|
| Tetrachloroethylene | TWA: 25 ppm STEL: 100 ppm | (Vacated) TWA: 25 ppm (Vacated) TWA: 170 mg/m ³ Ceiling: 200 ppm TWA: 100 ppm | IDLH: 150 ppm | TWA: 100 ppm TWA: 670 mg/m ³ TWA: 200 ppm TWA: 1250 mg/m ³ STEL: 200 ppm STEL: 1340 mg/m ³ |

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

OSHA - Occupational Safety and Health Administration

NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures

Use only under a chemical fume hood. 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

Long sleeved clothing.

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 | Liquid |
| Appearance | Colorless |
| Odor | Characteristic, sweet |
| Odor Threshold | No information available |
| pH | No information available |
| Melting Point/Range | -22 °C / -7.6 °F |
| Boiling Point/Range | 120 - 122 °C / 248 - 251.6 °F @ 760 mmHg |
| Flash Point | No information available |
| Evaporation Rate | 6.0 (Ether = 1.0) |
| Flammability (solid,gas) | Not applicable |
| Flammability or explosive limits | |
| Upper | No data available |
| Lower | No data available |
| Vapor Pressure | 18 mbar @ 20 °C |
| Vapor Density | No information available |
| Density | 1.619 |
| Specific Gravity | 1.625 |
| Solubility | 0.15 g/L water (20°C) |
| Partition coefficient; n-octanol/water | No data available |
| Autoignition Temperature | No information available |
| Decomposition Temperature | > 150°C |
| Viscosity | 0.89 mPa s at 20 °C |
| Molecular Formula | C ₂ Cl ₄ |
| Molecular Weight | 165.83 |

10. Stability and reactivity

| | |
|---|--|
| Reactive Hazard | None known, based on information available |
| Stability | Stable under normal conditions. |
| Conditions to Avoid | Incompatible products. Excess heat. Exposure to moist air or water. |
| Incompatible Materials | Strong acids, Strong oxidizing agents, Strong bases, Metals, Zinc, Amines, Aluminium |
| Hazardous Decomposition Products | Chlorine, Hydrogen chloride gas, Phosgene |
| 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 |
|---------------------|---------------------------|--------------------------|------------------------------|
| Tetrachloroethylene | LD50 = 2629 mg/kg (Rat) | LD50 > 10000 mg/kg (Rat) | LC50 = 27.8 mg/L (Rat) 4 h |

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 |
|---------------------|----------|----------|------------------------|-------|------|--------|
| Tetrachloroethylene | 127-18-4 | Group 2A | Reasonably Anticipated | A3 | X | A3 |

IARC: (International Agency for Research on Cancer)

NTP: (National Toxicity Program)

ACGIH: (American Conference of Governmental Industrial Hygienists)

Mexico - Occupational Exposure Limits - Carcinogens

IARC: (International Agency for Research on Cancer)

Group 1 - Carcinogenic to Humans

Group 2A - Probably Carcinogenic to Humans

Group 2B - Possibly Carcinogenic to Humans

NTP: (National Toxicity Program)

Known - Known Carcinogen

Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

A1 - Known Human Carcinogen

A2 - Suspected Human Carcinogen

A3 - Animal Carcinogen

ACGIH: (American Conference of Governmental Industrial Hygienists)

Mexico - Occupational Exposure Limits - Carcinogens

A1 - Confirmed Human Carcinogen

A2 - Suspected Human Carcinogen

A3 - Confirmed Animal Carcinogen

A4 - Not Classifiable as a Human Carcinogen

A5 - Not Suspected as a Human Carcinogen

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)

STOT - repeated exposure Kidney Liver Blood

Aspiration hazard No information available

Symptoms / effects, both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Endocrine Disruptor Information

| Component | EU - Endocrine Disruptors Candidate List | EU - Endocrine Disruptors - Evaluated Substances | Japan - Endocrine Disruptor Information |
|---------------------|--|--|---|
| Tetrachloroethylene | Group II Chemical | Not applicable | Not applicable |

Other Adverse Effects Tumorigenic effects have been reported in experimental animals.

12. Ecological information

Ecotoxicity

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

| Component | Freshwater Algae | Freshwater Fish | Microtox | Water Flea |
|---------------------|--|---|--|---|
| Tetrachloroethylene | EC50: > 500 mg/L, 96h (Pseudokirchneriella subcapitata) | LC50: 4.73 - 5.27 mg/L, 96h flow-through (Oncorhynchus mykiss) LC50: 11.0 - 15.0 mg/L, 96h static (Lepomis macrochirus) LC50: 8.6 - 13.5 mg/L, 96h static (Pimephales promelas) LC50: 12.4 - 14.4 mg/L, 96h flow-through (Pimephales promelas) | EC50 = 100 mg/L 24 h EC50 = 112 mg/L 24 h EC50 = 120.0 mg/L 30 min | EC50: 6.1 - 9.0 mg/L, 48h Static (Daphnia magna) |

Persistence and Degradability Insoluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility . Is not likely mobile in the environment due its low water solubility. Will likely be mobile in the environment due to its volatility.

| Component | log Pow |
|---------------------|-------------|
| Tetrachloroethylene | 2.53 - 2.88 |

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 |
|--------------------------------|------------------------|------------------------|
| Tetrachloroethylene - 127-18-4 | U210 | - |

14. Transport information

DOT

UN-No UN1897
 Proper Shipping Name TETRACHLOROETHYLENE
 Hazard Class 6.1
 Packing Group III

TDG

UN-No UN1897

Proper Shipping Name TETRACHLOROETHYLENE
 Hazard Class 6.1
 Packing Group III

IATA

UN-No UN1897
 Proper Shipping Name TETRACHLOROETHYLENE
 Hazard Class 6.1
 Packing Group III

IMDG/IMO

UN-No UN1897
 Proper Shipping Name TETRACHLOROETHYLENE
 Hazard Class 6.1
 Subsidiary Hazard Class P
 Packing Group III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

| Component | TSCA | DSL | NDSL | EINECS | ELINCS | NLP | PICCS | ENCS | AICS | IECSC | KECL |
|---------------------|------|-----|------|-----------|--------|-----|-------|------|------|-------|------|
| Tetrachloroethylene | X | X | - | 204-825-9 | - | | X | X | X | X | X |

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

| Component | CAS-No | Weight % | SARA 313 - Threshold Values % |
|---------------------|----------|----------|-------------------------------|
| Tetrachloroethylene | 127-18-4 | >95 | 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 |
|---------------------|----------------------------|-----------------------------|------------------------|---------------------------|
| Tetrachloroethylene | - | - | X | X |

Clean Air Act

| Component | HAPS Data | Class 1 Ozone Depletors | Class 2 Ozone Depletors |
|---------------------|-----------|-------------------------|-------------------------|
| Tetrachloroethylene | X | | - |

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 |
|---------------------|--------------------------|----------------|
| Tetrachloroethylene | 100 lb 1 lb | - |

California Proposition 65 This product contains the following proposition 65 chemicals

| Component | CAS-No | California Prop. 65 | Prop 65 NSRL | Category |
|---------------------|----------|---------------------|--------------|------------|
| Tetrachloroethylene | 127-18-4 | Carcinogen | 14 µg/day | Carcinogen |

U.S. State Right-to-Know Regulations

| Component | Massachusetts | New Jersey | Pennsylvania | Illinois | Rhode Island |
|---------------------|---------------|------------|--------------|----------|--------------|
| Tetrachloroethylene | X | X | X | X | X |

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant Y
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

Creation Date 10-Dec-2009

Revision Date 23-Jan-2018

Print Date 23-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



SAFETY DATA SHEET

Creation Date 31-May-2018

Revision Date 04-Jun-2018

Revision Number 7

SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1. Product identification

| | |
|----------------------|------------------------------------|
| Product Description: | <u>Xylenes, mixture of isomers</u> |
| Cat No. : | 383940000; 383940010; 383940050 |
| CAS-No | 1330-20-7 |
| EC-No. | 215-535-7 |
| Molecular Formula | C8 H10 |

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

| | |
|--------------------------------|---|
| Recommended Use | Laboratory chemicals. |
| Sector of use | SU3 - Industrial uses: Uses of substances as such or in preparations at industrial sites |
| Product category | PC21 - Laboratory chemicals |
| Process categories | PROC15 - Use as a laboratory reagent |
| Environmental release category | ERC6a - Industrial use resulting in manufacture of another substance (use of intermediates) |
| Uses advised against | No Information available |

1.3. Details of the supplier of the safety data sheet

| | |
|----------------|--|
| Company | Acros Organics BVBA Janssen Pharmaceuticaaan 3a 2440 Geel, Belgium |
| E-mail address | begel.sdsdesk@thermofisher.com |

1.4. 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

SECTION 2: HAZARDS IDENTIFICATION

2.1. Classification of the substance or mixture

CLP Classification - Regulation (EC) No 1272/2008

Physical hazards

| | |
|-------------------|-------------------|
| Flammable liquids | Category 3 (H226) |
|-------------------|-------------------|

Health hazards

| | |
|--|-------------------|
| Aspiration Toxicity | Category 1 (H304) |
| Acute dermal toxicity | Category 4 (H312) |
| Acute Inhalation Toxicity - Vapors | Category 4 (H332) |
| Skin Corrosion/Irritation | Category 2 (H315) |
| Serious Eye Damage/Eye Irritation | Category 2 (H319) |
| Specific target organ toxicity - (single exposure) | Category 3 (H335) |
| Specific target organ toxicity - (repeated exposure) | Category 2 (H373) |

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Environmental hazards

Chronic aquatic toxicity

Category 3 (H412)

2.2. Label elements



Signal Word

Danger

Hazard Statements

H226 - Flammable liquid and vapor
H304 - May be fatal if swallowed and enters airways
H312 - Harmful in contact with skin
H332 - Harmful if inhaled
H315 - Causes skin irritation
H319 - Causes serious eye irritation
H335 - May cause respiratory irritation
H373 - May cause damage to organs through prolonged or repeated exposure
H412 - Harmful to aquatic life with long lasting effects

Precautionary Statements

P210 - Keep away from heat/sparks/open flames/hot surfaces. - No smoking
P303 + P361 + P353 - IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower
P301 + P310 - IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician
P331 - Do NOT induce vomiting
P304 + P340 - IF INHALED: Remove to fresh air and keep at rest in a position comfortable for breathing
P264 - Wash face, hands and any exposed skin thoroughly after handling
P337 + P313 - If eye irritation persists: Get medical advice/ attention
P280 - Wear protective gloves/ protective clothing/ eye protection/ face protection
P332 + P313 - If skin irritation occurs: Get medical advice/ attention

2.3. Other hazards

No information available

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1. Substances

| Component | CAS-No | EC-No. | Weight % | CLP Classification - Regulation (EC) No 1272/2008 |
|------------------------------|-----------|-------------------|----------|---|
| Xylenes (o-, m-, p- isomers) | 1330-20-7 | EEC No. 215-535-7 | >95 | Flam. Liq. 3 (H226) Asp. Tox. 1 (H304) Acute Tox. 4 (H312) Acute Tox. 4 (H332) |

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| | | | | |
|--|--|--|--|---|
| | | | | Skin Irrit. 2 (H315) Eye Irrit. 2 (H319) STOT SE 3 (H335) STOT RE 2 (H373) Aquatic Chronic 3 (H412) |
|--|--|--|--|---|

Full text of Hazard Statements: see section 16

SECTION 4: FIRST AID MEASURES

4.1. Description of 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. If skin irritation persists, call a physician. |
| Ingestion | Clean mouth with water and drink afterwards plenty of water. Do not induce vomiting. Call a physician or Poison Control Center immediately. If vomiting occurs naturally, have victim lean forward. |
| Inhalation | Move to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur. Risk of serious damage to the lungs. |
| Self-Protection of the First Aider | Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination. |

4.2. Most important symptoms and effects, both acute and delayed

Breathing difficulties. Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting

4.3. Indication of any immediate medical attention and special treatment needed

| | |
|---------------------------|---|
| Notes to Physician | Treat symptomatically. Symptoms may be delayed. |
|---------------------------|---|

SECTION 5: FIREFIGHTING MEASURES

5.1. Extinguishing media

Suitable Extinguishing Media

Cool closed containers exposed to fire with water spray.

Extinguishing media which must not be used for safety reasons

Do not use a solid water stream as it may scatter and spread fire.

5.2. Special hazards arising from the substance or mixture

Flammable. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back.

Hazardous Combustion Products

None under normal use conditions.

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5.3. Advice for firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures

Ensure adequate ventilation. Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges.

6.2. Environmental precautions

Do not flush into surface water or sanitary sewer system.

6.3. Methods and material for containment and cleaning up

Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Remove all sources of ignition. Take precautionary measures against static discharges. Use spark-proof tools and explosion-proof equipment.

6.4. Reference to other sections

Refer to protective measures listed in Sections 8 and 13.

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for safe handling

Wear personal protective equipment. Ensure adequate ventilation. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. Use explosion-proof equipment. Take precautionary measures against static discharges.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice. Keep away from food, drink and animal feeding stuffs. Do not eat, drink or smoke when using this product. Remove and wash contaminated clothing before re-use. Wash hands before breaks and at the end of workday.

7.2. Conditions for safe storage, including any incompatibilities

Keep away from heat and sources of ignition. Flammables area. Keep container tightly closed in a dry and well-ventilated place.

7.3. Specific end use(s)

Use in laboratories

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control parameters

Exposure limits

List source(s): **EU** - Commission Directive 2006/15/EC of 7 February 2006 establishing a second list of indicative occupational exposure limit values in implementation of Council Directive 98/24/EC and amending Directives 91/322/EEC and 2000/39/EC on the protection of the health and safety of workers from the risks related to chemical agents at work. **UK** - EH40/2005 Containing the workplace exposure limits (WELs) for use with the Control of Substances Hazardous to Health Regulations (COSHH) 2002 (as amended). Updated by September 2006 official press release and October 2007 Supplement. **IRE** - 2010 Code of Practice for the

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Safety, Health and Welfare at Work (Chemical Agents) Regulations 2001. Published by the Health and Safety Authority.

| Component | The United Kingdom | European Union | Ireland |
|------------------------------|---|---|---|
| Xylenes (o-, m-, p- isomers) | STEL: 100 ppm 15 min STEL: 441 mg/m ³ 15 min TWA: 50 ppm 8 hr TWA: 220 mg/m ³ 8 hr Skin | TWA: 50 ppm 8 hr TWA: 221 mg/m ³ 8 hr STEL: 100 ppm 15 min STEL: 442 mg/m ³ 15 min Possibility of significant uptake through the skin | TWA: 50 ppm 8 hr. TWA: 221 mg/m ³ 8 hr. STEL: 100 ppm 15 min STEL: 442 mg/m ³ 15 min Skin |

Biological limit values

List source(s): **UK** - Biological Monitoring Guidance Values provided by the UK's Health and Safety Executive (HSE) Control of Substances Hazardous to Health Regulations (COSHH) 2002 (as amended) and EH40/2005.

| Component | United Kingdom | European Union |
|------------------------------|--|----------------|
| Xylenes (o-, m-, p- isomers) | Methyl hippuric acid: 650 mmol/mol creatinine urine post shift | |

Monitoring methods

BS EN 14042:2003 Title Identifier: Workplace atmospheres. Guide for the application and use of procedures for the assessment of exposure to chemical and biological agents.

MDHS70 General methods for sampling airborne gases and vapours

MDHS 88 Volatile organic compounds in air. Laboratory method using diffusive samplers, solvent desorption and gas chromatography

MDHS 96 Volatile organic compounds in air - Laboratory method using pumped solid sorbent tubes, solvent desorption and gas chromatography

Derived No Effect Level (DNEL) No information available

| Route of exposure | Acute effects (local) | Acute effects (systemic) | Chronic effects (local) | Chronic effects (systemic) |
|------------------------------|-----------------------|--------------------------|-------------------------|----------------------------|
| Oral Dermal Inhalation | | | | |

Predicted No Effect Concentration (PNEC) No information available.

8.2. Exposure controls

Engineering Measures

Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas. Use explosion-proof electrical/ventilating/lighting/equipment.

Wherever possible, engineering control measures such as the isolation or enclosure of the process, the introduction of process or equipment changes to minimise release or contact, and the use of properly designed ventilation systems, should be adopted to control hazardous materials at source

Personal protective equipment

Eye Protection Goggles (European standard - EN 166)

Hand Protection Protective gloves

| Glove material | Breakthrough time | Glove thickness | EU standard | Glove comments |
|----------------|-----------------------------------|-----------------|-------------|-----------------------|
| Viton (R) | See manufacturers recommendations | - | EN 374 | (minimum requirement) |

Skin and body protection Long sleeved clothing

Inspect gloves before use.

Please observe the instructions regarding permeability and breakthrough time which are provided by the supplier of the gloves. (Refer to manufacturer/supplier for information)

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Ensure gloves are suitable for the task: Chemical compatibility, Dexterity, Operational conditions, User susceptibility, e.g. sensitisation effects, also take into consideration the specific local conditions under which the product is used, such as the danger of cuts, abrasion.

Remove gloves with care avoiding skin contamination.

Respiratory Protection

When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.
To protect the wearer, respiratory protective equipment must be the correct fit and be used and maintained properly

Large scale/emergency use

Use a NIOSH/MSHA or European Standard EN 136 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced
Recommended Filter type: Organic gases and vapours filter Type A Brown conforming to EN14387

Small scale/Laboratory use

Use a NIOSH/MSHA or European Standard EN 149:2001 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.
Recommended half mask:- Valve filtering: EN405; or; Half mask: EN140; plus filter, EN 141
When RPE is used a face piece Fit Test should be conducted

Environmental exposure controls

Prevent product from entering drains. Do not allow material to contaminate ground water system. Local authorities should be advised if significant spillages cannot be contained.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on basic physical and chemical properties

Appearance

Physical State

Liquid

Odor

No information available

Odor Threshold

No data available

pH

No information available

Melting Point/Range

-34 °C / -29.2 °F

Softening Point

No data available

Boiling Point/Range

136 - 140 °C / 276.8 - 284 °F @ 760 mmHg

Flash Point

23 °C / 73.4 °F

Method - No information available

Evaporation Rate

No data available

Flammability (solid,gas)

Not applicable

Liquid

Explosion Limits

No data available

Vapor Pressure

No data available

Vapor Density

No data available

(Air = 1.0)

Specific Gravity / Density

0.865

Bulk Density

Not applicable

Liquid

Water Solubility

Insoluble

Solubility in other solvents

No information available

Partition Coefficient (n-octanol/water)

Component

log Pow

Xylenes (o-, m-, p- isomers)

3.15

Autoignition Temperature

No data available

Decomposition Temperature

No data available

Viscosity

No data available

Explosive Properties

No information available

explosive air/vapour mixtures possible

Oxidizing Properties

No information available

9.2. Other information

Molecular Formula

C8 H10

SAFETY DATA SHEET

Xylenes, mixture of isomers

Revision Date 04-Jun-2018

Molecular Weight 106.17

SECTION 10: STABILITY AND REACTIVITY

10.1. Reactivity

None known, based on information available

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

Hazardous Polymerization
Hazardous Reactions

No information available.
None under normal processing.

10.4. Conditions to avoid

Keep away from open flames, hot surfaces and sources of ignition.

10.5. Incompatible materials

None known.

10.6. Hazardous decomposition products

None under normal use conditions.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Product Information

(a) acute toxicity;

Oral

Based on available data, the classification criteria are not met

Dermal

Category 4

Inhalation

Category 4

| Component | LD50 Oral | LD50 Dermal | LC50 Inhalation |
|------------------------------|---------------------------|-------------|--|
| Xylenes (o-, m-, p- isomers) | LD50 = 3500 mg/kg (Rat) | | 29.08 mg/L [MOE Risk Assessment Vol.1, 2002] |

(b) skin corrosion/irritation;

Category 2

(c) serious eye damage/irritation;

Category 2

(d) respiratory or skin sensitization;

Respiratory

Based on available data, the classification criteria are not met

Skin

Based on available data, the classification criteria are not met

(e) germ cell mutagenicity;

Based on available data, the classification criteria are not met

(f) carcinogenicity;

Based on available data, the classification criteria are not met

There are no known carcinogenic chemicals in this product

(g) reproductive toxicity;

Based on available data, the classification criteria are not met

SAFETY DATA SHEET

Xylenes, mixture of isomers

Revision Date 04-Jun-2018

(h) STOT-single exposure; Category 3

Results / Target organs Respiratory system.

(i) STOT-repeated exposure; Category 2

Target Organs No information available.

(j) aspiration hazard; Category 1

Symptoms / effects, both acute and delayed Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting

SECTION 12: ECOLOGICAL INFORMATION

12.1. Toxicity

Ecotoxicity effects

The product contains following substances which are hazardous for the environment.
Contains a substance which is: Very toxic to aquatic organisms.

| Component | Freshwater Fish | Water Flea | Freshwater Algae | Microtox |
|------------------------------|--|---|------------------|-------------------------|
| Xylenes (o-, m-, p- isomers) | LC50: 13.1 - 16.5 mg/L, 96h flow-through (Lepomis macrochirus) LC50: = 19 mg/L, 96h (Lepomis macrochirus) LC50: 7.711 - 9.591 mg/L, 96h static (Lepomis macrochirus) LC50: 23.53 - 29.97 mg/L, 96h static (Pimephales promelas) LC50: = 780 mg/L, 96h semi-static (Cyprinus carpio) LC50: > 780 mg/L, 96h (Cyprinus carpio) LC50: 30.26 - 40.75 mg/L, 96h static (Poecilia reticulata) LC50: 13.5 - 17.3 mg/L, 96h (Oncorhynchus mykiss) LC50: = 13.4 mg/L, 96h flow-through (Pimephales promelas) LC50: 2.661 - 4.093 mg/L, 96h static (Oncorhynchus mykiss) | EC50: = 3.82 mg/L, 48h (water flea) LC50: = 0.6 mg/L, 48h (Gammarus lacustris) | | EC50 = 0.0084 mg/L 24 h |

12.2. Persistence and degradability

Persistence

Persistence is unlikely.

Degradation in sewage treatment plant

Contains substances known to be hazardous to the environment or not degradable in waste water treatment plants.

12.3. Bioaccumulative potential

Bioaccumulation is unlikely

| Component | log Pow | Bioconcentration factor (BCF) |
|------------------------------|---------|-------------------------------|
| Xylenes (o-, m-, p- isomers) | 3.15 | 0.6 - 15 |

SAFETY DATA SHEET

Xylenes, mixture of isomers

Revision Date 04-Jun-2018

12.4. Mobility in soil

Spillage unlikely to penetrate soil The product is insoluble and floats on water Is not likely mobile in the environment due its low water solubility.

12.5. Results of PBT and vPvB assessment

No data available for assessment.

12.6. Other adverse effects

Endocrine Disruptor Information
Persistent Organic Pollutant
Ozone Depletion Potential

This product does not contain any known or suspected endocrine disruptors
This product does not contain any known or suspected substance
This product does not contain any known or suspected substance

SECTION 13: DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods

Waste from Residues / Unused Products

Waste is classified as hazardous. Dispose of in accordance with the European Directives on waste and hazardous waste. Dispose of in accordance with local regulations.

Contaminated Packaging

Dispose of this container to hazardous or special waste collection point. Empty containers retain product residue, (liquid and/or vapor), and can be dangerous. Keep product and empty container away from heat and sources of ignition.

European Waste Catalogue (EWC)

According to the European Waste Catalogue, Waste Codes are not product specific, but application specific.

Other Information

Do not dispose of waste into sewer. Waste codes should be assigned by the user based on the application for which the product was used. Can be incinerated, when in compliance with local regulations. Do not let this chemical enter the environment. Do not empty into drains.

SECTION 14: TRANSPORT INFORMATION

IMDG/IMO

14.1. UN number

UN1307

14.2. UN proper shipping name

XYLENES

14.3. Transport hazard class(es)

3

14.4. Packing group

III

ADR

14.1. UN number

UN1307

14.2. UN proper shipping name

XYLENES

14.3. Transport hazard class(es)

3

14.4. Packing group

III

IATA

14.1. UN number

UN1307

14.2. UN proper shipping name

XYLENES

14.3. Transport hazard class(es)

3

14.4. Packing group

III

14.5. Environmental hazards

No hazards identified

14.6. Special precautions for user

No special precautions required

SAFETY DATA SHEET

Xylenes, mixture of isomers

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14.7. Transport in bulk according to Not applicable, packaged goods
Annex II of MARPOL73/78 and the
IBC Code

SECTION 15: REGULATORY INFORMATION

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

International Inventories X = listed.

| Component | EINECS | ELINCS | NLP | TSCA | DSL | NDSL | PICCS | ENCS | IECSC | AICS | KECL |
|------------------------------|-----------|--------|-----|------|-----|------|-------|------|-------|------|------|
| Xylenes (o-, m-, p- isomers) | 215-535-7 | - | | X | X | - | X | X | X | X | X |

National Regulations

| Component | Germany - Water Classification (VwVwS) | Germany - TA-Luft Class |
|------------------------------|--|-------------------------|
| Xylenes (o-, m-, p- isomers) | WGK 2 | |

| Component | France - INRS (Tables of occupational diseases) |
|------------------------------|---|
| Xylenes (o-, m-, p- isomers) | Tableaux des maladies professionnelles (TMP) - RG 4bis, RG 84 |

Take note of Control of Substances Hazardous to Health Regulations (COSHH) 2002 and 2005 Amendment.

15.2. Chemical safety assessment

A Chemical Safety Assessment/Report (CSA/CSR) has not been conducted

SECTION 16: OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3

H304 - May be fatal if swallowed and enters airways
H312 - Harmful in contact with skin
H332 - Harmful if inhaled
H315 - Causes skin irritation
H319 - Causes serious eye irritation
H335 - May cause respiratory irritation
H373 - May cause damage to organs through prolonged or repeated exposure
H412 - Harmful to aquatic life with long lasting effects
H226 - Flammable liquid and vapor

Legend

CAS - Chemical Abstracts Service

EINECS/ELINCS - European Inventory of Existing Commercial Chemical Substances/EU List of Notified Chemical Substances

PICCS - Philippines Inventory of Chemicals and Chemical Substances

IECSC - Chinese Inventory of Existing Chemical Substances

KECL - Korean Existing and Evaluated Chemical Substances

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

ENCS - Japanese Existing and New Chemical Substances

AICS - Australian Inventory of Chemical Substances

NZIoC - New Zealand Inventory of Chemicals

WEL - Workplace Exposure Limit

ACGIH - American Conference of Governmental Industrial Hygienists

DNEL - Derived No Effect Level

RPE - Respiratory Protective Equipment

LC50 - Lethal Concentration 50%

NOEC - No Observed Effect Concentration

PBT - Persistent, Bioaccumulative, Toxic

TWA - Time Weighted Average

IARC - International Agency for Research on Cancer

PNEC - Predicted No Effect Concentration

LD50 - Lethal Dose 50%

EC50 - Effective Concentration 50%

POW - Partition coefficient Octanol:Water

vPvB - very Persistent, very Bioaccumulative

SAFETY DATA SHEET

Xylenes, mixture of isomers

Revision Date 04-Jun-2018

ADR - European Agreement Concerning the International Carriage of Dangerous Goods by Road

IMO/IMDG - International Maritime Organization/International Maritime Dangerous Goods Code

OECD - Organisation for Economic Co-operation and Development

BCF - Bioconcentration factor

ICAO/IATA - International Civil Aviation Organization/International Air Transport Association

MARPOL - International Convention for the Prevention of Pollution from Ships

ATE - Acute Toxicity Estimate

VOC - Volatile Organic Compounds

Key literature references and sources for data

Suppliers safety data sheet, Chemadvisor - LOLI, Merck index, RTECS

Training Advice

Chemical hazard awareness training, incorporating labelling, Safety Data Sheets (SDS), Personal Protective Equipment (PPE) and hygiene.

Use of personal protective equipment, covering appropriate selection, compatibility, breakthrough thresholds, care, maintenance, fit and standards.

First aid for chemical exposure, including the use of eye wash and safety showers.

Chemical incident response training.

Fire prevention and fighting, identifying hazards and risks, static electricity, explosive atmospheres posed by vapours and dusts.

Creation Date 31-May-2018

Revision Date 04-Jun-2018

Revision Summary SDS sections updated, 2, 3.

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 Safety Data Sheet

SAFETY DATA SHEET

Creation Date 26-Sep-2009

Revision Date 23-Jan-2018

Revision Number 4

1. Identification

Product Name m-Xylene

Cat No. : AC610470000; AC610471000

CAS-No 108-38-3
Synonyms 1,3-Dimethylbenzene

Recommended Use Laboratory chemicals.
Uses advised against Not for 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 NumberFor information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11Emergency 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)

| | |
|------------------------------------|------------|
| Flammable liquids | Category 3 |
| Acute dermal toxicity | Category 4 |
| Acute Inhalation Toxicity - Vapors | Category 4 |
| Skin Corrosion/irritation | Category 2 |
| Serious Eye Damage/Eye Irritation | Category 2 |

Label Elements**Signal Word**

Warning

Hazard Statements

Flammable liquid and vapor
Harmful in contact with skin
Causes skin irritation
Causes serious eye irritation
Harmful if inhaled

**Precautionary Statements****Prevention**

Wear protective gloves/protective clothing/eye protection/face protection

Avoid breathing dust/fume/gas/mist/vapors/spray

Use only outdoors or in a well-ventilated area

Wash face, hands and any exposed skin thoroughly after handling

Keep away from heat/sparks/open flames/hot surfaces. - No smoking

Keep container tightly closed

Ground/bond container and receiving equipment

Use explosion-proof electrical/ventilating/lighting/equipment

Use only non-sparking tools

Take precautionary measures against static discharge

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

Call a POISON CENTER or doctor/physician if you feel unwell

Skin

Call a POISON CENTER or doctor/physician if you feel unwell

If skin irritation occurs: Get medical advice/attention

IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower

Wash contaminated clothing 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

Fire

In case of fire: Use CO₂, dry chemical, or foam for extinction

Storage

Store in a well-ventilated place. Keep cool

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

None identified

3. Composition/Information on Ingredients

| Component | CAS-No | Weight % |
|-----------|----------|----------|
| m-Xylene | 108-38-3 | >95 |

4. First-aid measures

Eye Contact

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

Skin Contact

Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation

Move to fresh air. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required. If not breathing, give artificial respiration.

| | |
|--|---|
| Ingestion | Do not induce vomiting. Call a physician or Poison Control Center immediately. |
| Most important symptoms and effects | Breathing difficulties. Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting |
| Notes to Physician | Treat symptomatically |

5. Fire-fighting measures

| | |
|---|---|
| Suitable Extinguishing Media | Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Cool closed containers exposed to fire with water spray. |
| Unsuitable Extinguishing Media | No information available |
| Flash Point | 25 °C / 77 °F |
| Method - | No information available |
| Autoignition Temperature | 465 °C / 869 °F |
| Explosion Limits | |
| Upper | 7.0% |
| Lower | 1.1% |
| Sensitivity to Mechanical Impact | No information available |
| Sensitivity to Static Discharge | No information available |

Specific Hazards Arising from the Chemical

Flammable. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO₂)

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. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

| | | | |
|---------------|---------------------|--------------------|-------------------------|
| Health | Flammability | Instability | Physical hazards |
| 2 | 3 | 0 | N/A |

6. Accidental release measures

| | |
|---|--|
| Personal Precautions | Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges. |
| Environmental Precautions | Do not flush into surface water or sanitary sewer system. |
| Methods for Containment and Clean Up | Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment. Take precautionary measures against static discharges. |

7. Handling and storage

| | |
|-----------------|--|
| Handling | Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. Take precautionary measures against static discharges. |
| Storage | Keep containers tightly closed in a dry, cool and well-ventilated place. Flammables area. Keep away from heat and sources of ignition. |

8. Exposure controls / personal protection

Exposure Guidelines

| Component | ACGIH TLV | OSHA PEL | NIOSH IDLH | Mexico OEL (TWA) |
|-----------|-------------------------------|----------|---|--|
| m-Xylene | TWA: 100 ppm STEL: 150 ppm | | IDLH: 900 ppm TWA: 100 ppm TWA: 435 mg/m ³ STEL: 150 ppm STEL: 655 mg/m ³ | TWA: 100 ppm TWA: 435 mg/m ³ STEL: 150 ppm STEL: 655 mg/m ³ |

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures

Ensure that eyewash stations and safety showers are close to the workstation location.
Ensure adequate ventilation, especially in confined areas. Use explosion-proof electrical/ventilating/lighting/equipment.

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 | Liquid |
| Appearance | Colorless |
| Odor | aromatic |
| Odor Threshold | No information available |
| pH | No information available |
| Melting Point/Range | -48 °C / -54.4 °F |
| Boiling Point/Range | 139 - 139 °C / 282.2 - 282.2 °F |
| Flash Point | 25 °C / 77 °F |
| Evaporation Rate | 0.7 |
| Flammability (solid,gas) | Not applicable |
| Flammability or explosive limits | |
| Upper | 7.0% |
| Lower | 1.1% |
| Vapor Pressure | 8 mbar @ 20 °C |
| Vapor Density | 3.66 |
| Specific Gravity | 0.864 |
| Solubility | slightly soluble |
| Partition coefficient; n-octanol/water | No data available |
| Autoignition Temperature | 465 °C / 869 °F |
| Decomposition Temperature | No information available |
| Viscosity | 0.62 mPa.s at 20 °C |
| Molecular Formula | C8 H10 |
| Molecular Weight | 106.17 |

10. Stability and reactivity

Reactive Hazard

None known, based on information available

| | |
|---|---|
| Stability | Stable under normal conditions. |
| Conditions to Avoid | Incompatible products. Excess heat. Keep away from open flames, hot surfaces and sources of ignition. |
| Incompatible Materials | Strong oxidizing agents, Strong acids |
| 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 |
|-----------|-----------------------|---|-----------------|
| m-Xylene | LD50 = 5 g/kg (Rat) | LD50 = 12.18 g/kg (Rabbit) LD50 = 14100 µL/kg (Rabbit) | 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 |
|-----------|----------|------------|------------|------------|------------|------------|
| m-Xylene | 108-38-3 | 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 Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting

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. Contains a substance which is: Toxic to aquatic organisms.

| Component | Freshwater Algae | Freshwater Fish | Microtox | Water Flea |
|-----------|--|---|-------------------------|---|
| m-Xylene | EC50: = 4.9 mg/L, 72h static (Pseudokirchneriella subcapitata) | LC50: = 8.4 mg/L, 96h semi-static (Oncorhynchus mykiss) LC50: 14.3 - 18 mg/L, 96h flow-through (Pimephales promelas) LC50: = 12.9 mg/L, 96h semi-static (Poecilia reticulata) | EC50 = 0.0084 mg/L 24 h | EC50: 2.81 - 5.0 mg/L, 48h Static (Daphnia magna) |

Persistence and Degradability Persistence is unlikely

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility. Is not likely mobile in the environment due its low water solubility.

| Component | log Pow |
|-----------|---------|
| m-Xylene | 3.2 |

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 UN1307
 Proper Shipping Name XYLENES
 Hazard Class 3
 Packing Group III

TDG

UN-No UN1307
 Proper Shipping Name XYLENES
 Hazard Class 3
 Packing Group III

IATA

UN-No UN1307
 Proper Shipping Name XYLENES
 Hazard Class 3
 Packing Group III

IMDG/IMO

UN-No UN1307
 Proper Shipping Name XYLENES
 Hazard Class 3
 Packing Group III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

| Component | TSCA | DSL | NDSL | EINECS | ELINCS | NLP | PICCS | ENCS | AICS | IECSC | KECL |
|-----------|------|-----|------|-----------|--------|-----|-------|------|------|-------|------|
| m-Xylene | X | X | - | 203-576-3 | - | | X | X | X | X | X |

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated

polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

| Component | CAS-No | Weight % | SARA 313 - Threshold Values % |
|-----------|----------|----------|-------------------------------|
| m-Xylene | 108-38-3 | >95 | 1.0 |

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 |
|-----------|----------------------------|-----------------------------|------------------------|---------------------------|
| m-Xylene | X | - | - | - |

Clean Air Act

| Component | HAPS Data | Class 1 Ozone Depletors | Class 2 Ozone Depletors |
|-----------|-----------|-------------------------|-------------------------|
| m-Xylene | X | | - |

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 |
|-----------|--------------------------|----------------|
| m-Xylene | 1000 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 |
|-----------|---------------|------------|--------------|----------|--------------|
| m-Xylene | 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 |
| Creation Date | 26-Sep-2009 |
| Revision Date | 23-Jan-2018 |
| Print Date | 23-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

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End of SDS

SAFETY DATA SHEET

Creation Date 26-Sep-2009

Revision Date 26-Jan-2018

Revision Number 6

1. Identification

Product Name Mesitylene

Cat No. : AC125580000; AC125580010; AC125580025; AC125580050;
AC125582500

CAS-No 108-67-8
Synonyms 1,3,5-Trimethylbenzene

Recommended Use Laboratory chemicals.
Uses advised against Not for 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)

| | |
|---|------------|
| Flammable liquids | Category 3 |
| Skin Corrosion/irritation | Category 2 |
| Serious Eye Damage/Eye Irritation | Category 2 |
| Specific target organ toxicity (single exposure) | Category 3 |
| Target Organs - Respiratory system, Central nervous system (CNS). | |
| Aspiration Toxicity | Category 1 |

Label Elements

Signal Word

Danger

Hazard Statements

Flammable liquid and vapor
May be fatal if swallowed and enters airways
Causes skin irritation
Causes serious eye irritation
May cause respiratory irritation
May cause drowsiness or dizziness

**Precautionary Statements****Prevention**

Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves/protective clothing/eye protection/face protection
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Keep cool

Response

Get medical attention/advice if you feel unwell

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell

Skin

If skin irritation occurs: Get medical advice/attention
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing 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

Ingestion

IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
Do NOT induce vomiting

Fire

In case of fire: Use CO₂, dry chemical, or foam for extinction

Storage

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

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Toxic to aquatic life with long lasting effects

3. Composition/Information on Ingredients

| Component | CAS-No | Weight % |
|------------------------|----------|----------|
| 1,3,5-Trimethylbenzene | 108-67-8 | 97-99 |

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 soap and plenty of water while removing all contaminated clothes and shoes. Obtain medical attention. |
| Inhalation | Move to fresh air. If breathing is difficult, give oxygen. Obtain medical attention. Risk of serious damage to the lungs. |
| Ingestion | Clean mouth with water and drink afterwards plenty of water. Do not induce vomiting. Call a physician or Poison Control Center immediately. If vomiting occurs naturally, have victim lean forward. |
| Most important symptoms and effects | . Breathing difficulties. Vapors may cause drowsiness and dizziness: Symptoms may be delayed: Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting |
| Notes to Physician | Treat symptomatically |

5. Fire-fighting measures

| | |
|---|---|
| Suitable Extinguishing Media | Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Cool closed containers exposed to fire with water spray. |
| Unsuitable Extinguishing Media | No information available |
| Flash Point | 44 °C / 111.2 °F |
| Method - | No information available |
| Autoignition Temperature | 550 °C / 1022 °F |
| Explosion Limits | |
| Upper | 6.00% |
| Lower | 1.00% |
| Sensitivity to Mechanical Impact | No information available |
| Sensitivity to Static Discharge | No information available |

Specific Hazards Arising from the Chemical

Flammable. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO₂)

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
3

Flammability
2

Instability
0

Physical hazards
N/A

6. Accidental release measures

| | |
|---|--|
| Personal Precautions | Ensure adequate ventilation. Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges. |
| Environmental Precautions | Do not flush into surface water or sanitary sewer system. See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage. |
| Methods for Containment and Clean Up | Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment. Take precautionary measures against static discharges. |

7. Handling and storage

| | |
|-----------------|--|
| Handling | Wear personal protective equipment. Ensure adequate ventilation. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. Take precautionary measures against static discharges. Use explosion-proof equipment. |
| Storage | Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition. Flammables area. |

8. Exposure controls / personal protection

Exposure Guidelines

| Component | ACGIH TLV | OSHA PEL | NIOSH IDLH | Mexico OEL (TWA) |
|------------------------|-----------|----------|---|------------------|
| 1,3,5-Trimethylbenzene | | | TWA: 25 ppm TWA: 125 mg/m ³ | |

Legend

NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

| | |
|-----------------------------|--|
| Engineering Measures | Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location. Use explosion-proof electrical/ventilating/lighting/equipment. |
|-----------------------------|--|

Personal Protective Equipment

| | |
|---------------------------------|---|
| Eye/face Protection | Tightly fitting safety goggles. Face-shield. |
| Skin and body protection | Long sleeved clothing. |
| 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 | Liquid |
| Appearance | Colorless |
| Odor | aromatic |
| Odor Threshold | No information available |
| pH | No information available |
| Melting Point/Range | -45 °C / -49 °F |
| Boiling Point/Range | 163 - 166 °C / 325.4 - 330.8 °F @ 760 mmHg |
| Flash Point | 44 °C / 111.2 °F |
| Evaporation Rate | No information available |
| Flammability (solid,gas) | Not applicable |
| Flammability or explosive limits | |
| Upper | 6.00% |
| Lower | 1.00% |
| Vapor Pressure | 2.5 mbar @ 20 °C |
| Vapor Density | 4.1 (Air = 1.0) |
| Specific Gravity | 0.868 |
| Solubility | slightly soluble |
| Partition coefficient; n-octanol/water | No data available |
| Autoignition Temperature | 550 °C / 1022 °F |
| Decomposition Temperature | No information available |

| | |
|-------------------|--------------------------------|
| Viscosity | No information available |
| Molecular Formula | C ₉ H ₁₂ |
| Molecular Weight | 120.19 |

10. Stability and reactivity

| | |
|----------------------------------|---|
| Reactive Hazard | None known, based on information available |
| Stability | Stable under normal conditions. |
| Conditions to Avoid | Incompatible products. Excess heat. Keep away from open flames, hot surfaces and sources of ignition. |
| Incompatible Materials | Strong oxidizing agents, Nitric acid |
| 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 No acute toxicity information is available for this product

Component Information

| Component | LD50 Oral | LD50 Dermal | LC50 Inhalation |
|------------------------|---------------------------|-------------|--|
| 1,3,5-Trimethylbenzene | LD50 = 5000 mg/kg (Rat) | Not listed | LC50 = 24 g/m ³ (Rat) 4 h |

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, respiratory system 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 |
|------------------------|----------|------------|------------|------------|------------|------------|
| 1,3,5-Trimethylbenzene | 108-67-8 | Not listed | Not listed | Not listed | Not listed | Not listed |

Mutagenic Effects Not mutagenic in AMES Test

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system Central nervous system (CNS)
STOT - repeated exposure None known

Aspiration hazard Category 1

Symptoms / effects, both acute and delayed Vapors may cause drowsiness and dizziness: Symptoms may be delayed: Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information No information available

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

12. Ecological information

Ecotoxicity

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

| Component | Freshwater Algae | Freshwater Fish | Microtox | Water Flea |
|------------------------|------------------|---|------------|---|
| 1,3,5-Trimethylbenzene | Not listed | LC50: = 3.48 mg/L, 96h (Pimephales promelas) | Not listed | EC50: = 50 mg/L, 24h (Daphnia magna) |

Persistence and Degradability Soluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its water solubility.

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 UN2325
 Proper Shipping Name 1,3,5-TRIMETHYLBENZENE
 Hazard Class 3
 Packing Group III

TDG

UN-No UN2325
 Proper Shipping Name 1,3,5-TRIMETHYLBENZENE
 Hazard Class 3
 Packing Group III

IATA

UN-No UN2325
 Proper Shipping Name 1,3,5-TRIMETHYLBENZENE
 Hazard Class 3
 Packing Group III

IMDG/IMO

UN-No UN2325
 Proper Shipping Name 1,3,5-TRIMETHYLBENZENE
 Hazard Class 3
 Packing Group III

15. Regulatory information

All of the components in the product are on the following Inventory lists: Australia Complete Regulatory Information contained in following SDS's X = listed China Canada The product is classified and labeled according to EC directives or corresponding national laws The product is classified and labeled in accordance with Directive 1999/45/EC Europe TSCA Korea Philippines Japan U.S.A. (TSCA) Canada (DSL/NDL) Europe (EINECS/ELINCS/NLP) Australia (AICS) Korea (ECL) China (IECSC) Japan (ENCS) Philippines (PICCS)

International Inventories

| Component | TSCA | DSL | NDL | EINECS | ELINCS | NLP | PICCS | ENCS | AICS | IECSC | KECL |
|------------------------|------|-----|-----|-----------|--------|-----|-------|------|------|-------|------|
| 1,3,5-Trimethylbenzene | X | X | - | 203-604-4 | - | | X | X | X | X | X |

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313 Not applicable

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

CWA (Clean Water Act) Not applicable

Clean Air Act Not applicable

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA Not applicable

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 |
|------------------------|---------------|------------|--------------|----------|--------------|
| 1,3,5-Trimethylbenzene | 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 Moderate risk, Grade 2

16. Other information

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

Creation Date 26-Sep-2009

Revision Date 26-Jan-2018

Print Date 26-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

Safety Data Sheet

Prepared in accordance with Commission Regulation (EU) 2015/830



Stock Number: 31275

Revision Date: 24-04-2018

This document replaces SDS dated: 06-01-2017

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

Chrysene Standard

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier: Chrysene Standard

Stock Number: 31275

Other means of identification:

Synonyms: None Known

REACH Registration No.: None Known

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

Relevant identified uses: For Laboratory use only

Uses advised against: Uses other than recommended use.

1.3 Details of the Supplier of the Safety Data Sheet:

Manufacturer

Restek Corporation
110 Benner Circle
Bellefonte, Pa. 16823
USA

00 1 814-353-1300

00 1 814-353-1309

sds@restek.com

Supplier

Thames Restek UK LTD
Units 8-16, Ministry Wharf
Wycombe Road, Saunderton
Buckinghamshire

United Kingdom HP14 4HW

01494 563377

sales@thamesrestek.co.uk

1.4 Emergency telephone number:

00 1 800-424-9300
(CHEMTREC within the US)

0870-8200418
(CHEMTREC within the UK)

00 1 703-741-5970

(Outside USA)

+1 703-741-5970

(CHEMTREC International)

Poison Centre contact information:

National Poisons Information Service (NPIS)

Email: director.birmingham.unit@npis.org

Website: <http://www.npis.org/>

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture:

**Classification according to Regulation (EC)
No 1272/2008 [CLP]:**

Carcinogenicity Category 1B

Flammable Liquid Category 2

Serious Eye Damage/Eye Irritation Category 2

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Chrysene Standard

Specific Target Organ Systemic Toxicity (STOT) - Single Exposure Category 3

2.2 Label elements:

Labelling according to Regulation (EC) No 1272/2008 [CLP]:

Hazard
pictograms:



Signal Word:

Danger

Hazard Statements:

H225 - Highly flammable liquid and vapour

H319 - Causes serious eye irritation

H336 - May cause drowsiness or dizziness

H350 - May cause cancer.

Precautionary Statements:

P201 - Obtain special instructions before use.

P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

P280 - Wear protective gloves/protective clothing/eye protection/face protection.

P303+P361+P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.

P304+P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing.

P305+P351+P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

Supplemental Hazard information (EU):

None Known

2.3 Other hazards:

This substance does not meet the PBT or vPvB criteria of REACH, Annex XIII

SECTION 3: Composition/information on ingredients

3.1 Substances:

Not applicable

3.2 Mixtures:

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Chrysene Standard

| Chemical Name | % | CAS # | EC No. REACH Registration No. | Classification (EC) No 1272/2008 | M Factor | SCL | Acute Toxicity Estimates |
|---------------|------|----------|-------------------------------------|---|----------------------|----------------------|--------------------------------|
| chrysene | 0.1 | 218-01-9 | 205-923-4 None Known | Aquatic Acute 1; H400 Aquatic Chronic 1; H410 Carc. 1B; H350 Muta. 2; H341 | No data available | No data available | Not determined |
| Acetone | 99.9 | 67-64-1 | 200-662-2 None Known | Eye Irrit. 2; H319 Flam. Liq. 2; H225 STOT SE 3; H336 EUH066 | No data available | No data available | Not determined |

For full text of H-statements see Section 16.

SECTION 4: First aid measures

4.1 Description of 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.

Eye contact:

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.

Self protection of the first aider:

No data available

4.2 Most important symptoms and effects, both acute and delayed:

Causes serious eye irritation May cause drowsiness or dizziness

4.3 Indication of any immediate medical attention and special treatment needed:

No additional first aid information available

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Chrysene Standard

SECTION 5: Firefighting measures

5.1 Extinguishing media:

Suitable 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.

Unsuitable extinguishing media:

None Known

5.2 Special hazards arising from the substance or mixture:

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

Hazardous Combustion Products:

Carbon dioxide, Carbon monoxide

5.3 Advice for firefighters:

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.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:

Non-emergency personnel:

Non-emergency personnel should be kept clear of the area

Emergency responders:

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.

6.2 Environmental precautions:

No data available

6.3 Methods and material for containment and cleaning up:

Small spills:

Refer to information provided for large spills

Large spills:

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

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with suitable absorbent material like granulated clay. Gather and store in a sealed container pending a waste disposal evaluation.

6.4 Reference to other sections:

Refer to section 13 for disposal information

SECTION 7: Handling and storage

7.1 Precautions for safe handling:

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

7.2 Conditions for safe storage, including any incompatibilities:

Conditions for safe storage:

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

Materials to Avoid/Chemical Incompatibility:

Strong oxidizing agents, Strong acids

7.3 Specific end use(s):

For Laboratory use only

SECTION 8: Exposure controls/personal protection

8.1 Control parameters:

Occupational Exposure limit values:

| Chemical Name | United Kingdom - Workplace Exposure Limits (WELs) - TWAs | United Kingdom - Workplace Exposure Limits (WELs) - STELs | United Kingdom - Biological Monitoring Guidance Values |
|---------------|--|---|--|
| Acetone | 500 ppm TWA; 1210 mg/m ³ TWA | 1500 ppm STEL; 3620 mg/m ³ STEL | No data available |

DNEL:

None Known

PNEC:

None Known

8.2 Exposure controls:

Appropriate engineering controls:

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

Individual protection measures, such as personal protective equipment:

Eye and face protection:

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

Skin Protection:

Hand protection:

Nitrile Neoprene

Other skin protection:

Wear protective gloves. Inspect gloves for chemical break-through and

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Chrysene Standard

| | |
|---|--|
| | 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 |
| 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. |
| Respirator Type(s): | Not normally required. |
| Thermal Hazards: | Not applicable |
| Environmental exposure controls: | No data available |

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties:

| | |
|--|--------------------------------|
| Appearance: | No data available |
| Colour: | Depends upon product selection |
| Odour: | Strong |
| Odour threshold: | ND |
| pH: | Not applicable |
| Melting Point/Freezing Point (°C): | |
| Melting point (°C): | -95 |
| Freezing point (°C): | No data available |
| Initial boiling point and boiling range (°C): | 56 |
| Flash point (°C): | -20 |
| Evaporation Rate (water = 1): | No data available |
| Flammability (solid, gas): | No data available |
| Upper/lower flammability or explosive limits: | |
| Upper flammable or explosive limit, % in air: | No data available |
| Lower flammable or explosive limit, % in air: | No data available |
| Vapour pressure: | No data available |
| Vapor Density (Air=1): | 2 |
| Relative density (water = 1): | 0.791 |
| Solubility(ies): | Complete; 100% |

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Partition coefficient: n-octanol/water: No data available
Auto-ignition temperature (°C): 465
Decomposition temperature (°C): No data available
Viscosity: No data available
Explosive properties: No data available
Oxidizing properties: No data available

9.2 Other information:

Volatile Organic Chemicals: 0
Bulk density: 6.601

SECTION 10: Stability and reactivity

10.1 Reactivity: Not expected to be reactive
10.2 Chemical stability: Stable under normal conditions.
10.3 Possibility of hazardous reactions: None expected under standard conditions of storage
10.4 Conditions to avoid: No data available
10.5 Incompatible materials: Strong oxidizing agents, Strong acids
10.6 Hazardous decomposition products: Carbon dioxide, Carbon monoxide

SECTION 11: Toxicological information

11.1 Information on toxicological effects:

Acute toxicity:

| Chemical Name | ORAL LD50 (rat) | DERMAL LD50 (rabbit) | INHALATION LC50 (rat) |
|---------------|-----------------------------|-------------------------------------|---------------------------------------|
| Acetone | ORAL LD50 Rat 5800 mg/kg | DERMAL LD50 Rabbit > 15700 mg/kg | INHALATION LC50-8H Rat 50100 MG/M3 |

Based on available data, the classification criteria are not met.

Skin corrosion/irritation:

Based on available data, the classification criteria are not met.

Serious eye damage/irritation:

| | |
|----|----------------|
| pH | Not applicable |
|----|----------------|

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Classification is based on pH and the components listed in Section 3.

Respiratory or skin sensitisation:

Based on available data, the classification criteria are not met.

Germ cell mutagenicity:

Based on available data, the classification criteria are not met.

Carcinogenicity:

Classification has been based on toxicological information of the components in Section 3.

Reproductive toxicity:

Based on available data, the classification criteria are not met.

STOT-single exposure:

Classification has been based on toxicological information of the components in Section 3.

STOT-repeated exposure:

Based on available data, the classification criteria are not met.

Aspiration hazard:

Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

12.1 Toxicity:

This material is not expected to be harmful to the ecology.

Ecological Toxicity Data:

| Chemical Name | CAS # | Aquatic EC50 Crustacea | Aquatic ERC50 Algae | Aquatic LC50 Fish |
|-------------------|-------|---------------------------|------------------------|-------------------|
| No data available | | | | |

12.2 Persistence and degradability:

No data

No data

12.3 Bioaccumulative potential:

No data

12.4 Mobility in soil:

No data

12.5 Results of PBT and vPvB assessment:

No data available

12.6 Other adverse effects:

None Known

12.7 Additional information:

No data available

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

Chrysene Standard

SECTION 13: Disposal considerations

13.1 Waste treatment methods:

Disposal methods:

Spent or discarded material is a hazardous waste.

Dispose of by incineration following Federal, State, Local, or Provincial regulations.

Waste codes / waste designations according to LoW:

No data available

SECTION 14: Transport information

International carriage of dangerous goods by road (ADR), rail or inland waterways:

14.1 UN number: UN1090

14.2 UN proper shipping name: Acetone

14.3 Transport hazard class(es): 3

14.4 Packing group: II

International carriage of dangerous goods by air (IATA):

14.1 UN number: UN1090

14.2 UN proper shipping name: Acetone

14.3 Transport hazard class(es): 3

14.4 Packing group: II

14.5 Environmental hazards: No

14.6 Special precautions for user: No data available

14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code: No data available

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:

| Chemical Name | EINECS | SVHC |
|---------------|--------|------|
| Acetone | Yes | No |
| chrysene | Yes | No |

15.2 Chemical Safety Assessment

No Chemical Safety Assessment has been carried out for this

Safety Data Sheet

Prepared in accordance with Commission Regulation (EU) 2015/830



Stock Number: 31275

Revision Date: 24-04-2018

This document replaces SDS dated: 06-01-2017

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

Chrysene Standard

substance/mixture by the supplier.

SECTION 16: Other information

Revision Date: 24-04-2018

Indication of changes: Any changes to the SDS compared to previous versions are marked by a vertical line in front of the concerned paragraph.

Abbreviations and acronyms:

CAS = Chemical Abstract Service
DNEL= Derivative No Effect Level
EC= European Community
EINECS = European Inventory of Existing Chemical Substances
MSHA = Mine Safety Health Administration
NIOSH = National Institute of Occupational Safety & Health
OEL = Occupational Exposure Limit
PBT= Persistent, Bioaccumulative, Toxic
PNEC= Predicted No Effect Concentration
SCOEL= Scientific Committee on Occupational Exposure Limits
TLV = Threshold Limit Value
TWA= Time Weighted Average
vPvB= Very Persistent, Very Bioaccumulative
Wt.% = Weight Percent

Key literature references and sources for data: No data available

Hazard phrase(s) referenced in section 3

H341 - Suspected of causing genetic defects.
H350 - May cause cancer.
H225 - Highly flammable liquid and vapour
H319 - Causes serious eye irritation
H336 - May cause drowsiness or dizziness
H410 - Very toxic to aquatic life with long lasting effects

Precautionary Statements:

Prevention:

P201 - Obtain special instructions before use.
P202 - Do not handle until all safety precautions have been read and understood.
P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Safety Data Sheet

Prepared in accordance with Commission Regulation (EU) 2015/830



Stock Number: 31275

Revision Date: 24-04-2018

This document replaces SDS dated: 06-01-2017

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

Chrysene Standard

Response:

P240 - Ground/bond container and receiving equipment.
P241 - Use explosion-proof electrical/ventilating/lighting equipment.
P242 - Use only non-sparking tools.
P243 - Take precautionary measures against static discharge.
P261 - Avoid breathing dust/fume/gas/mist/vapours/spray.
P264 - Wash thoroughly after handling.
P271 - Use only outdoors or in a well-ventilated area.
P280 - Wear protective gloves/protective clothing/eye protection/face protection.
P303+P361+P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304+P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing.
P305+P351+P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308+P313 - IF exposed or concerned: Get medical advice/ attention.
P312 - Call a POISON CENTER/doctor if you feel unwell.
P337+P313 - If eye irritation persists: Get medical advice/attention.
P370+P378 - In case of fire: Use an appropriate extinguisher (see section 5) to extinguish.

Storage:

P403+P233 - Store in a well-ventilated place. Keep container tightly closed.
P403+P235 - Store in a well-ventilated place. Keep cool.
P405 - Store locked up.

Disposal:

P501 - Dispose of contents/container to a suitable disposal site in accordance with local/national/international regulations.

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Safety Data Sheet

Prepared in accordance with Commission Regulation (EU) 2015/830



Stock Number: 31275

Revision Date: 24-04-2018

This document replaces SDS dated: 06-01-2017

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

Chrysene Standard

assumed. All such being given and accepted at your risk.



Safety Data Sheet

Revision Date: 08/13/18

www.restek.com

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

1. IDENTIFICATION

| | |
|---------------------------------------|--|
| Catalog Number / Product Name: | 31272 / Benzo(b)fluoranthene 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: | 10 |
| Intended use: | For Laboratory use only |

2. HAZARD(S) IDENTIFICATION

Emergency Overview:

GHS Hazard
Symbols:



GHS Classification: 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.
Causes serious eye irritation.
May cause drowsiness or dizziness.
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.
Wear protective gloves/protective clothing/eye protection/face protection.

First Aid Measures: 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.
If eye irritation persists: Get medical advice/attention.
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 (b) fluoranthene | 205-99-2 | 205-911-9 | 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 (b) fluoranthene | 205-99-2 | Not established | None Known | Not established | No data available |

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: | 0 |
| Molecular Weight: | 58.08 |

10. STABILITY AND REACTIVITY

| | |
|---|--------------------------------------|
| Stability: | Stable under normal conditions. |
| Conditions to Avoid: | None known. |
| Materials to Avoid / Chemical Incompatibility: | 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/m ³ 8 h; Oral LD50 Rat 5800 mg/kg |

Component Carcinogenic Data:

OSHA:

| Chemical Name | CAS No. | |
|----------------------|----------|---------|
| Benzo(b)fluoranthene | 205-99-2 | Present |

ACGIH:

| Chemical Name | CAS No. | |
|----------------------|----------|---|
| Benzo[b]fluoranthene | 205-99-2 | 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 92 [2010]; Supplement 7 [1987]; Monograph 32 [1983] | 205-99-2 | Group 2B |

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 (b) fluoranthene | 205-99-2 | X | X | - | - |

The following chemicals are listed on CA Prop 65:

| Chemical Name | CAS # | Regulation |
|----------------------|----------|----------------|
| Benzo[b]fluoranthene | 205-99-2 | 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 (b) fluoranthene | 205-99-2 | X | X | X | X |

16. OTHER INFORMATION

Prior Version Date: 12/08/16

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

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SAFETY DATA SHEET

Version 4.7
Revision Date 12/28/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION**1.1 Product identifiers**

Product name : Lead

Product Number : 695912

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 # : (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 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 or doctor/ physician if you feel unwell. Rinse mouth. |
| P308 + P313 | IF exposed or concerned: Get medical advice/ attention. |
| P391 | Collect spillage. |
| P405 | Store locked up. |
| P501 | Dispose of contents/ container to an approved waste disposal plant. |

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

| | |
|------------------|----------------|
| Formula | : Pb |
| Molecular weight | : 207.20 g/mol |
| CAS-No. | : 7439-92-1 |
| EC-No. | : 231-100-4 |

Hazardous components

| Component | Classification | Concentration |
|-------------|---|---------------|
| Lead | | |
| | Acute Tox. 4; Carc. 2; Repr. 2; STOT RE 2; Aquatic Acute 1; Aquatic Chronic 1; H302, H351, H361, H373, H410 | <= 100 % |

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

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

Lead 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

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): 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/m ³ | USA. ACGIH Threshold Limit Values (TLV) |
| | | Confirmed animal carcinogen with unknown relevance to humans | | |
| | | TWA | 0.05 mg/m ³ | 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/m ³ | 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

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: Reasonably anticipated to be a human carcinogen (Lead)

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

Suspected human reproductive toxicant

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 # sperm positive females; # females pregnant per # females mated). Effects on Fertility: Pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea).

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

May cause 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 dolomieu - 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 |

New Jersey Right To Know Components

| | CAS-No. | Revision Date |
|------|-----------|---------------|
| Lead | 7439-92-1 | 1994-04-01 |

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.

| | CAS-No. | Revision Date |
|------|-----------|---------------|
| 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.

| | CAS-No. | Revision Date |
|------|-----------|---------------|
| 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. |
| H373 | May cause damage to organs through prolonged or repeated exposure. |

H400 Very toxic to aquatic life.
H410 Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard: 1
Chronic Health Hazard: *
Flammability: 0
Physical Hazard 0

NFPA Rating

Health hazard: 1
Fire Hazard: 0
Reactivity Hazard: 0

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.7

Revision Date: 12/28/2015

Print Date: 05/01/2016

SAFETY DATA SHEET

Version 3.12
Revision Date 12/02/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION**1.1 Product identifiers**

Product name : Mercury

Product Number : 215457
Brand : Sigma-Aldrich
Index-No. : 080-001-00-0

CAS-No. : 7439-97-6

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

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (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, Inhalation (Category 2), H330
Reproductive toxicity (Category 1B), H360
Specific target organ toxicity - repeated exposure (Category 1), H372
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H330 Fatal if inhaled.
H360 May damage fertility or the unborn child.
H372 Causes damage to organs through prolonged or repeated exposure.
H410 Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201 Obtain special instructions before use.
P202 Do not handle until all safety precautions have been read and understood.

| | |
|--------------------|---|
| P260 | Do not breathe dust/ fume/ gas/ mist/ vapours/ spray. |
| P264 | Wash skin thoroughly after handling. |
| P270 | Do not eat, drink or smoke when using this product. |
| P271 | Use only outdoors or in a well-ventilated area. |
| P273 | Avoid release to the environment. |
| P280 | Wear protective gloves/ protective clothing/ eye protection/ face protection. |
| P284 | Wear respiratory protection. |
| P304 + P340 + P310 | IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician. |
| P308 + P313 | IF exposed or concerned: Get medical advice/ attention. |
| P391 | Collect spillage. |
| P403 + P233 | Store in a well-ventilated place. Keep container tightly closed. |
| P405 | Store locked up. |
| P501 | Dispose of contents/ container to an approved waste disposal plant. |

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

| | |
|------------------|----------------|
| Formula | : Hg |
| Molecular weight | : 200.59 g/mol |
| CAS-No. | : 7439-97-6 |
| EC-No. | : 231-106-7 |
| Index-No. | : 080-001-00-0 |

Hazardous components

| Component | Classification | Concentration |
|----------------|---|---------------|
| Mercury | | |
| | Acute Tox. 2; Repr. 1B; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H330, H360, H372, H410 | <= 100 % |

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Mercury/mercury 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 breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal. In some instances, a mercury spill kit may be used. Please consult with your site EHS representative to determine the most appropriate clean up method. Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Store under inert gas.

Storage class (TRGS 510): Non-combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

| Component | CAS-No. | Value | Control parameters | Basis |
|-----------|-----------|---------------------------------|-----------------------|--|
| Mercury | 7439-97-6 | C | 0.1 mg/m ³ | USA. NIOSH Recommended Exposure Limits |
| | Remarks | Potential for dermal absorption | | |

| | | | | |
|--|--|---|-------------|---|
| | | CEIL | 1.0mg/10m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-2 |
| | | TWA | 0.05 mg/m3 | USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000 |
| | | Skin notation | | |
| | | TWA | 0.025 mg/m3 | USA. ACGIH Threshold Limit Values (TLV) |
| | | Central Nervous System impairment Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human carcinogen Danger of cutaneous absorption | | |
| | | TWA | 0.05 mg/m3 | USA. NIOSH Recommended Exposure Limits |
| | | Potential for dermal absorption | | |

Biological occupational exposure limits

| Component | CAS-No. | Parameters | Value | Biological specimen | Basis |
|-----------|-----------|---|--------------|---------------------|---|
| Mercury | 7439-97-6 | Mercury | 0.0400 mg/g | In urine | ACGIH - Biological Exposure Indices (BEI) |
| | Remarks | Prior to shift (16 hours after exposure ceases) | | | |
| | | Mercury | 15.0000 µg/l | In blood | ACGIH - Biological Exposure Indices (BEI) |
| | | End of shift at end of workweek | | | |

8.2 Exposure controls

Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES**9.1 Information on basic physical and chemical properties**

- | | |
|---|--|
| a) Appearance | Form: liquid Colour: silver, white |
| b) Odour | odourless |
| c) Odour Threshold | No data available |
| d) pH | No data available |
| e) Melting point/freezing point | Melting point/range: -38.87 °C (-37.97 °F) - lit. |
| f) Initial boiling point and boiling range | 356.6 °C (673.9 °F) - lit. |
| g) Flash point | Not applicable |
| h) Evaporation rate | No data available |
| i) Flammability (solid, gas) | No data available |
| j) Upper/lower flammability or explosive limits | No data available |
| k) Vapour pressure | < 0.01 hPa (< 0.01 mmHg) at 20 °C (68 °F) 1 hPa (1 mmHg) at 126 °C (259 °F) |
| l) Vapour density | 6.93 - (Air = 1.0) |
| m) Relative density | 13.55 g/cm ³ at 25 °C (77 °F) |
| n) Water solubility | 0.00006 g/l at 25 °C (77 °F) |
| o) Partition coefficient: n-octanol/water | No data available |
| p) Auto-ignition temperature | No data available |
| q) Decomposition temperature | No data available |
| r) Viscosity | No data available |
| s) Explosive properties | No data available |
| t) Oxidizing properties | No data available |

9.2 Other safety information

Relative vapour density 6.93 - (Air = 1.0)

10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to avoid

No data available

10.5 Incompatible materials

Strong oxidizing agents, Ammonia, Azides, Nitrates, Chlorates, Copper

10.6 Hazardous decomposition products

Other decomposition products - No data available

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

No data available

LC50 Inhalation - Rat - male - 2 h - < 27 mg/m³

Dermal: No data available

No data available

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation

No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (Mercury)

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

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

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION**12.1 Toxicity**

Toxicity to fish mortality LC50 - Cyprinus carpio (Carp) - 0.160 mg/l - 96 h

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potentialBioaccumulation Carassius auratus (goldfish) - 1,789 d
- 0.25 µg/l

Bioconcentration factor (BCF): 155,986

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

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.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION**DOT (US)**

UN number: 2809 Class: 8 (6.1) Packing group: III
Proper shipping name: A,W Mercury
Reportable Quantity (RQ): 1 lbs

Poison Inhalation Hazard: No

IMDG

UN number: 2809 Class: 8 (6.1) Packing group: III EMS-No: F-A, S-B
Proper shipping name: MERCURY
Marine pollutant: yes

IATA

UN number: 2809 Class: 8 (6.1) Packing group: III
Proper shipping name: Mercury

15. REGULATORY INFORMATION**SARA 302 Components**

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

| | CAS-No. | Revision Date |
|---------|-----------|---------------|
| Mercury | 7439-97-6 | 2007-07-01 |

Pennsylvania Right To Know Components

| | CAS-No. | Revision Date |
|---------|-----------|---------------|
| Mercury | 7439-97-6 | 2007-07-01 |

New Jersey Right To Know Components

| | CAS-No. | Revision Date |
|---------|-----------|---------------|
| Mercury | 7439-97-6 | 2007-07-01 |

California Prop. 65 Components

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

| CAS-No. | Revision Date |
|-----------|---------------|
| 7439-97-6 | 2013-12-20 |

Mercury

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

| | |
|-----------------|---|
| Acute Tox. | Acute toxicity |
| Aquatic Acute | Acute aquatic toxicity |
| Aquatic Chronic | Chronic aquatic toxicity |
| H330 | Fatal if inhaled. |
| H360 | May damage fertility or the unborn child. |
| H372 | Causes damage to organs through prolonged or repeated exposure. |
| H400 | Very toxic to aquatic life. |
| H410 | Very toxic to aquatic life with long lasting effects. |
| Repr. | Reproductive toxicity |

HMIS Rating

| | |
|------------------------|---|
| Health hazard: | 2 |
| Chronic Health Hazard: | * |
| Flammability: | 0 |
| Physical Hazard | 0 |

NFPA Rating

| | |
|--------------------|---|
| Health hazard: | 2 |
| Fire Hazard: | 0 |
| Reactivity Hazard: | 0 |

Further information

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Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 3.12

Revision Date: 12/02/2015

Print Date: 05/01/2016

SAFETY DATA SHEET

Version 4.7
Revision Date 05/23/2016
Print Date 06/23/2016

1. PRODUCT AND COMPANY IDENTIFICATION**1.1 Product identifiers**

Product name : Arsenic

Product Number : 202657
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, 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 4), H302
Acute toxicity, Inhalation (Category 3), H331
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H302 Harmful 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.
P264 Wash skin thoroughly after handling.
P270 Do not eat, drink or smoke when using this product.
P271 Use only outdoors or in a well-ventilated area.
P273 Avoid release to the environment.

| | |
|--------------------|---|
| P301 + P312 + P330 | IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell. Rinse mouth. |
| P304 + P340 + P311 | IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor. |
| P391 | Collect spillage. |
| P403 + P233 | Store in a well-ventilated place. Keep container tightly closed. |
| P405 | Store locked up. |
| P501 | Dispose of contents/ container to an approved waste disposal plant. |

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

| | |
|------------------|----------------|
| Formula | : As |
| Molecular weight | : 74.92 g/mol |
| CAS-No. | : 7440-38-2 |
| EC-No. | : 231-148-6 |
| Index-No. | : 033-001-00-X |

Hazardous components

| Component | Classification | Concentration |
|----------------|--|---------------|
| Arsenic | | |
| | Acute Tox. 4; Acute Tox. 3; Aquatic Acute 1; Aquatic Chronic 1; H302, H331, H410 | <= 100 % |

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

No data available

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Wear respiratory protection. Avoid 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): 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 |
|-----------|-----------|--|--------------------------|---|
| Arsenic | 7440-38-2 | TWA | 0.01 mg/m ³ | USA. ACGIH Threshold Limit Values (TLV) |
| | Remarks | Lung cancer Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Confirmed human carcinogen | | |
| | | C | 0.0020 mg/m ³ | USA. NIOSH Recommended Exposure Limits |
| | | Potential Occupational Carcinogen See Appendix A 15 minute ceiling value | | |

Biological occupational exposure limits

| Component | CAS-No. | Parameters | Value | Biological specimen | Basis |
|-----------|-----------|---|-----------|---------------------|---|
| Arsenic | 7440-38-2 | inorganic arsenic plus methylated metabolites | 35µg As/l | In urine | ACGIH - Biological Exposure Indices (BEI) |
| | Remarks | End of the workweek (After four or five consecutive working days) | | | |

| | | | | | |
|--|--|---|-----------|-------|---|
| | | with exposure) | | | |
| | | inorganic arsenic plus methylated metabolites | 35µg As/l | Urine | ACGIH - Biological Exposure Indices (BEI) |
| | | End of the workweek (After four or five consecutive working days with exposure) | | | |

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 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).

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: Pieces 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 (1,503 °F) - lit. |
| f) Initial boiling point and boiling range | 613 °C (1,135 °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 | 5.727 g/mL 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

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

Hazardous decomposition products formed under fire conditions. - Arsenic 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 - 763 mg/kg

Remarks: Behavioral:Ataxia. Diarrhoea

LD50 Oral - Mouse - 145 mg/kg

Remarks: Behavioral:Ataxia. Diarrhoea

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

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)

NTP: Known to be human carcinogen (Arsenic)

Known to be human carcinogen (Arsenic)

OSHA: OSHA specifically regulated carcinogen (Arsenic)

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: CG0525000

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.

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish LC50 - Pimephales promelas (fathead minnow) - 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

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: 1558 Class: 6.1

Packing group: II

Proper shipping name: Arsenic

Reportable Quantity (RQ): 1 lbs

Poison Inhalation Hazard: No

IMDG

UN number: 1558 Class: 6.1

Packing group: II

EMS-No: F-A, S-A

Proper shipping name: ARSENIC

Marine pollutant:yes

IATA

UN number: 1558 Class: 6.1

Packing group: II

Proper shipping name: Arsenic

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 |
|---------|-----------|---------------|
| Arsenic | 7440-38-2 | 2007-07-01 |

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

| | CAS-No. | Revision Date |
|---------|-----------|---------------|
| Arsenic | 7440-38-2 | 2007-07-01 |

Pennsylvania Right To Know Components

Arsenic

CAS-No.
7440-38-2

Revision Date
2007-07-01

New Jersey Right To Know Components

Arsenic

CAS-No.
7440-38-2

Revision Date
2007-07-01

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.

Arsenic

CAS-No.
7440-38-2

Revision Date
2008-10-10

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 |
| H302 | Harmful if swallowed. |
| H331 | Toxic if inhaled. |
| H400 | Very toxic to aquatic life. |
| H410 | Very toxic to aquatic life with long lasting effects. |

HMIS Rating

| | |
|------------------------|---|
| Health hazard: | 2 |
| Chronic Health Hazard: | * |
| Flammability: | 0 |
| Physical Hazard | 0 |

NFPA Rating

| | |
|--------------------|---|
| Health hazard: | 2 |
| Fire Hazard: | 0 |
| Reactivity Hazard: | 0 |

Further information

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Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.7

Revision Date: 05/23/2016

Print Date: 06/23/2016

SAFETY DATA SHEET

Version 4.7
Revision Date 12/28/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION**1.1 Product identifiers**

Product name : Nickel

Product Number : 268259
Brand : Aldrich
Index-No. : 028-002-00-7

CAS-No. : 7440-02-0

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

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION**2.1 Classification of the substance or mixture****GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

Skin sensitisation (Category 1), H317
Carcinogenicity (Category 2), H351
Specific target organ toxicity - repeated exposure, Inhalation (Category 1), H372
Acute aquatic toxicity (Category 3), H402
Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

H317

May cause an allergic skin reaction.

H351

Suspected of causing cancer.

H372

Causes damage to organs through prolonged or repeated exposure if inhaled.

H412

Harmful to aquatic life with long lasting effects.

Precautionary statement(s)

P201

Obtain special instructions before use.

P202

Do not handle until all safety precautions have been read and

| | |
|-------------|---|
| | understood. |
| P260 | Do not breathe dust/ fume/ gas/ mist/ vapours/ spray. |
| P264 | Wash skin thoroughly after handling. |
| P270 | Do not eat, drink or smoke when using this product. |
| P272 | Contaminated work clothing should not be allowed out of the workplace. |
| P273 | Avoid release to the environment. |
| P280 | Wear protective gloves/ protective clothing/ eye protection/ face protection. |
| P302 + P352 | IF ON SKIN: Wash with plenty of soap and water. |
| P308 + P313 | IF exposed or concerned: Get medical advice/ attention. |
| P333 + P313 | If skin irritation or rash occurs: Get medical advice/ attention. |
| P363 | Wash contaminated clothing before reuse. |
| P405 | Store locked up. |
| P501 | Dispose of contents/ container to an approved waste disposal plant. |

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

| | |
|------------------|----------------|
| Formula | : Ni |
| Molecular weight | : 58.69 g/mol |
| CAS-No. | : 7440-02-0 |
| EC-No. | : 231-111-4 |
| Index-No. | : 028-002-00-7 |

Hazardous components

| Component | Classification | Concentration |
|---------------|--|---------------|
| Nickel | | |
| | Skin Sens. 1; Carc. 2; STOT RE 1; Aquatic Acute 3; Aquatic Chronic 3; H317, H351, H372, H412 | <= 100 % |

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Nickel/nickel 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

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

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.

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): 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 |
|-----------|-----------|---|--------------------|--|
| Nickel | 7440-02-0 | TWA | 1.500000 mg/m3 | USA. ACGIH Threshold Limit Values (TLV) |
| | Remarks | Dermatitis Pneumoconiosis Not suspected as a human carcinogen | | |
| | | TWA | 1.000000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants |
| | | TWA | 0.015000 mg/m3 | USA. NIOSH Recommended Exposure Limits |
| | | Potential Occupational Carcinogen See Appendix A | | |

| | | | | |
|--|--|---|-------------------|--|
| | | TWA | 1.000000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants |
| | | TWA | 0.015000 mg/m3 | USA. NIOSH Recommended Exposure Limits |
| | | Potential Occupational Carcinogen See Appendix A | | |
| | | TWA | 1.5 mg/m3 | USA. ACGIH Threshold Limit Values (TLV) |
| | | Dermatitis Pneumoconiosis Not suspected as a human carcinogen | | |
| | | TWA | 1 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants |
| | | TWA | 0.015 mg/m3 | USA. NIOSH Recommended Exposure Limits |
| | | Potential Occupational Carcinogen See Appendix A | | |

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES**9.1 Information on basic physical and chemical properties**

| | |
|---|---|
| a) Appearance | Form: Foil Colour: white, silver, metallic |
| b) Odour | No data available |
| c) Odour Threshold | No data available |
| d) pH | No data available |
| e) Melting point/freezing point | Melting point/range: 1,453 °C (2,647 °F) - lit. |
| f) Initial boiling point and boiling range | 2,732 °C (4,950 °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 | 1 hPa (1 mmHg) at 1,810 °C (3,290 °F) |
| l) Vapour density | No data available |
| m) Relative density | 8.9 g/mL at 25 °C (77 °F) |
| n) Water solubility | insoluble |
| 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

acids, Oxidizing agents, Sulphur compounds, Hydrogen gas, Oxygen, Methanol, organic solvents, Aluminium, Fluorine, Ammonia

10.6 Hazardous decomposition products

Other decomposition products - No data available

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation

No data available

Respiratory or skin sensitisation

May cause sensitisation by skin contact.

Germ cell mutagenicity

No data available

Carcinogenicity

Limited evidence of carcinogenicity in animal studies

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Nickel)

1 - Group 1: Carcinogenic to humans (Nickel)

2B - Group 2B: Possibly carcinogenic to humans (Nickel)

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Nickel)

1 - Group 1: Carcinogenic to humans (Nickel)

2B - Group 2B: Possibly carcinogenic to humans (Nickel)

NTP: Reasonably anticipated to be a human carcinogen (Nickel)

Reasonably anticipated to be a human carcinogen (Nickel)

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

Inhalation - Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard

No data available

Additional Information

RTECS: QR5950000

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION**12.1 Toxicity**

Toxicity to fish LC50 - Cyprinus carpio (Carp) - 1.3 mg/l - 96 h

Toxicity to daphnia and other aquatic invertebrates EC50 - Daphnia magna (Water flea) - 1 mg/l - 48 h

12.2 Persistence and degradability

Not applicable

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Harmful to aquatic life 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)**

Not dangerous goods

IMDG

Not dangerous goods

IATA

Not dangerous goods

15. REGULATORY INFORMATION**SARA 302 Components**

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

| | CAS-No. | Revision Date |
|--------|-----------|---------------|
| Nickel | 7440-02-0 | 2007-07-01 |

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

| | | |
|---|----------------------|-----------------------------|
| Nickel | CAS-No. 7440-02-0 | Revision Date 2007-07-01 |
| Pennsylvania Right To Know Components | | |
| Nickel | CAS-No. 7440-02-0 | Revision Date 2007-07-01 |
| New Jersey Right To Know Components | | |
| Nickel | CAS-No. 7440-02-0 | Revision Date 2007-07-01 |
| California Prop. 65 Components | | |
| WARNING! This product contains a chemical known to the State of California to cause cancer. | | |
| Nickel | CAS-No. 7440-02-0 | Revision Date 2007-09-28 |

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

| | |
|-----------------|--|
| Aquatic Acute | Acute aquatic toxicity |
| Aquatic Chronic | Chronic aquatic toxicity |
| Carc. | Carcinogenicity |
| H317 | May cause an allergic skin reaction. |
| H351 | Suspected of causing cancer. |
| H372 | Causes damage to organs through prolonged or repeated exposure if inhaled. |
| H402 | Harmful to aquatic life. |
| H412 | Harmful to aquatic life with long lasting effects. |

HMIS Rating

| | |
|------------------------|---|
| Health hazard: | 2 |
| Chronic Health Hazard: | * |
| Flammability: | 0 |
| Physical Hazard | 0 |

NFPA Rating

| | |
|--------------------|---|
| Health hazard: | 2 |
| Fire Hazard: | 0 |
| Reactivity Hazard: | 0 |

Further information

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Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.7

Revision Date: 12/28/2015

Print Date: 05/01/2016

according to Regulation (EC) No. 1907/2006 as amended by (EC) No. 1272/2008

Section 1. Identification of the Substance/Mixture and of the Company/Undertaking

- 1.1 Product Code:** 700552
Product Name: Calcium Standard
- 1.2 Relevant identified uses of the substance or mixture and uses advised against:**
Relevant identified uses: For research use only, not for human or veterinary use.
- 1.3 Details of the Supplier of the Safety Data Sheet:**
- Company Name:** Cayman Chemical Company
1180 E. Ellsworth Rd.
Ann Arbor, MI 48108
- Web site address:** www.caymanchem.com
- Information:** Cayman Chemical Company +1 (734)971-3335
- 1.4 Emergency telephone number:**
- Emergency Contact:** CHEMTREC Within USA and Canada: +1 (800)424-9300
CHEMTREC Outside USA and Canada: +1 (703)527-3887

Section 2. Hazards Identification

- 2.1 Classification of the Substance or Mixture:**
- 2.1.1 Classification according to Regulation (EC) No 1272/2008 [CLP]:**
Skin Corrosion/Irritation, Category 3
- 2.2 Label Elements:**
- 2.2.1 Labeling according to Regulation (EC) No 1272/2008 [CLP]:**
- GHS Signal Word:** **Warning**
- GHS Hazard Phrases:**
H316: Causes mild skin irritation.
- GHS Precaution Phrases:**
No phrases apply.
- GHS Response Phrases:**
P332+313: If skin irritation occurs, get medical advice/attention.
- GHS Storage and Disposal Phrases:**
Please refer to Section 7 for Storage and Section 13 for Disposal information.
- 2.3 Adverse Human Health** Causes mild skin irritation.
- Effects and Symptoms:** Material may be irritating to the mucous membranes and upper respiratory tract.
May be harmful by inhalation, ingestion, or skin absorption.
May cause eye or respiratory system irritation.
To the best of our knowledge, the toxicological properties have not been thoroughly investigated.

Section 3. Composition/Information on Ingredients

| CAS # / RTECS # | Hazardous Components (Chemical Name)/ REACH Registration No. | Concentration | EC No./ EC Index No. | GHS Classification |
|-----------------------|---|---------------|-------------------------|--|
| 471-34-1 FF9335000 | Calcium carbonate | 2.0 % | 207-439-9 NA | No data available. |
| 77-86-1 TY2900000 | Trizma base | 1.21 % | 201-064-4 NA | Skin Corr. 2: H315 Eye Damage 2: H319 STOT (SE) 3: H335 H336 |
| 7732-18-5 | Water | 96.79 % | 231-791-2 | No data available. |



SAFETY DATA SHEET

Calcium Standard

Revision: 04/16/2015

Supersedes Revision: 06/09/2011

ZC0110000

NA

Section 4. First Aid Measures

- 4.1 Description of First Aid** No data available.
- Measures:**
- In Case of Inhalation:** Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Get immediate medical attention.
- In Case of Skin Contact:** Immediately wash skin with soap and plenty of water for at least 15 minutes. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse.
- In Case of Eye Contact:** Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes. Have eyes examined and tested by medical personnel.
- In Case of Ingestion:** Wash out mouth with water provided person is conscious. Never give anything by mouth to an unconscious person. Get medical attention. Do NOT induce vomiting unless directed to do so by medical personnel.

Section 5. Fire Fighting Measures

- 5.1 Suitable Extinguishing** Use alcohol-resistant foam, carbon dioxide, water, or dry chemical spray.
- Media:** Use water spray to cool fire-exposed containers.
- Unsuitable Extinguishing** A solid water stream may be inefficient.
- Media:**
- 5.2 Flammable Properties and** No data available.
- Hazards:**
- Flash Pt:** No data.
- Explosive Limits:** LEL: No data. UEL: No data.
- Autoignition Pt:** No data.
- 5.3 Fire Fighting Instructions:** As in any fire, wear self-contained breathing apparatus pressure-demand (NIOSH approved or equivalent), and full protective gear to prevent contact with skin and eyes.

Section 6. Accidental Release Measures

- 6.1 Protective Precautions,** Avoid breathing vapors and provide adequate ventilation.
- Protective Equipment and** As conditions warrant, wear a NIOSH approved self-contained breathing apparatus, or respirator,
- Emergency Procedures:** and appropriate personal protection (rubber boots, safety goggles, and heavy rubber gloves).
- 6.2 Environmental** Take steps to avoid release into the environment, if safe to do so.
- Precautions:**
- 6.3 Methods and Material For** Contain spill and collect, as appropriate.
- Containment and Cleaning** Transfer to a chemical waste container for disposal in accordance with local regulations.
- Up:**

Section 7. Handling and Storage

- 7.1 Precautions To Be Taken** Avoid breathing dust/fume/gas/mist/vapours/spray.
- in Handling:** Avoid prolonged or repeated exposure.
- 7.2 Precautions To Be Taken** Keep container tightly closed.
- in Storing:** Store in accordance with information listed on the product insert.

Section 8. Exposure Controls/Personal Protection

8.1 Exposure Parameters:

| CAS # | Partial Chemical Name | Britain EH40 | France VL | Europe |
|-----------|-----------------------|--------------|-------------------|--------------|
| 471-34-1 | Calcium carbonate | No data. | TWA: 10 mg/m3 | No data. |
| 77-86-1 | Trizma base | No data. | No data. | No data. |
| 7732-18-5 | Water | No data. | No data. | No data. |
| CAS # | Partial Chemical Name | OSHA TWA | ACGIH TWA | Other Limits |
| 471-34-1 | Calcium carbonate | No data. | TLV: 10 mg/m3 (E) | No data. |
| 77-86-1 | Trizma base | No data. | No data. | No data. |
| 7732-18-5 | Water | No data. | No data. | No data. |

8.2 Exposure Controls:

8.2.1 Engineering Controls Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

8.2.2 Personal protection equipment:

Eye Protection: Safety glasses

Protective Gloves: Compatible chemical-resistant gloves

Other Protective Clothing: Lab coat

Respiratory Equipment NIOSH approved respirator, as conditions warrant.

(Specify Type):

Work/Hygienic/Maintenance Practices: Do not take internally.

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower.

Wash thoroughly after handling.

No data available.

Section 9. Physical and Chemical Properties

9.1 Information on Basic Physical and Chemical Properties

Physical States: [] Gas [X] Liquid [] Solid

Appearance and Odor: Solution

pH: 7.0

Melting Point: No data.

Boiling Point: No data.

Flash Pt: No data.

Evaporation Rate: No data.

Explosive Limits: LEL: No data. UEL: No data.

Vapor Pressure (vs. Air or mm Hg): No data.

Vapor Density (vs. Air = 1): No data.

Specific Gravity (Water = 1): No data.

Solubility in Water: No data.

Autoignition Pt: No data.



SAFETY DATA SHEET

Calcium Standard

Revision: 04/16/2015
Supersedes Revision: 06/09/2011

9.2 Other Information

Percent Volatile: No data.

Section 10. Stability and Reactivity

- 10.1 Reactivity:** No data available.
- 10.2 Stability:** Unstable [] Stable [X]
- 10.3 Stability Note(s):** Stable if stored in accordance with information listed on the product insert.
- Polymerization:** Will occur [] Will not occur [X]
- 10.4 Conditions To Avoid:** No data available.
- 10.5 Incompatibility - Materials To Avoid:** No data available.
- 10.6 Hazardous Decomposition Or Byproducts:** No data available.

Section 11. Toxicological Information

- 11.1 Information on Toxicological Effects:** The toxicological effects of this product have not been thoroughly studied.

Carcinogenicity: NTP? No IARC Monographs? No OSHA Regulated? No

| CAS # | Hazardous Components (Chemical Name) | NTP | IARC | ACGIH | OSHA |
|-----------|--------------------------------------|------|------|-------|------|
| 471-34-1 | Calcium carbonate | n.a. | n.a. | n.a. | n.a. |
| 77-86-1 | Trizma base | n.a. | n.a. | n.a. | n.a. |
| 7732-18-5 | Water | n.a. | n.a. | n.a. | n.a. |

Section 12. Ecological Information

- 12.1 Toxicity:** Avoid release into the environment.
Runoff from fire control or dilution water may cause pollution.
- 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:** No data available.

Section 13. Disposal Considerations

- 13.1 Waste Disposal Method:** Dispose in accordance with local, state, and federal regulations.

Section 14. Transport Information

14.1 LAND TRANSPORT (US DOT):

DOT Proper Shipping Name: Not dangerous goods.

DOT Hazard Class:

UN/NA Number:

14.1 LAND TRANSPORT (European ADR/RID):

ADR/RID Shipping Name: Not dangerous goods.

UN Number:

Hazard Class:

14.3 AIR TRANSPORT (ICAO/IATA):

ICAO/IATA Shipping Name: Not dangerous goods.

Additional Transport Information: Transport in accordance with local, state, and federal regulations.

Section 15. Regulatory Information

EPA SARA (Superfund Amendments and Reauthorization Act of 1986) Lists

| CAS # | Hazardous Components (Chemical Name) | S. 302 (EHS) | S. 304 RQ | S. 313 (TRI) |
|-----------|--------------------------------------|--------------|-----------|---------------|
| 471-34-1 | Calcium carbonate | No | No | No |
| 77-86-1 | Trizma base | No | No | Yes-Cat. N106 |
| 7732-18-5 | Water | No | No | No |

| CAS # | Hazardous Components (Chemical Name) | Other US EPA or State Lists |
|-----------|--------------------------------------|--|
| 471-34-1 | Calcium carbonate | CAA HAP,ODC: No; CWA NPDES: No; TSCA: Yes - Inventory; CA PROP.65: No |
| 77-86-1 | Trizma base | CAA HAP,ODC: HAP; CWA NPDES: No; TSCA: Yes - Inventory; CA PROP.65: No |
| 7732-18-5 | Water | CAA HAP,ODC: No; CWA NPDES: No; TSCA: Yes - Inventory; CA PROP.65: No |

Regulatory Information Statement: This SDS was prepared in accordance with 29 CFR 1910.1200 and Regulation (EC) No.1272/2008.

Section 16. Other Information

Revision Date: 04/16/2015

Additional Information About This Product: No data available.

Company Policy or Disclaimer: DISCLAIMER: This information is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.

SAFETY DATA SHEET

Version 4.10
Revision Date 12/29/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Cadmium

Product Number : 414891
Brand : Aldrich
Index-No. : 048-002-00-0

CAS-No. : 7440-43-9

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

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (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, Inhalation (Category 2), H330
Germ cell mutagenicity (Category 2), H341
Carcinogenicity (Category 1B), H350
Reproductive toxicity (Category 2), H361
Specific target organ toxicity - repeated exposure (Category 1), H372
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s)

| | |
|------|---|
| H330 | Fatal if inhaled. |
| H341 | Suspected of causing genetic defects. |
| H350 | May cause cancer. |
| H361 | Suspected of damaging fertility or the unborn child. |
| H372 | Causes damage to organs through prolonged or repeated exposure. |
| H410 | Very toxic to aquatic life with long lasting effects. |

| | |
|----------------------------|---|
| Precautionary statement(s) | |
| P201 | Obtain special instructions before use. |
| P202 | Do not handle until all safety precautions have been read and understood. |
| P260 | Do not breathe dust/ fume/ gas/ mist/ vapours/ spray. |
| P264 | Wash skin thoroughly after handling. |
| P270 | Do not eat, drink or smoke when using this product. |
| P271 | Use only outdoors or in a well-ventilated area. |
| P273 | Avoid release to the environment. |
| P280 | Wear protective gloves/ protective clothing/ eye protection/ face protection. |
| P284 | Wear respiratory protection. |
| P304 + P340 + P310 | IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician. |
| P308 + P313 | IF exposed or concerned: Get medical advice/ attention. |
| P391 | Collect spillage. |
| P403 + P233 | Store in a well-ventilated place. Keep container tightly closed. |
| P405 | Store locked up. |
| P501 | Dispose of contents/ container to an approved waste disposal plant. |

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

| | |
|------------------|----------------|
| Formula | : Cd |
| Molecular weight | : 112.41 g/mol |
| CAS-No. | : 7440-43-9 |
| EC-No. | : 231-152-8 |
| Index-No. | : 048-002-00-0 |

Hazardous components

| Component | Classification | Concentration |
|--|---|---------------|
| Cadmium Included in the Candidate List of Substances of Very High Concern (SVHC) according to Regulation (EC) No. 1907/2006 (REACH) | | |
| | Acute Tox. 2; Muta. 2; Carc. 1B; Repr. 2; STOT RE 1; Aquatic Acute 1; Aquatic Chronic 1; H330, H341, H350, H361, H372, H410 | <= 100 % |

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Cadmium/cadmium 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. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.
Provide appropriate exhaust ventilation at places where dust is formed.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

Air sensitive.

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 |
|-----------|-----------|--|----------------------------|---|
| Cadmium | 7440-43-9 | TWA | 0.010000 mg/m ³ | USA. ACGIH Threshold Limit Values (TLV) |
| | Remarks | Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) | | |

| | | | | |
|--|--|---|-------------------|--|
| | | Suspected human carcinogen | | |
| | | TWA | 0.002000 mg/m3 | USA. ACGIH Threshold Limit Values (TLV) |
| | | Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen | | |
| | | Substance listed; for more information see OSHA document 1910.1027 | | |
| | | TWA | 0.100000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-2 |
| | | Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect. | | |
| | | TWA | 0.200000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-2 |
| | | Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect. | | |
| | | CEIL | 0.300000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-2 |
| | | Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect. | | |
| | | CEIL | 0.600000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-2 |
| | | Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect. | | |
| | | TWA | 0.100000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-2 |
| | | Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect. | | |
| | | CEIL | 0.300000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-2 |
| | | Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect. | | |
| | | Potential Occupational Carcinogen See Appendix A | | |
| | | TWA | 0.200000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-2 |
| | | Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect. | | |
| | | CEIL | 0.600000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-2 |
| | | Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect. | | |
| | | PEL | 0.005000 mg/m3 | OSHA Specifically Regulated Chemicals/Carcinogens |
| | | 1910.1027 This standard applies to all occupational exposures to cadmium and cadmium compounds, in all forms, and in all industries covered by the Occupational Safety and Health Act, except the construction-related industries, which are covered under 29 CFR 1926.63. OSHA specifically regulated carcinogen | | |

| | | | | |
|--|--|---|-------------------|---|
| | | Potential Occupational Carcinogen See Appendix A | | |
| | | Potential Occupational Carcinogen See Appendix A | | |
| | | TWA | 0.010000 mg/m3 | USA. ACGIH Threshold Limit Values (TLV) |
| | | Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen varies | | |
| | | TWA | 0.002000 mg/m3 | USA. ACGIH Threshold Limit Values (TLV) |
| | | Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen varies | | |
| | | PEL | 0.005000 mg/m3 | OSHA Specifically Regulated Chemicals/Carcinogens |
| | | 1910.1027 This standard applies to all occupational exposures to cadmium and cadmium compounds, in all forms, and in all industries covered by the Occupational Safety and Health Act, except the construction- related industries, which are covered under 29 CFR 1926.63. OSHA specifically regulated carcinogen | | |
| | | TWA | 0.1 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-2 |
| | | Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect. | | |
| | | TWA | 0.2 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-2 |
| | | Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect. | | |
| | | CEIL | 0.3 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-2 |
| | | Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect. | | |
| | | CEIL | 0.6 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-2 |
| | | Z37.5-1970 This standard applies to any operations or sectors for which the Cadmium standard, 1910.1027, is stayed or otherwise not in effect. | | |
| | | Substance listed; for more information see OSHA document 1910.1027 | | |
| | | Potential Occupational Carcinogen See Appendix A | | |
| | | TWA | 0.01 mg/m3 | USA. ACGIH Threshold Limit Values (TLV) |
| | | Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen varies | | |

| | | | | |
|--|--|---|-------------|---|
| | | TWA | 0.002 mg/m3 | USA. ACGIH Threshold Limit Values (TLV) |
| | | Kidney damage Substances for which there is a Biological Exposure Index or Indices (see BEI® section) Suspected human carcinogen varies | | |
| | | PEL | 0.005 mg/m3 | OSHA Specifically Regulated Chemicals/Carcinogens |
| | | 1910.1027 This standard applies to all occupational exposures to cadmium and cadmium compounds, in all forms, and in all industries covered by the Occupational Safety and Health Act, except the construction-related industries, which are covered under 29 CFR 1926.63. OSHA specifically regulated carcinogen | | |

Biological occupational exposure limits

| Component | CAS-No. | Parameters | Value | Biological specimen | Basis |
|-----------|-----------|--------------|------------------|---------------------|---|
| Cadmium | 7440-43-9 | cadmium | 0.0050 mg/g | Urine | ACGIH - Biological Exposure Indices (BEI) |
| | Remarks | Not critical | | | |
| | | cadmium | 5.0000 µg/l | In blood | ACGIH - Biological Exposure Indices (BEI) |
| | | Not critical | | | |
| | | cadmium | 5 µg/l | In blood | ACGIH - Biological Exposure Indices (BEI) |
| | | Not critical | | | |
| | | cadmium | 5µg/g creatinine | Urine | ACGIH - Biological Exposure Indices (BEI) |
| | | Not critical | | | |

8.2 Exposure controls

Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

| | |
|---|---|
| a) Appearance | Form: granular Colour: light grey |
| b) Odour | odourless |
| c) Odour Threshold | No data available |
| d) pH | No data available |
| e) Melting point/freezing point | Melting point/range: 320.9 °C (609.6 °F) - lit. |
| f) Initial boiling point and boiling range | 765 °C (1,409 °F) - lit. |
| g) Flash point | Not applicable |
| h) Evaporation rate | No data available |
| i) Flammability (solid, gas) | No data available |
| j) Upper/lower flammability or explosive limits | No data available |
| k) Vapour pressure | No data available |
| l) Vapour density | No data available |
| m) Relative density | 8.65 g/cm ³ at 25 °C (77 °F) |
| n) Water solubility | 0.0023 g/l at 20 °C (68 °F) |
| o) Partition coefficient: n-octanol/water | No data available |
| p) Auto-ignition temperature | No data available |
| q) Decomposition temperature | No data available |
| r) Viscosity | No data available |
| s) Explosive properties | No data available |
| t) Oxidizing properties | No data available |

9.2 Other safety information

No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to avoid

No data available

10.5 Incompatible materials

Oxidizing agents, acids

10.6 Hazardous decomposition products

Other decomposition products - No data available

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 2,330 mg/kg

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation

No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

IARC: 1 - Group 1: Carcinogenic to humans (Cadmium)

NTP: Known to be human carcinogenThe reference note has been added by TD based on the background information of the NTP. (Cadmium)

OSHA: OSHA specifically regulated carcinogen (Cadmium)

Reproductive toxicity

No data available

Specific target organ toxicity - single exposure

No data available

Specific target organ toxicity - repeated exposure

No data available

Aspiration hazard

No data available

Additional Information

RTECS: EU9800000

Damage to the lungs., Kidney injury may occur., prolonged or repeated exposure can cause:, Vomiting, Diarrhoea, Lung irritation

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish LC50 - Pimephales promelas (fathead minnow) - 0.001 mg/l - 96 h

Toxicity to daphnia and other aquatic invertebrates EC50 - Daphnia magna (Water flea) - 0.024 mg/l - 48 h

Toxicity to algae static test EC50 - Selenastrum capricornutum (green algae) - 0.023 mg/l - 72 h (OECD Test Guideline 201)

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential

Bioaccumulation Oncorhynchus mykiss (rainbow trout) - 72 d
- 1.27 µg/l

Bioconcentration factor (BCF): 55

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. 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: 3288 Class: 6.1 Packing group: II
Proper shipping name: Toxic solid, inorganic, n.o.s. (Cadmium)
Reportable Quantity (RQ): 10 lbs

Poison Inhalation Hazard: No

IMDG

UN number: 3288 Class: 6.1 Packing group: II EMS-No: F-A, S-A
Proper shipping name: TOXIC SOLID, INORGANIC, N.O.S. (Cadmium)
Marine pollutant: yes

IATA

UN number: 3288 Class: 6.1 Packing group: II

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

| | CAS-No. | Revision Date |
|---------|-----------|---------------|
| Cadmium | 7440-43-9 | 2007-07-01 |

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

| | CAS-No. | Revision Date |
|---------|-----------|---------------|
| Cadmium | 7440-43-9 | 2007-07-01 |

Pennsylvania Right To Know Components

| | CAS-No. | Revision Date |
|---------|-----------|---------------|
| Cadmium | 7440-43-9 | 2007-07-01 |

New Jersey Right To Know Components

| | CAS-No. | Revision Date |
|---------|-----------|---------------|
| Cadmium | 7440-43-9 | 2007-07-01 |

California Prop. 65 Components

WARNING! This product contains a chemical known to the State of California to cause cancer.

| | CAS-No. | Revision Date |
|---------|-----------|---------------|
| Cadmium | 7440-43-9 | 2009-02-01 |

WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

| | CAS-No. | Revision Date |
|---------|-----------|---------------|
| Cadmium | 7440-43-9 | 2009-02-01 |

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

| | |
|-----------------|---|
| Acute Tox. | Acute toxicity |
| Aquatic Acute | Acute aquatic toxicity |
| Aquatic Chronic | Chronic aquatic toxicity |
| Carc. | Carcinogenicity |
| H330 | Fatal if inhaled. |
| H341 | Suspected of causing genetic defects. |
| H350 | May cause cancer. |
| H361 | Suspected of damaging fertility or the unborn child. |
| H372 | Causes damage to organs through prolonged or repeated exposure. |
| H400 | Very toxic to aquatic life. |
| H410 | Very toxic to aquatic life with long lasting effects. |

HMIS Rating

| | |
|------------------------|---|
| Health hazard: | 4 |
| Chronic Health Hazard: | * |
| Flammability: | 0 |
| Physical Hazard | 0 |

NFPA Rating

| | |
|----------------|---|
| Health hazard: | 4 |
| Fire Hazard: | 0 |

Reactivity Hazard: 0

Further information

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Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.10

Revision Date: 12/29/2015

Print Date: 05/01/2016

SAFETY DATA SHEET

Version 4.7
Revision Date 02/27/2015
Print Date 05/24/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1 Product identifiers

Product name : Copper

Product Number : 12816
Brand : Aldrich

CAS-No. : 7440-50-8

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

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832
Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

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

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula : Cu
Molecular weight : 63.55 g/mol
CAS-No. : 7440-50-8
EC-No. : 231-159-6

Hazardous components

| Component | Classification | Concentration |
|-----------|----------------|---------------|
| Copper | | |
| | | <= 100 % |

4. FIRST AID MEASURES

4.1 Description of first aid measures

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration.

In case of skin contact

Wash off with soap and plenty of water.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES**5.1 Extinguishing media****Suitable extinguishing media**

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Copper oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES**6.1 Personal precautions, protective equipment and emergency procedures**

Avoid dust formation. Avoid breathing vapours, mist or gas.

For personal protection see section 8.

6.2 Environmental precautions

No special environmental precautions required.

6.3 Methods and materials for containment and cleaning up

Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE**7.1 Precautions for safe handling**

Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.

Provide appropriate exhaust ventilation at places where dust is formed.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

Store under inert gas. Air sensitive.

Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION**8.1 Control parameters**

Components with workplace control parameters

| Component | CAS-No. | Value | Control parameters | Basis |
|-----------|-----------|--|--------------------|--|
| Copper | 7440-50-8 | TWA | 1.000000 mg/m3 | USA. ACGIH Threshold Limit Values (TLV) |
| | Remarks | Irritation Gastrointestinal metal fume fever | | |
| | | TWA | 0.200000 mg/m3 | USA. ACGIH Threshold Limit Values (TLV) |
| | | Irritation Gastrointestinal metal fume fever | | |
| | | TWA | 1.000000 mg/m3 | USA. NIOSH Recommended Exposure Limits |
| | | TWA | 1.000000 mg/m3 | USA. NIOSH Recommended Exposure Limits |
| | | TWA | 1.000000 mg/m3 | USA. NIOSH Recommended Exposure Limits |
| | | TWA | 1.000000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants |
| | | TWA | 0.100000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants |

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: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatrill® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

No special environmental precautions required.

9. PHYSICAL AND CHEMICAL PROPERTIES**9.1 Information on basic physical and chemical properties**

| | |
|---|--|
| a) Appearance | Form: Foil Colour: light red |
| b) Odour | No data available |
| c) Odour Threshold | No data available |
| d) pH | No data available |
| e) Melting point/freezing point | Melting point/range: 1,083.4 °C (1,982.1 °F) |
| f) Initial boiling point and boiling range | 2,567 °C (4,653 °F) |
| g) Flash point | No data available |
| h) Evaporation rate | No data available |
| i) Flammability (solid, gas) | No data available |
| j) Upper/lower flammability or explosive limits | No data available |
| k) Vapour pressure | No data available |
| l) Vapour density | No data available |
| m) Relative density | 8.940 g/cm ³ |
| n) Water solubility | No data available |
| o) Partition coefficient: n-octanol/water | No data available |
| p) Auto-ignition temperature | No data available |
| q) Decomposition temperature | No data available |
| r) Viscosity | No data available |
| s) Explosive properties | No data available |
| t) Oxidizing properties | No data available |

9.2 Other safety information

No data available

10. STABILITY AND REACTIVITY**10.1 Reactivity**

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to avoid

No data available

10.5 Incompatible materials

Strong acids, Strong oxidizing agents, Acid chlorides, Halogens

10.6 Hazardous decomposition products

Other decomposition products - No data available

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

No data available

Inhalation: No data available

Dermal: No data available

LD50 Intraperitoneal - Mouse - 3.5 mg/kg

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation

No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure

No data available

Specific target organ toxicity - repeated exposure

No data available

Aspiration hazard

No data available

Additional Information

RTECS: GL5325000

Symptoms of systemic copper poisoning may include: capillary damage, headache, cold sweat, weak pulse, and kidney and liver damage, central nervous system excitation followed by depression, jaundice, convulsions, paralysis, and coma. Death may occur from shock or renal failure. Chronic copper poisoning is typified by hepatic cirrhosis, brain damage and demyelination, kidney defects, and copper deposition in the cornea as exemplified by humans with Wilson's disease. It has also been reported that copper poisoning has lead to hemolytic anemia and accelerates arteriosclerosis.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

No data available

12.2 Persistence and degradability

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

Not dangerous goods

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Copper)
Marine pollutant: yes

IATA

UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Copper)

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

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.

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

| | | |
|--------|----------------------|-----------------------------|
| Copper | CAS-No. 7440-50-8 | Revision Date 1989-08-11 |
|--------|----------------------|-----------------------------|

New Jersey Right To Know Components

| | | |
|--------|----------------------|-----------------------------|
| Copper | CAS-No. 7440-50-8 | Revision Date 1989-08-11 |
|--------|----------------------|-----------------------------|

California Prop. 65 Components

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

16. OTHER INFORMATION

HMIS Rating

| | |
|------------------------|---|
| Health hazard: | 0 |
| Chronic Health Hazard: | |
| Flammability: | 0 |
| Physical Hazard | 0 |

NFPA Rating

| | |
|--------------------|---|
| Health hazard: | 0 |
| Fire Hazard: | 0 |
| Reactivity Hazard: | 0 |

Further information

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Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 4.7

Revision Date: 02/27/2015

Print Date: 05/24/2016

SAFETY DATA SHEET

Version 5.8
Revision Date 10/12/2015
Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION**1.1 Product identifiers**

Product name : Zinc

Product Number : 96454

Brand : Sigma-Aldrich

CAS-No. : 7440-66-6

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

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich
3050 Spruce Street
SAINT LOUIS MO 63103
USA

Telephone : +1 800-325-5832

Fax : +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION**2.1 Classification of the substance or mixture****GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)**

Combustible dust,
Acute aquatic toxicity (Category 1), H400
Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word : Warning

Hazard statement(s)

H410

May form combustible dust concentrations in air
Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P273

Avoid release to the environment.

P391

Collect spillage.

P501

Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

Combustible dust

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2 Mixtures

Formula : Zn
Molecular weight : 65.39 g/mol

Hazardous components

| Hazardous components | | Classification | Concentration |
|---------------------------------|--------------|--|---------------|
| Zinc powder (stabilized) | | | |
| CAS-No. | 7440-66-6 | Aquatic Acute 1; Aquatic Chronic 1; H410 | <= 100 % |
| EC-No. | 231-175-3 | | |
| Index-No. | 030-001-01-9 | | |
| Zinc oxide | | | |
| CAS-No. | 1314-13-2 | Aquatic Acute 1; Aquatic Chronic 1; H410 | >= 5 - < 10 % |
| EC-No. | 215-222-5 | | |
| Index-No. | 030-013-00-7 | | |

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Special powder against metal fire Dry sand Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Unsuitable extinguishing media

Water

5.2 Special hazards arising from the substance or mixture

Zinc/zinc oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.

Provide appropriate exhaust ventilation at places where dust is formed.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place.

Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

| Component | CAS-No. | Value | Control parameters | Basis |
|------------|-----------|------------------|--------------------|---|
| Zinc oxide | 1314-13-2 | TWA | 2.000000 mg/m3 | USA. ACGIH Threshold Limit Values (TLV) |
| | Remarks | metal fume fever | | |
| | | STEL | 10.000000 mg/m3 | USA. ACGIH Threshold Limit Values (TLV) |
| | | metal fume fever | | |

| | | | | |
|--|--|-----|--------------------|--|
| | | TWA | 5.000000 mg/m3 | USA. NIOSH Recommended Exposure Limits |
| | | TWA | 5.000000 mg/m3 | USA. NIOSH Recommended Exposure Limits |
| | | ST | 10.000000 mg/m3 | USA. NIOSH Recommended Exposure Limits |
| | | C | 15.000000 mg/m3 | USA. NIOSH Recommended Exposure Limits |
| | | TWA | 5.000000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants |
| | | TWA | 15.000000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants |
| | | TWA | 5.000000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants |
| | | TWA | 5.000000 mg/m3 | USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants |

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact

Material: Nitrile rubber

Minimum layer thickness: 0.11 mm

Break through time: 480 min

Material tested: Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES**9.1 Information on basic physical and chemical properties**

| | |
|---|--|
| a) Appearance | Form: powder Colour: grey |
| b) Odour | odourless |
| c) Odour Threshold | No data available |
| d) pH | Not applicable |
| e) Melting point/freezing point | Melting point/range: 420 °C (788 °F) - lit. |
| f) Initial boiling point and boiling range | 907 °C (1,665 °F) - lit. |
| g) Flash point | Not applicable |
| h) Evaporation rate | No data available |
| i) Flammability (solid, gas) | May form combustible dust concentrations in air |
| j) Upper/lower flammability or explosive limits | No data available |
| k) Vapour pressure | Not applicable |
| l) Vapour density | No data available |
| m) Relative density | 7.133 g/mL at 25 °C (77 °F) |
| n) Water solubility | insoluble |
| o) Partition coefficient: n-octanol/water | Not applicable |
| p) Auto-ignition temperature | does not ignite |
| q) Decomposition temperature | No data available |
| r) Viscosity | No data available |
| s) Explosive properties | During processing, dust may form explosive mixture in air. |
| t) Oxidizing properties | No data available |

9.2 Other safety information

| | |
|--------------|-----------------------------|
| Bulk density | 1.8 - 3.2 kg/m ³ |
|--------------|-----------------------------|

10. STABILITY AND REACTIVITY**10.1 Reactivity**

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

Dust may form explosive mixture in air.

10.4 Conditions to avoid

No data available

10.5 Incompatible materials

Strong oxidizing agents, Acids and bases

10.6 Hazardous decomposition products

Other decomposition products - No data available

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

No data available (Zinc powder (stabilized))

Inhalation: No data available (Zinc powder (stabilized))

Dermal: No data available (Zinc powder (stabilized))

No data available (Zinc powder (stabilized))

Skin corrosion/irritation

No data available (Zinc powder (stabilized))

Serious eye damage/eye irritation

No data available (Zinc powder (stabilized))

Respiratory or skin sensitisation

Did not cause sensitisation on laboratory animals. (Zinc powder (stabilized))

Germ cell mutagenicity

No data available (Zinc powder (stabilized))

Carcinogenicity

IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available (Zinc powder (stabilized))

No data available (Zinc powder (stabilized))

Specific target organ toxicity - single exposure

No data available (Zinc powder (stabilized))

Specific target organ toxicity - repeated exposure

No data available

Aspiration hazard

No data available (Zinc powder (stabilized))

Additional Information

RTECS: ZG8600000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Effects due to ingestion may include:, chills, dry throat, sweet taste, Fever, Cough, Nausea, Vomiting, Weakness, Contact with eyes or skin may cause:, Irritation (Zinc powder (stabilized))

12. ECOLOGICAL INFORMATION

12.1 Toxicity

| | |
|---|--|
| Toxicity to fish | LC50 - Cyprinus carpio (Carp) - 450 µg/l - 96 h (Zinc powder (stabilized)) |
| Toxicity to daphnia and other aquatic invertebrates | LC50 - Daphnia magna (Water flea) - 0.068 mg/l - 48 h (Zinc powder (stabilized)) |
| | mortality NOEC - Daphnia (water flea) - 0.101 - 0.14 mg/l - 7 d (Zinc powder (stabilized)) |

12.2 Persistence and degradability

The methods for determining the biological degradability are not applicable to inorganic substances.

12.3 Bioaccumulative potential

Bioaccumulation Algae - 7 d
at 16 °C - 5 µg/l (Zinc powder (stabilized))

Bioconcentration factor (BCF): 466

12.4 Mobility in soil

No data available (Zinc powder (stabilized))

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Very toxic to aquatic life with long lasting effects.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Zinc powder (stabilized))
Reportable Quantity (RQ): 1020 lbs

Poison Inhalation Hazard: No

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Zinc powder (stabilized))
Marine pollutant: yes

IATA

UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Zinc powder (stabilized))

Further information

EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

| | CAS-No. | Revision Date |
|--------------------------|-----------|---------------|
| Zinc oxide | 1314-13-2 | 2007-03-01 |
| Zinc powder (stabilized) | 7440-66-6 | 1993-04-24 |

SARA 311/312 Hazards

No SARA Hazards

Massachusetts Right To Know Components

| | CAS-No. | Revision Date |
|--------------------------|-----------|---------------|
| Zinc powder (stabilized) | 7440-66-6 | 1993-04-24 |
| Zinc oxide | 1314-13-2 | 2007-03-01 |

Pennsylvania Right To Know Components

| | CAS-No. | Revision Date |
|--------------------------|-----------|---------------|
| Zinc powder (stabilized) | 7440-66-6 | 1993-04-24 |
| Zinc oxide | 1314-13-2 | 2007-03-01 |

New Jersey Right To Know Components

| | CAS-No. | Revision Date |
|--------------------------|-----------|---------------|
| Zinc powder (stabilized) | 7440-66-6 | 1993-04-24 |
| Zinc oxide | 1314-13-2 | 2007-03-01 |

California Prop. 65 Components

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

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

| | |
|-----------------|---|
| | May form combustible dust concentrations in air |
| Aquatic Acute | Acute aquatic toxicity |
| Aquatic Chronic | Chronic aquatic toxicity |
| H400 | Very toxic to aquatic life. |
| H410 | Very toxic to aquatic life with long lasting effects. |

HMIS Rating

| | |
|------------------------|---|
| Health hazard: | 0 |
| Chronic Health Hazard: | |
| Flammability: | 0 |
| Physical Hazard | 0 |

NFPA Rating

| | |
|--------------------|---|
| Health hazard: | 0 |
| Fire Hazard: | 0 |
| Reactivity Hazard: | 0 |

Further information

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Preparation Information

Sigma-Aldrich Corporation
Product Safety – Americas Region
1-800-521-8956

Version: 5.8

Revision Date: 10/12/2015

Print Date: 05/01/2016



Safety Data Sheet

Revision Date: 08/13/18

www.restek.com

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

1. IDENTIFICATION

| | |
|---------------------------------------|--|
| Catalog Number / Product Name: | 31272 / Benzo(b)fluoranthene 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: | 10 |
| Intended use: | For Laboratory use only |

2. HAZARD(S) IDENTIFICATION

Emergency Overview:

GHS Hazard
Symbols:



GHS Classification: 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.
Causes serious eye irritation.
May cause drowsiness or dizziness.
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.
Wear protective gloves/protective clothing/eye protection/face protection.

First Aid Measures: 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.
If eye irritation persists: Get medical advice/attention.
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 (b) fluoranthene | 205-99-2 | 205-911-9 | 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 (b) fluoranthene | 205-99-2 | Not established | None Known | Not established | No data available |

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: | 0 |
| Molecular Weight: | 58.08 |

10. STABILITY AND REACTIVITY

| | |
|---|--------------------------------------|
| Stability: | Stable under normal conditions. |
| Conditions to Avoid: | None known. |
| Materials to Avoid / Chemical Incompatibility: | 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/m ³ 8 h; Oral LD50 Rat 5800 mg/kg |

Component Carcinogenic Data:

OSHA:

| Chemical Name | CAS No. | |
|----------------------|----------|---------|
| Benzo(b)fluoranthene | 205-99-2 | Present |

ACGIH:

| Chemical Name | CAS No. | |
|----------------------|----------|---|
| Benzo[b]fluoranthene | 205-99-2 | 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 92 [2010]; Supplement 7 [1987]; Monograph 32 [1983] | 205-99-2 | Group 2B |

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 (b) fluoranthene | 205-99-2 | X | X | - | - |

The following chemicals are listed on CA Prop 65:

| Chemical Name | CAS # | Regulation |
|----------------------|----------|----------------|
| Benzo[b]fluoranthene | 205-99-2 | 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 (b) fluoranthene | 205-99-2 | X | X | X | X |

16. OTHER INFORMATION

Prior Version Date: 12/08/16

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

Revision Date: 06/15/18

www.restek.com

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

1. IDENTIFICATION

| | |
|---------------------------------------|--|
| Catalog Number / Product Name: | 31274 / Benzo(k)fluoranthene 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: 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.
Causes serious eye irritation.
May cause drowsiness or dizziness.
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.
Wear protective gloves/protective clothing/eye protection/face protection.

First Aid Measures: 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.
If eye irritation persists: Get medical advice/attention.
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 (k) fluoranthene | 207-08-9 | 205-916-6 | 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 (k) fluoranthene | 207-08-9 | Not established | None Known | Not established | No data available |

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): | 480 °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: | 0 |
| Molecular Weight: | 58.08 |

10. STABILITY AND REACTIVITY

| | |
|---|--------------------------------------|
| Stability: | Stable under normal conditions. |
| Conditions to Avoid: | None known. |
| Materials to Avoid / Chemical Incompatibility: | 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/m ³ 8 h; Oral LD50 Rat 5800 mg/kg |

Component Carcinogenic Data:

OSHA:

| Chemical Name | CAS No. | |
|----------------------|----------|---------|
| Benzo(k)fluoranthene | 207-08-9 | Present |

ACGIH:

| Chemical Name | CAS No. | |
|---------------|---------|---|
| 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 92 [2010]; Supplement 7 [1987]; Monograph 32 [1983] | 207-08-9 | Group 2B |

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, |

Waste Disposal of Packaging:

or Provincial regulations.
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

| Chemical Name | CAS# | CERCLA | SARA 313 | SARA EHS 313 | TSCA |
|------------------------|----------|--------|----------|--------------|------|
| Acetone | 67-64-1 | X | - | - | X |
| benzo (k) fluoranthene | 207-08-9 | X | X | - | - |

The following chemicals are listed on CA Prop 65:

| Chemical Name | CAS # | Regulation |
|----------------------|----------|----------------|
| Benzo[k]fluoranthene | 207-08-9 | 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 (k) fluoranthene | 207-08-9 | X | X | X | X |

16. OTHER INFORMATION

Prior Version Date: 12/30/16

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.



Material Safety Data Sheet

Benzo[a]pyrene, 98%

MSDS# 37175

Section 1 - Chemical Product and Company Identification

MSDS Name: Benzo[a]pyrene, 98%

Catalog Numbers: AC105600000, AC105600010, AC105601000, AC377200000, AC377200010, AC377201000

Synonyms: 3,4-Benzopyrene; 3,4-Benzpyrene; Benzo[def]chrysene.

Company Identification:

Acros Organics BVBA
Janssen Pharmaceuticaaan 3a
2440 Geel, Belgium

Company Identification: (USA)

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

For information in the US, call:

800-ACROS-01

For information in Europe, call:

+32 14 57 52 11

Emergency Number, Europe:

+32 14 57 52 99

Emergency Number US:

201-796-7100

CHEMTREC Phone Number, US:

800-424-9300

CHEMTREC Phone Number, Europe:

703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#: 50-32-8
Chemical Name: Benzo[a]pyrene
%: >96
EINECS#: 200-028-5

Hazard Symbols:



T N



Risk Phrases:

45 46 60 61 43 50/53

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Danger! May cause allergic skin reaction. Cancer hazard. May cause harm to the unborn child. May impair fertility. May cause eye, skin, and respiratory tract irritation. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. May cause heritable genetic damage. Target Organs: Reproductive system, skin.

Potential Health Effects

Eye: May cause eye irritation.

Skin: May cause skin irritation. May be harmful if absorbed through the skin. May cause an allergic reaction in certain individuals.

Ingestion: May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated. May be harmful if swallowed.

Inhalation: May cause respiratory tract irritation. The toxicological properties of this substance have not been fully investigated. May be harmful if inhaled.

Chronic: May cause cancer in humans. May cause reproductive and fetal effects. Laboratory experiments have resulted in mutagenic effects.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion: Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

Inhalation: Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician:

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam.

Autoignition Temperature: Not available.

Flash Point: Not available

Explosion Limits: Not available

Lower: Not available

Explosion Limits: Not available

Upper: Not available

NFPA Rating: health: 2; flammability: 0; instability: 0;

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|----------------|---|---------------|---|
| Benzo[a]pyrene | 0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches). | 0.1 mg/m3 TWA | 0.2 mg/m3 TWA (benzene soluble fraction) (listed under Coal tar pitches). |

OSHA Vacated PELs: Benzo[a]pyrene: 0.2 mg/m3 TWA (benzene soluble fraction) (listed under Coal tar pitches)

Engineering Controls:

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

Personal Protective Equipment

Eyes: 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: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Powder

Color: yellow to brown

Odor: faint aromatic odor

pH: Not available

Vapor Pressure: Not available

Vapor Density: Not available

Evaporation Rate: Not available

Viscosity: Not available

Boiling Point: 495 deg C @ 760 mm Hg (923.00°F)

Freezing/Melting Point: 175 - 179 deg C

Decomposition Temperature: Not available

Solubility in water: 1.60x10⁻³ mg/l @25°C

Specific Gravity/Density:

Molecular Formula: C₂₀H₁₂

Molecular Weight: 252.31

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: Dust generation.

Incompatibilities with Other Materials: Strong oxidizing agents.

Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#: CAS# 50-32-8: DJ3675000

LD50/LC50: RTECS: Not available.

Carcinogenicity: Benzo[a]pyrene - ACGIH: A1 - Confirmed Human Carcinogen (Coal tar pitches). California: carcinogen, initial date 7/1/87 NTP: Suspect carcinogen IARC: Group 1 carcinogen

Other: The toxicological properties have not been fully investigated.

Section 12 - Ecological Information

Not available

Section 13 - Disposal Considerations

Dispose of in a manner consistent with federal, state, and local regulations.

Section 14 - Transport Information

US DOT

Shipping Name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOL (Benzo{a} pyrene)

Hazard Class: 9

UN Number: UN3077

Packing Group: III

Canada TDG

Shipping Name: Not available

Hazard Class:

UN Number:

Packing Group:

Section 15 - Regulatory Information

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: T N

Risk Phrases:

R 45 May cause cancer.

R 46 May cause heritable genetic damage.

R 61 May cause harm to the unborn child.

R 43 May cause sensitization by skin contact.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

R 60 May impair fertility.

Safety Phrases:

S 53 Avoid exposure - obtain special instructions before use.

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 60 This material and its container must be disposed of as hazardous waste.

S 61 Avoid release to the environment. Refer to special instructions/safety data sheets.

WGK (Water Danger/Protection)

CAS# 50-32-8: Not available

Canada

CAS# 50-32-8 is listed on Canada's DSL List

Canadian WHMIS Classifications: D2A, D2B

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

CAS# 50-32-8 is listed on Canada's Ingredient Disclosure List

US Federal

TSCA

CAS# 50-32-8 is listed on the TSCA
Inventory.

Section 16 - Other Information

MSDS Creation Date: 9/02/1997

Revision #8 Date 7/20/2009

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential, or exemplary damages howsoever arising, even if the company has been advised of the possibility of such damages.

Safety Data Sheet

Prepared in accordance with Commission Regulation (EU) 2015/830



Stock Number: 31270

Revision Date: 13-08-2018

This document replaces SDS dated: 08-12-2016

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

Benzo(a)anthracene Standard

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier: Benzo(a)anthracene Standard

Stock Number: 31270

Other means of identification:

Synonyms: None Known

REACH Registration No.: None Known

Molecular formula: CH3OH

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

Relevant identified uses: For Laboratory use only

Uses advised against: Uses other than recommended use.

1.3 Details of the Supplier of the Safety Data Sheet:

Manufacturer

Supplier

Restek Corporation
110 Benner Circle
Bellefonte, Pa. 16823
USA

00 1 814-353-1300

00 1 814-353-1309

sds@restek.com

00 1 800-424-9300

(CHEMTREC within the US)

00 1 703-741-5970

(Outside USA)

National Poisons Information Service (NPIS)

Email: director.birmingham.unit@npis.org

Website: <http://www.npis.org/>

Thames Restek UK LTD

Units 8-16, Ministry Wharf

Wycombe Road, Saunderton

Buckinghamshire

United Kingdom HP14 4HW

01494 563377

sales@thamesrestek.co.uk

0870-8200418

(CHEMTREC within the UK)

+1 703-741-5970

(CHEMTREC International)

1.4 Emergency telephone number:

Poison Centre contact information:

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture:

Classification according to Regulation (EC) Carcinogenicity Category 1B

No 1272/2008 [CLP]: Specific Target Organ Systemic Toxicity (STOT) - Single Exposure Category 1

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Flammable Liquid Category 2

Hazardous to the aquatic environment - Chronic Category 2

Acute Toxicity - Dermal Category 3

Acute Toxicity - Oral Category 3

2.2 Label elements:

Labelling according to Regulation (EC) No 1272/2008 [CLP]:

Hazard
pictograms:



Signal Word:

Danger

Hazard Statements:

H225 - Highly flammable liquid and vapour

H301+H311 - Toxic if swallowed or in contact with skin

H350 - May cause cancer.

H370 - Causes damage to organs

H411 - Toxic to aquatic life with long lasting effects

Precautionary Statements:

P201 - Obtain special instructions before use.

P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

P233 - Keep container tightly closed.

P260 - Do not breathe dust/fume/gas/mist/vapours/spray.

P280 - Wear protective gloves/protective clothing/eye protection/face protection.

P301+P310 - IF SWALLOWED: Immediately call a POISON CENTER/doctor.

Supplemental Hazard information (EU):

None Known

2.3 Other hazards:

This substance does not meet the PBT or vPvB criteria of REACH, Annex XIII

SECTION 3: Composition/information on ingredients

3.1 Substances:

Not applicable

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Benzo(a)anthracene Standard

3.2 Mixtures:

| Chemical Name | % | CAS # | EC No. REACH Registration No. | Classification (EC) No 1272/2008 | M Factor | SCL | Acute Toxicity Estimates |
|---------------------|------|---------|-------------------------------------|--|--|---|--------------------------------|
| benz (a) anthracene | 0.1 | 56-55-3 | 200-280-6 None Known | Aquatic Acute 1; H400 Aquatic Chronic 1; H410 Carc. 1B; H350 | AQUATIC CHRONIC 1: M = 100 AQUATIC ACUTE 1: M = 100 | No data available | Not determined |
| methanol | 99.9 | 67-56-1 | 200-659-6 None Known | Acute Tox. 3 (Dermal); H311 Acute Tox. 3 (Inh Dust/Mist); H331 Acute Tox. 3 (Oral); H301 Flam. Liq. 2; H225 STOT SE 1; H370 | No data available | STOT SE 2: 3%<10% STOT SE 1: 10% | Not determined |

For full text of H-statements see Section 16.

SECTION 4: First aid measures

4.1 Description of 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.

Eye contact:

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.

Self protection of the first aider:

No data available

4.2 Most important symptoms and

Coma and death

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effects, both acute and delayed:

4.3 Indication of any immediate medical attention and special treatment needed:

IF exposed or concerned: Get medical advice/ attention. IF exposed or concerned: Call a POISON CENTER/doctor. Call a POISON CENTER/doctor if you feel unwell.

SECTION 5: Firefighting measures

5.1 Extinguishing media:

Suitable extinguishing media:

Use alcohol resistant foam, carbon dioxide, or dry chemical extinguishing agents. Water may be ineffective but water spray can be used to extinguish a fire if swept across the base of the flames. Water can absorb heat and keep exposed material from being damaged by fire.

Unsuitable extinguishing media:

None Known

5.2 Special hazards arising from the substance or mixture:

Vapors may be ignited by sparks, flames or other sources of ignition if material is above the flash point giving rise to a fire (Class B). Vapors are heavier than air and may travel to a source of ignition and flash back.

Hazardous Combustion Products:

Carbon dioxide, Carbon monoxide

5.3 Advice for firefighters:

Do not enter fire area without proper protection including self-contained 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.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:

Non-emergency personnel:

Non-emergency personnel should be kept clear of the area

Emergency responders:

Exposure to the spilled material may be severely irritating or toxic. Follow personal protective equipment recommendations found in Section 8 of this SDS. Personal protective equipment needs must be evaluated based on information provided on this sheet and the special circumstances created by the spill including; the material spilled, the quantity of the spill, the area in which the spill occurred, and the expertise of employees in the area responding to the spill. Never exceed any occupational exposure limits.

6.2 Environmental precautions:

No data available

6.3 Methods and material for containment and cleaning up:

Small spills:

Refer to information provided for large spills

Large spills:

Prevent the spread of any spill to minimize harm to human health and the

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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.

6.4 Reference to other sections:

Refer to section 13 for disposal information

SECTION 7: Handling and storage

7.1 Precautions for safe handling:

Toxic or severely irritating material. Avoid contacting and avoid breathing the material. Use only in a well ventilated area. Use spark-proof tools and explosion-proof equipment

7.2 Conditions for safe storage, including any incompatibilities:

Conditions for safe storage:

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

Materials to Avoid/Chemical Incompatibility:

Strong oxidizing agents

7.3 Specific end use(s):

For Laboratory use only

SECTION 8: Exposure controls/personal protection

8.1 Control parameters:

Occupational Exposure limit values:

| Chemical Name | United Kingdom - Workplace Exposure Limits (WELs) - TWAs | United Kingdom - Workplace Exposure Limits (WELs) - STELs | United Kingdom - Biological Monitoring Guidance Values |
|---------------|--|---|--|
| methanol | 200 ppm TWA; 266 mg/m ³ TWA | 250 ppm STEL; 333 mg/m ³ STEL | No data available |

DNEL:

None Known

PNEC:

None Known

8.2 Exposure controls:

Appropriate engineering controls:

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

Individual protection measures, such as personal protective equipment:

Eye and face protection:

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

Skin Protection:

Hand protection:

No information available

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Other 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

Respiratory Protection:

If an exposure limit is exceeded or if an operator is experiencing symptoms of inhalation overexposure as explained in Section 3, provide respiratory protection. Respiratory protection may be required to avoid overexposure when handling this product. General or local exhaust ventilation is the preferred means of protection. Use a respirator if general room ventilation is not available or sufficient to eliminate symptoms.

Respirator Type(s):

None required where adequate ventilation is provided. If airborne concentrations are above the applicable exposure limits, use NIOSH/MSHA approved respiratory protection.

Thermal Hazards:

Not applicable

Environmental exposure controls:

No data available

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties:

Appearance:

No data available

Colour:

No data available

Odour:

Mild

Odour threshold:

No data available

pH:

Not applicable

Melting Point/Freezing Point (°C):

Melting point (°C):

No data available

Freezing point (°C):

No data available

Initial boiling point and boiling range (°C): 65

Flash point (°C): 11

Evaporation Rate (water = 1): No data available

Flammability (solid, gas): No data available

Upper/lower flammability or explosive limits:

Upper flammable or explosive limit, %
in air: 36

Lower flammable or explosive limit, % 6

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in air:

| | |
|---|-------------------|
| Vapour pressure: | No data available |
| Vapor Density (Air=1): | 1.1 |
| Relative density (water = 1): | 0.800 |
| Solubility(ies): | Moderate; 50-99% |
| Partition coefficient: n-octanol/water: | No data available |
| Auto-ignition temperature (°C): | 464 |
| Decomposition temperature (°C): | No data available |
| Viscosity: | No data available |
| Explosive properties: | No data available |
| Oxidizing properties: | No data available |

9.2 Other information:

| | |
|-----------------------------|-------|
| Volatile Organic Chemicals: | 0 |
| Bulk density: | 6.676 |

SECTION 10: Stability and reactivity

| | |
|--|--|
| 10.1 Reactivity: | Not expected to be reactive |
| 10.2 Chemical stability: | Stable under normal conditions. |
| 10.3 Possibility of hazardous reactions: | None expected under standard conditions of storage |
| 10.4 Conditions to avoid: | No data available |
| 10.5 Incompatible materials: | Strong oxidizing agents |
| 10.6 Hazardous decomposition products: | Carbon dioxide, Carbon monoxide |

SECTION 11: Toxicological information

11.1 Information on toxicological effects:

Acute toxicity:

| Chemical Name | ORAL LD50 (rat) | DERMAL LD50 (rabbit) | INHALATION LC50 (rat) |
|---------------|-------------------|----------------------|-------------------------------------|
| methanol | No data available | No data available | INHALATION LC50-8H Rat 22500 ppm |

Classification has been based on toxicological information of the components in Section 3.

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Skin corrosion/irritation:

Based on available data, the classification criteria are not met.

Serious eye damage/irritation:

Based on available data, the classification criteria are not met.

Respiratory or skin sensitisation:

Based on available data, the classification criteria are not met.

Germ cell mutagenicity:

Based on available data, the classification criteria are not met.

Carcinogenicity:

Classification has been based on toxicological information of the components in Section 3.

Reproductive toxicity:

Based on available data, the classification criteria are not met.

STOT-single exposure:

Classification has been based on toxicological information of the components in Section 3.

STOT-repeated exposure:

Based on available data, the classification criteria are not met.

Aspiration hazard:

Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

12.1 Toxicity:

Moderate ecological hazard. This product may be dangerous to plants and/or wildlife.

Ecological Toxicity Data:

| Chemical Name | CAS # | Aquatic EC50 Crustacea | Aquatic ERC50 Algae | Aquatic LC50 Fish |
|-------------------|-------|---------------------------|------------------------|-------------------|
| No data available | | | | |

12.2 Persistence and degradability:

Biodegrades slowly.

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

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12.6 Other adverse effects: None Known
12.7 Additional information: No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods:

Disposal methods: Spent or discarded material is a hazardous waste.
Dispose of by incineration following Federal, State, Local, or Provincial regulations.

Waste codes / waste designations according to LoW: No data available

SECTION 14: Transport information

International carriage of dangerous goods by road (ADR), rail or inland waterways:

14.1 UN number: UN1230
14.2 UN proper shipping name: Methanol
14.3 Transport hazard class(es): 3(6.1)
14.4 Packing group: II

International carriage of dangerous goods by air (IATA):

14.1 UN number: UN1230
14.2 UN proper shipping name: Methanol
14.3 Transport hazard class(es): 3(6.1)
14.4 Packing group: II

14.5 Environmental hazards: Yes
14.6 Special precautions for user: No data available
14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code: No data available

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:

| Chemical Name | EINECS | SVHC |
|---------------|--------|------|
| methanol | Yes | No |

Safety Data Sheet

Prepared in accordance with Commission Regulation (EU) 2015/830



Stock Number: 31270

Revision Date: 13-08-2018

This document replaces SDS dated: 08-12-2016

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

Benzo(a)anthracene Standard

| | | |
|---------------------|-----|----|
| benz (a) anthracene | Yes | No |
|---------------------|-----|----|

15.2 Chemical Safety Assessment

No Chemical Safety Assessment has been carried out for this substance/mixture by the supplier.

SECTION 16: Other information

Revision Date:

13-08-2018

Indication of changes:

Any changes to the SDS compared to previous versions are marked by a vertical line in front of the concerned paragraph.

Abbreviations and acronyms:

CAS = Chemical Abstract Service
DNEL= Derivative No Effect Level
EC= European Community
EINECS = European Inventory of Existing Chemical Substances
MSHA = Mine Safety Health Administration
NIOSH = National Institute of Occupational Safety & Health
OEL = Occupational Exposure Limit
PBT= Persistent, Bioaccumulative, Toxic
PNEC= Predicted No Effect Concentration
SCOEL= Scientific Committee on Occupational Exposure Limits
TLV = Threshold Limit Value
TWA= Time Weighted Average
vPvB= Very Persistent, Very Bioaccumulative
Wt.% = Weight Percent

Key literature references and sources for data:

No data available

Hazard phrase(s) referenced in section 3

H350 - May cause cancer.
H225 - Highly flammable liquid and vapour
H301+H311+H331 - Toxic if swallowed, in contact with skin or if inhaled
H370 - Causes damage to organs
H410 - Very toxic to aquatic life with long lasting effects

Precautionary Statements:

Prevention:

P201 - Obtain special instructions before use.
P202 - Do not handle until all safety precautions have been read and understood.

Safety Data Sheet

Prepared in accordance with Commission Regulation (EU) 2015/830



Stock Number: 31270

Revision Date: 13-08-2018

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

Benzo(a)anthracene Standard

Response:

P210 - Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

P233 - Keep container tightly closed.

P240 - Ground/bond container and receiving equipment.

P241 - Use explosion-proof electrical/ventilating/lighting equipment.

P242 - Use only non-sparking tools.

P243 - Take precautionary measures against static discharge.

P260 - Do not breathe dust/fume/gas/mist/vapours/spray.

P264 - Wash thoroughly after handling.

P270 - Do not eat, drink or smoke when using this product.

P273 - Avoid release to the environment.

P280 - Wear protective gloves/protective clothing/eye protection/face protection.

P301+P310 - IF SWALLOWED: Immediately call a POISON CENTER/doctor.

P302+P352 - If on skin: Wash with plenty of water.

P303+P361+P353 - IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.

P308+P311 - IF exposed or concerned: Call a POISON CENTER/doctor.

P308+P313 - IF exposed or concerned: Get medical advice/ attention.

P312 - Call a POISON CENTER/doctor if you feel unwell.

P321 - Specific treatment (see Sections 4 to 8 on this SDS and any additional information on this label).

P330 - Rinse mouth.

P361+P364 - Take off immediately all contaminated clothing and wash it before reuse.

P370+P378 - In case of fire: Use an appropriate extinguisher (see section 5) to extinguish.

P391 - Collect spillage.

Storage:

P233 - Keep container tightly closed.

P403+P235 - Store in a well-ventilated place. Keep cool.

P405 - Store locked up.

Disposal:

P501 - Dispose of contents/container to a suitable disposal site in accordance with local/national/international regulations.

Disclaimer of Liability:

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.

Safety Data Sheet

Prepared in accordance with Commission Regulation (EU) 2015/830



Stock Number: 31270

Revision Date: 13-08-2018

This document replaces SDS dated: 08-12-2016

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

Benzo(a)anthracene Standard

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.

Material Safety Data Sheet

Chrysene, 98%

ACC# 95251

Section 1 - Chemical Product and Company Identification

MSDS Name: Chrysene, 98%**Catalog Numbers:** AC224140000, AC224140010, AC224140050, AC224145000**Synonyms:** 1,2-Benzophenanthrene; Benzo(a)phenanthrene; 1,2,5,6-Dibenzonaphthalene.**Company Identification:**

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01**For emergencies in the US, call CHEMTREC:** 800-424-9300

Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|----------|---------------|---------|---------------|
| 218-01-9 | Chrysene | 98 | 205-923-4 |

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: very light beige solid.**Caution!** May cause eye and skin irritation. May cause respiratory tract irritation. May cause cancer in humans.**Target Organs:** Liver, skin.**Potential Health Effects****Eye:** May cause eye irritation.**Skin:** May cause skin irritation.**Ingestion:** May cause gastrointestinal irritation with nausea, vomiting and diarrhea.**Inhalation:** May cause respiratory tract irritation.**Chronic:** May cause cancer according to animal studies.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.**Skin:** Get medical aid. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.**Ingestion:** Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.**Inhalation:** Get medical aid immediately. Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.**Notes to Physician:** Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. This material in sufficient quantity and reduced particle size is capable of creating a dust explosion.

Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or chemical foam.

Flash Point: Not applicable.

Autoignition Temperature: Not available.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: ; Flammability: 1; Instability:

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section. Wear a self contained breathing apparatus and appropriate personal protection. (See Exposure Controls, Personal Protection section). Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Wash thoroughly after handling. Avoid contact with eyes, skin, and clothing. Use only with adequate ventilation. Avoid breathing dust.

Storage: Store in a tightly closed container. Store in a cool, dry area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels.

Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---------------|---|---|---|
| Chrysene | 0.2 mg/m ³ TWA (as benzene soluble aerosol) (listed under Coal tar pitches). | 0.1 mg/m ³ TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m ³ IDLH (listed under Coal tar pitches). | 0.2 mg/m ³ TWA (benzene soluble fraction) (listed under Coal tar pitches). |

OSHA Vacated PELs: Chrysene: No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes: 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: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: 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.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance: very light beige

Odor: Not available.

pH: Not available.

Vapor Pressure: Not available.

Vapor Density: Not available.

Evaporation Rate: Not available.

Viscosity: Not available.

Boiling Point: 448 deg C @ 760 mm Hg

Freezing/Melting Point: 250-255 deg C

Decomposition Temperature: Not available.

Solubility: insoluble

Specific Gravity/Density: Not available.

Molecular Formula: C₁₈H₁₂

Molecular Weight: 228.29

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: Dust generation.

Incompatibilities with Other Materials: Strong oxidizing agents.

Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:

CAS# 218-01-9: GC0700000

LD50/LC50:

Not available.

Carcinogenicity:

CAS# 218-01-9:

- **ACGIH:** A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans
- **California:** carcinogen, initial date 1/1/90
- **NTP:** Known carcinogen (listed as Coal tar pitches).
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

Epidemiology: No information found

Teratogenicity: No information found

Reproductive Effects: No information found

Mutagenicity: Chrysene was mutagenic to *S. Typhimurium* in the presence of an exogenous metabolic system.

Neurotoxicity: No information found

Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Water flea LC50 = 1.9 mg/L; 2 Hr.; Unspecified Fish toxicity : LC50 (96hr) Neaethes arenacedentata >1ppm.(Rossi,S.S. et al Marine Pollut. Bull. 1978) Invertebrate toxicity : lethal treshold concentration (24hr) Daphnia Magna 0,7æg/l.(* Newsted,J.L. et al Environ. Toxicol. Chem. 1987) Bioaccumulation : 24hr Daphnia Magna log bioconcentration factor 3.7845 (*)

Environmental: Degradation studies : biodegradated by white rot fungus (Proc.Annu.Meet.Am.Wood-Preserv.Assoc.1989) May be utilised by axenic cultures of microorganisms e.g. Pseudomonas pancimobilis EPA505, which may have novel degradative systems(Mueller,J.G. et al ppl.Environ.Microbiol.1990; Mueller, J.G. et al Environ.Sci.Technol.1991).

Physical: Not found.

Other: No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series:

CAS# 218-01-9: waste number U050.

Section 14 - Transport Information

| | US DOT | Canada TDG |
|-----------------------|--|---------------------------|
| Shipping Name: | DOT regulated - small quantity provisions apply (see 49CFR173.4) | No information available. |
| Hazard Class: | | |
| UN Number: | | |
| Packing Group: | | |

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 218-01-9 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 218-01-9: 100 lb final RQ; 45.4 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

Section 313

This material contains Chrysene (CAS# 218-01-9, 98%),which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 218-01-9 is listed as a Priority Pollutant under the Clean Water Act.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 218-01-9 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65**The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:**

WARNING: This product contains Chrysene, a chemical known to the state of California to cause cancer. California No Significant Risk Level: CAS# 218-01-9: 0.35 µg/day NSRL (oral)

European/International Regulations**European Labeling in Accordance with EC Directives****Hazard Symbols:**

T

Risk Phrases:

R 45 May cause cancer.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.

S 60 This material and its container must be disposed of as hazardous waste.

S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger/Protection)

CAS# 218-01-9: No information available.

Canada - DSL/NDSL

CAS# 218-01-9 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 218-01-9 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 6/30/1999

Revision #5 Date: 11/20/2008

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.



SAFETY DATA SHEET (SDS)

For Welding Consumables and Related Products
Conforms to the criteria of the Globally Harmonized System of Classification and Labeling of Chemicals (GHS),
OSHA Hazard Communication Standard 29CFR 1910.1200
Standard Must Be Consulted for Specific Requirements

MSDS: Magnesium WIRE AND RODS
REVISED 5-2018
SDS Number: 014- MAG

SECTION I – IDENTIFICATION of Product and Company

| | | | |
|--|--|----------------------------------|-----------------------------|
| Manufacturer/Supplier: Washington Alloy Company | Recommended use: Welding, Filler Metal, Brazing | Restriction on use: Not Known | Telephone No: 704-598-1325 |
| Address: 7010-G Reames Rd, Charlotte, NC 28216 | | | Emergency No: 704-598-1325 |
| Trade Name of Magnesium: AZ61A, AZ92A, AZ101A | | | Specification: AWS A5.19 |

SECTION II – COMPOSITION / INFORMATION ON INGREDIENTS

GHS Hazard Classification: STOT SE 3 (H336, H335), (H372), Aquatic Acute 1 (H400)/ **Label Elements** - Hazard symbol and Signal word =



GHS07



GHS08



GHS09

Danger

Hazard statement and Precautionary statement =

Very toxic to aquatic life, Causes damage to organs through prolonged or repeated exposure, May cause drowsiness or dizziness, May cause respiratory irritation.; Wash thoroughly after handling. Do not eat, drink or smoke when using this product Do not breathe dust/fume/gas/mist/vapors/spray. Avoid breathing dust/fume/gas/mist/vapor/spray.. Use only outdoors or in a well-ventilated area. Avoid release to the environment. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor if you feel unwell. Get medical advice and attention if you feel unwell. Collect spillage. Store in a well-ventilated place; Keep container tightly closed. Store locked up. Dispose of contents/container in accordance with local/ regional/ national/ international regulations. Manganese and Manganese compounds above safe exposure limits can affect or cause irreversible damage to the central nervous system, including the brain: symptoms may result in impaired speech and movement, lack of energy, stiffness in legs, feet, toes, muscular weakness as well as psychological disturbances. Reports of bronchitis and lung fibrosis have also been noted.

Other Hazards which do not result in GHS classification and Overview: Electric shock can kill. Wear approved head, hand and body protection, which help to prevent injury from radiation, sparks and electrical shock. Welding arc and sparks can ignite combustibles or flammable materials. See ANSI Z-49.1. This would include wearing welder's gloves and a protective face shield and may include arm protectors, apron, hats, shoulder protection, as well as dark substantial clothing. Welders should be trained not to allow electrically live parts to contract the skin or wet clothing and gloves. The welders should insulate themselves from the work and ground. Arc Rays can injure eyes and burn skin. Read and understand the manufacturer's instructions and precautionary label on this product and your employer's safety practices. See Section XIII. As shipped these are odorless, solid rods that are nonflammable, non-explosive, non-reactive and non-hazardous with a metallic luster.

Substance: Welding fumes and gases cannot be classified simply. The composition and quantity of these fumes and gases are dependent upon the metal being welded, the procedures followed, and the electrodes used. Fumes may affect eyes, skin, respiratory system as well as pancreas and liver.

Workers should be aware that the composition and quantity of fumes and gases to which they may be exposed, are influenced by: coatings which may be present on the metal being welded (such as paint, plating, or galvanizing), the number of welders in operation and the volume of the work area, the quality and amount of ventilation, the position of the welder's head with respect to the fume plume, as well as the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing procedure). When the electrode is consumed, the fumes and gas decomposition products generated are different in percent and form from the ingredients listed in Section III, The composition of these fumes and gases are the concerning matter and not the composition of the electrode itself. Decomposition products include those originating from the volatilization, reaction, or oxidation of the ingredients shown in Section III, plus those from the base metal, coating and the other factors noted above. Reasonable expected fume constituents of this product would include: Complex oxides or compounds of chromium, magnesium, manganese, silicon, copper, aluminum, zinc and may be present. (Other complex oxides may be present when using fluxes).
Ingredients listed in Section III

| Chemical Identity | CAS No. | EINECS# |
|-------------------|------------|-----------|
| Carbon dioxide | 124-38-9 | 204-696-9 |
| Carbon monoxide | 630-8-0 | 211-128-3 |
| Nitrogen dioxide | 10102-44-0 | - |
| Ozone | 10028-15-6 | 233-069-2 |
| Manganese (Mn) | 7439-96-5 | 231-105-1 |

SAFETY DATA SHEET (SDS)

MSDS: Magnesium WIRE AND RODS
REVISED 5-2018
SDS Number: 014- MAG

SECTION III – COMPOSITION / INFORMATION ON INGREDIENTS

*The term “HAZARDOUS MATERIALS” should be interpreted as a term required and defined in OSHA HAZARD COMMUNICATION STANDARD 29 CFR 1910.1200 however the use of this term does not necessarily imply the existence of any hazard.

| Chemical Identity Ingredients | CAS No. | EINECS# | Composition percent in Weight (%) | | |
|--|-----------|-----------|-----------------------------------|---------|-----------|
| | | | AZ61A | AZ92A | AZ101A |
| Aluminum | 7429-90-5 | 231-072-3 | 5.8-7.2 | 8.3-9.7 | 9.5-10.5 |
| Zinc (Zn) Fume ⁽¹⁾ | 7440-66-6 | 231-175-3 | 0.40-1.5 | 1.7-2.3 | 0.75-1.25 |
| Beryllium | 7440-41-7 | 231-150-7 | 0.0002-0.0008 | | |
| Copper | 7440-50-8 | 231-159-6 | 0.05 | | |
| Manganese (Mn) (limits as fume) ⁽¹⁾ | 7439-96-5 | 231-105-1 | 0.15-0.5 | | |
| Iron | 7439-89-6 | 231-096-4 | 0.005 | | |
| Silicon (Si) | 7440-21-3 | 231-130-8 | 0.05 | | |
| Magnesium (Mg) | 7439-95-4 | 231-104-6 | Balance | | |
| Nickel (Ni) | 7440-02-0 | 231-111-4 | 0.005 | | |

Other elements or ingredients may be present but in quantities much less than 1%. ⁽¹⁾ Subject to reporting requirements of Section 302, 304, 311, 312, and 313 of the Emergency Planning and Community Right-To-Know Act of 1986 and 40CFR 370 and 372; (Resp) = Respiratory/ Respiration: Welding and cutting of products that contain Chromium may produce hexavalent chromium and YOU should read and follow OSHA's final rules Fed Register #:71:10099-10385 dated 02-28-2006. Occupational Safety and Health Administration 29 CFR 1910.1000 Permissible Exposure Limit (PEL). American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV[R]). *Ceiling Limit **Short Term Exposure Limit Single values are maximum

SECTION IV – FIRST AID MEASURES

Contact with skin, eyes, ingestion or injection should not be a source for exposure with proper protection.

Ingestion: Avoid contact with metal fume or powers which may lead to ingestion which may be harmful. Do not induce vomiting unless directed by medical personnel. Rinse mouth with water if conscious. Call a physician or poison control center immediately.

Inhalation: If breathing has stop or difficult move to fresh air and as needed perform artificial respiration. Call medical assistance or physician.

Skin Contact: Remove any contaminated clothing, gloves or other personnel equipment and promptly wash/flush with mild soap and water. For reddish or blistered skin from thermal/arc radiation promptly wash/flush with water. Get medical assistance or physician help as needed.

Eye Contact: Arc radiation can injure eyes and cause an arc flash – if this occurs, move to dark room removing lenses as required and get rest and cover eyes with non-stick dressings (padded dressing) Removal of dust and fumes requires flushing with abundant amounts of clean water for at least 15 minutes. Get medical assistance or physician help as needed or if issues persist.

Most important symptoms/effects, acute and delayed:

Symptoms: Short-term (acute) overexposure to welding fumes may result in discomfort such as metal fume fever, dizziness, nausea, dryness or irritation of nose, throat, or eyes. Pre-existing respiratory issues may be aggregated. Long-term (chronic) over-exposure to welding fumes can lead to siderosis (iron deposits in lung) and is believed to affect pulmonary function. Manganese and Manganese compounds above safe exposure limits can affect or cause irreversible damage to the central nervous system, including the brain: symptoms may result in impaired speech and movement, lack of energy, stiffness in legs, feet, toes, muscular weakness as well as psychological disturbances. Reports of bronchitis and lung fibrosis have also been noted.

Hazards: Welding fumes and gases cannot be classified simply. Refer to Section II under Substance and Section VIII

SECTION V – FIRE-FIGHTING MEASURES

As shipped these are odorless, solid rods that are nonflammable, non-explosive, non-reactive and non –hazardous. Welding arcs and sparks can ignite combustibles or flammable materials Read and understand the manufacturer's instructions and precautionary label on this product and your employer's safety practices. Read and understand: American National Standard ANSI Z49.1 *Safety in Welding, Cutting and Allied Processes*, published by the AMERICAN WELDING SOCIETY, 550 N.W. LeJeune Road, Miami, Florida 33126; OSHA *Safety and Health Standards* are published by the U.S. Government Printing Office, 732 North Capitol Street NW, Washington, DC 20401. Also, National Fire Protection Association NFPA 51B, *Standard for Fire Prevention During Welding, Cutting and other Hot Work; Also See NFPA 651*

Suitable (and unsuitable) extinguishing media: As shipped these items will not burn however in the event use media recommended for the burning materials and fire situation and surroundings. No unsuitable media known at this time. Do not use water or halogenated on molten metals.

Specific hazards arising from the chemicals: Welding arcs and sparks can ignite combustibles or flammable materials

Specific protective equipment and precautions for firefighters: Wear self-contained breathing apparatus and full protective clothing in case of fire or when fumes and vapors are present. Follow general fire-fighting precautions as in the workplace. Do not allow run off to enter drains or water sources.

SAFETY DATA SHEET (SDS)

| |
|-------------------------------|
| MSDS: Magnesium WIRE AND RODS |
| REVISED 5-2018 |
| SDS Number: 014- MAG |

SECTION VI – ACCIDENTAL RELEASE MEASURES

Personal Precautions, protective equipment and emergency procedures: With airborne dust and fumes, be sure to use adequate engineering ventilation controls and personal protection to prevent overexposure limits recommendations found in Section VIII.

Environment precautions: Control work practices to eliminate environmental release. These products are solid metal rods, with no spill or leak hazards as shipped. If product becomes molten dam up with sand type media until it cools back to a solid and reuse/recycle as scrap.

Methods and Materials for containment and cleaning up: Solid rods can be picked up and placed back in the original container. Clean up immediately while following all safety guidelines as well as using all personal protection safety listed in section VIII. Avoid generating dust and prevent materials from entering and drains, sewers or water sources. Disposal considerations found in Section XIII. When fumes and vapors are present follow general fire-fighting precautions as in the workplace and all applicable regulations

SECTION VII – HANDLING AND STORAGE

Precautions for safe handling: Handle with care wearing gloves and keep formation of airborne dust and fumes to a minimum. If needed use adequate engineering ventilation controls and personal protection to prevent overexposure limits recommendations found in Section VIII. Also read American National Standard ANSI Z49.1 *Safety in Welding, Cutting and Allied Processes*, published by the AMERICAN WELDING SOCIETY, 550 N.W. LeJeune Road, Miami, Florida 33126; OSHA *Safety and Health Standards* are published by the U.S. Government Printing Office, 732 North Capitol Street NW, Washington, DC 20401. Do not eat or drink while using these products and ensure proper ventilation is used. Wash hands after use. **Conditions for safe storage, including any incompatibilities:** All employees who handle these products should be trained to handle it safely. Open packages of these products/containers on a safe stable surface and must be properly labeled at all times. Store products in original closed packages, cool dry place, while avoiding extreme temperatures or incompatible items such as acids, strong bases, oxidizers and halogens. Always follow all regulations in accordance with local/regional/state/national guidelines.

SECTION VIII – EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

| Flux or other ingredients | CAS No. | EINECS# | Exposure Limit (mg/m ³) | |
|---|-----------|-----------|---|--------------------------|
| | | | OSHA PEL | ACGIH TLV |
| Iron (Fe) (limits as oxide fume) | 7439-89-6 | 231-096-4 | 10 | 5 (Resp) |
| Manganese (Mn) (limits as fume) ⁽¹⁾ | 7439-96-5 | 231-105-1 | 1, 3.0** , 5* | 0.02 (Resp) 0.1*** |
| Silicon (Si) | 7440-21-3 | 231-130-8 | 15 (dust) 5 (Resp) | WITHDRAWN |
| Nickel (Ni) ⁽¹⁾ | 7440-02-0 | 231-111-4 | 1 | 1.5 (inhalable fraction) |
| Copper (Cu) ^{(A) (1)} | 7440-50-8 | 231-159-6 | 1 (dust) 0.1(fume) | 1 (dust) 0.2 (fume) |
| Magnesium (Mg) | 7439-95-4 | 231-105-1 | 15 (total particulate) | 10 |
| Zinc (Zn) Fume ⁽¹⁾ | 7440-66-6 | 231-175-3 | 5 mg/m3 5 mg/m3 (Resp) 15 mg/m3 (total dust) | 2 (Resp)10** |
| Beryllium | 7440-41-7 | 239-981-7 | 0.002, 0.005 Ceiling, 0.025 for 30 minutes | 0.00005*** |
| Aluminum (Al) ^{(1) (2)} | 7429-90-5 | 231-072-3 | 15 (total dust) 5 (Resp) | 10 (dust)1 (Resp) |

Other elements or ingredients may be present but in quantities much less than 1%.⁽¹⁾ Subject to reporting requirements of Section 302, 304, 311, 312, and 313 of the Emergency Planning and Community Right-To-Know Act of 1986 and 40CFR 370 and 372; (Resp) = Respiratory/ Respiration: Welding and cutting of products that contain Chromium may produce hexavalent chromium and YOU should read and follow OSHA's final rules Fed Register #:71:10099-10385 dated 02-28-2006. Occupational Safety and Health Administration 29 CFR 1910.1000 Permissible Exposure Limit (PEL). American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV[R]). *Ceiling Limit **Short Term Exposure Limit ***Inhalable fraction

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits used a guideline in control for health hazards but not an indication of safe and dangerous exposure limits **TLV - Threshold Limit Value** - an airborne concentration of a substance, which represents conditions under which it is generally believed that nearly all workers, may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour & **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV.

OSHA - U.S. Occupational Safety and Health Administration. **PEL - Permissible Exposure Limit** - this exposure value means the same as a TLV, except that it is limits guideline by OSHA. **Eye Protection:** Wear a helmet or face shield with a filter lens shade number 12-14 or darker for arc welding. Shield other workers by providing screens and flash goggles. Use face-shield with filter lens of appropriate shade number (per ANSI Z49.1-1988, "Safety in Welding and Cutting"). **Protective Clothing:** Wear approved head, hand and body protection, which help to prevent injury from radiation, sparks and electrical shock. See ANSI Z-49.1. This would include wearing welder's gloves and a protective face shield and may include arm protectors, apron, hats, shoulder protection, as well as dark substantial clothing. Welders should be trained not to allow electrically live parts to contract the skin or wet clothing and gloves. The welders should insulate themselves from the work and ground.

Ventilation: Use plenty of ventilation and/or local exhaust at the arc, to keep the fumes and gases below the threshold limit value within the worker's breathing zone and the general work area. Welders should be advised to keep their head out of the fumes.

Respiratory Protection: Use respirable fume respirator or air supplied respirator when welding in a confined space or general work area where local exhaust and/or ventilation does not keep exposure below the threshold limit value.

HYGIENE/ WORK PRACTICES: With all chemicals/materials, avoid getting these products ON YOU or IN YOU. Wash hands after handling these products. Do not eat or drink while handling these products. Use ventilation and other engineering controls to minimize potential exposure to these products.

SAFETY DATA SHEET (SDS)

| |
|-------------------------------|
| MSDS: Magnesium WIRE AND RODS |
| REVISED 5-2018 |
| SDS Number: 014- MAG |

SECTION IX – PHYSICAL AND CHEMICAL PROPERTIES

Appearance / Color / Odor / Physical state / Form: Solid rods that are nonflammable, non-explosive, non-reactive and non –hazardous with a metallic luster. **Odor Threshold / pH / Flash Point / Evaporation Rate / Flammability (Solid, Gas) / Upper & Lower Flammability or Explosive Limits:** No data available **Vapor Pressure & Density / Relative Density / Partition coefficient (n-octanol/water) / Auto-ignition Decomposition temperature:** No data available **MELTING POINT:** 1112°F (600 °C) **SPECIFIC GRAVITY** N/A **Solubility(water/other):** Insoluble

SECTION X – STABILITY and REACTIVITY

Chemical stability: These products are considered stable as shipped and under normal conditions

Possibility of hazard reactions: No data and will not occur

Conditions to avoid: Avoid exposure to extreme temperatures, Incompatible materials

Incompatible materials: Incompatible items such as acids, oxidizers, halogens, Strong bases, mineral acids, and halogens.

Hazardous decomposition products: Read Substance in Section II. Welding and cutting of products that contain Chromium may produce hexavalent chromium and YOU should read and follow OSHA's final rules Fed Register #:71:10099-10385 dated 02-28-2006. Occupational Safety and Health Administration 29 CFR 1910.1000 Permissible Exposure Limit (PEL). The best method to determine the actual composition of generated fumes and gases is to take an air sample from inside the welder's helmet if worn or in breathing zone. For additional information, refer to the American Welding Society Publication, "Fumes and Gases in the Welding Environment".

SECTION XI- TOXICOLOGICAL INFORMATION

Oral/Dermal/inhalation: Acute oral toxicity; Iron: (Human-child); TDLo: 77 mg/kg. Oral (rat); LD50:30 gm/kg. Intraperitoneal (rabbit); LDLo: 20 mg/kg. Oral (guinea pig); LD50:20 gm/kg. Oral (rat); TDLo: 63 gm/kg/6W-C. Inhalation (rat); 250 mg/m3/6H/4W-I. Intratracheal (rat); TDLo: 450 mg/kg/15W-I. **Silicon:** Acute oral toxicity (LD50): 3160 mg/kg [Rat]. **Manganese:** Acute oral toxicity (LD50): 9000 mg/kg [Rat].; TCLO 2300 mg/m3 (inhalation human central nervous); **Silicon :** Acute oral toxicity (LD50): 3160 mg/kg [Rat].; **Copper:** Acute oral toxicity (TDLo): 12 mg/kg, gastrointestinal effects; **Zinc:** (TDLo): 124 mg/m3/50mins, pulmonary effects of skin; **Skin corrosion or irritation / Serious eye damage or irritation / Respiratory or skin sensitization / Germ cell mutagenicity / Reproductive toxicity / Specific target organ toxicity – single exposure / Specific target organ toxicity – repeated exposure:** Not classified **Carcinogenicity:** Overall Evaluation of welding fume and Nickel is listed by IARC as possibly carcinogenic to humans (Group 2B). **National Toxicology Program (NTP)** list Nickel with Reasonably Anticipated to be a Human Carcinogen; Nickel and compounds pose a respiratory cancer risk, and may give skin itch to dermatitis. Arc Rays can injure eyes and burn skin. Skin cancer has been reported **Information on the likely routes of exposures: Ingestion** is not a likely route of exposure for this product or expected under normal use. If swallowed call physician immediately! Do not induce vomiting unless directed by medical personnel. Rinse mouth with water if person is conscious. Never give fluids or induce vomiting if person is unconscious, having convulsions, or not breathing. **Inhalation** of welding fumes and gases can be dangerous to your health. **Skin/Eye Contact:** Arc Rays can injure eyes and burn skin. Skin cancer has been reported. **IARC-** has classified welding fumes as a possible carcinogenic to humans (Group 2B) **Symptoms related to physical, chemical and toxicological characteristics: Inhalation:** Short-term(acute) overexposure to welding fumes may result in discomfort such as metal fume fever, dizziness, nausea, dryness or irritation of nose, throat, or eyes. Pre-existing respiratory issues may be aggregated. Long-term (chronic) over-exposure to welding fumes can lead to siderosis (iron deposits in lung) and is believed to affect pulmonary function. Manganese and Manganese compounds above safe exposure limits can affect or cause irreversible damage to the central nervous system, including the brain: symptoms may result in impaired speech and movement, lack of energy, stiffness in legs, feet, toes, muscular weakness as well as psychological disturbances. Reports of bronchitis and lung fibrosis have also been noted. **Delayed and immediate effects and also chronic effects from short and long-term exposure:** There are no immediate health hazards associated with the wire or rod form of this product. Skin, respiratory, pancreas, and liver disorders may be aggravated by prolonged over-exposures to the dusts or fumes generated by these products. Pre-existing respiratory issues may be aggregated. Long-term (chronic) over-exposure to welding fumes can lead to siderosis (iron deposits in lung) and is believed to affect pulmonary function. Manganese and Manganese compounds above safe exposure limits can affect or cause irreversible damage to the central nervous system, including the brain: symptoms may result in impaired speech and movement, lack of energy, stiffness in legs, feet, toes, muscular weakness as well as psychological disturbances. Reports of bronchitis and lung fibrosis have also been noted. Treat symptoms and eliminate overexposure.

Other information during use: Inhalation acute toxicity: Carbon dioxide LC Lo (Human, 5 min): 90000 ppm Carbon monoxide LC 50 (Rat, 4 h): 1,300 mg/l Nitrogen dioxide LC 50 (Rat, 4 h): 88 ppm

SECTION XII- TOXICOLOGICAL INFORMATION

Ecotoxicity: Iron = LC50 Channel catfish (Ictalurus punctatus) > 500 mg/l, 96 hours; **Manganese** = EC 50 (Water flea (Daphnia magna), 48 h): 40 mg/l; **Nickel** LC50 Fathead minnows (Pimephales promelas) 2.916 mg/l, 96 hours, **EC50 Water flea** (Daphnia obtusa) 1 mg/l, 48 hours ; **Aluminum (Al)** LC 50 (Grass carp, white amur (Ctenopharyngodon idella) 96 h): 0.21-0.31 mg/l; **Copper** LC50 Fathead minnows (Pimephales promelas) 1.6 mg/l, 96 hours, **EC50 Water flea** (Daphnia obtusa) 0.102 mg/l, 48 hours ; **Specified substance(s):** Nickel Zebra mussel (Dreissana polymorpha), Bioconcentration Factor (BCF): 5,000 – 10,000 (lotic) Bioconcentration factor calculated using dry weight tissue concentration: Copper and/or copper alloys and compounds (as Cu) Blue-green algae (Anacystis nidulans), Bioconcentration Factor (BCF): 36.01 (Static); **Persistence and Degradability / Bioaccumulative Potential / Mobility in Soil:** No data

Other Adverse Effects: Possibly harmful to aquatic life. Do not allow material to be released to the environment without proper governmental permits. No further relevant information available.

SECTION XIII- DISPOSAL CONSIDERATIONS

Disposal Methods: Avoid or minimize generating waste. When possible collect scrap and by-products with proper id for recycling. Waste disposal must be in accordance with appropriate Federal, National, Provincial, State, and local regulations. These products, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority.

SAFETY DATA SHEET (SDS)

MSDS: Magnesium WIRE AND RODS
REVISED 5-2018
SDS Number: 014- MAG


SECTION XIV- TRANSPORT INFORMATION

UN Number / UN Proper shipping name / Transport Hazard class (es)/ Packing group / Marine pollutant / Special Precautions: Not Regulated as Dangerous Good or Not Regulated, No international regulations

SECTION XV- REGULATORY INFORMATION

United States: TSCA INVENTORY STATUS: The components of these products are listed on the TSCA Inventory; **CERCLA REPORTABLE QUANTITY (RQ):** Beryllium, Nickel, Copper, Manganese, Zinc, Manganese = Reportable quantity: Included in the regulation but with no data values. See regulation (40 CFR 302.4). **EPCRA/SARA Title III 313 Toxic Chemicals** The following metallic components are listed as SARA 313 "Toxic Chemicals" and potential subject to annual SARA 313 reporting. See Section III for weight percent. **Ingredient & Disclosure threshold:** Aluminum, Chromium, Copper, Manganese, Vanadium, Zinc all @ 1.0% de minimis concentration; Hexavalent chromium compounds 0.1% de minimis concentration N90; Zinc oxide 1.0% de minimis concentration N982

Superfund Amendments and Reauthorization Act 1986 (SARA): As shipped: Immediate (Acute) In use: Immediate delayed (Delayed)

California Proposition 65:  **WARNING:** This product may expose you to chemicals including [Cobalt (II) Oxide, Titanium dioxide (airborne, unbound particles of respirable size), Chromium (hexavalent compounds), Nickel, Lead and Lead Compounds, Carbon Black, Cadmium, Beryllium and Beryllium Compounds] which are known to the State of California to cause cancer, and [Chromium (hexavalent compounds), Nickel, Lead and Lead Compounds, Cadmium] which are known to the State of California to cause birth defects and/or other reproductive harm. For more information go to <https://www.p65warnings.ca.gov/>. Beryllium and Nickel, is on the California Proposition 65 lists. Hexavalent chromium compounds, Beryllium, Nickel, listed in the following- Carcinogens & Reproductive Toxic Listed Substance, Carcinogenic Substance 2/27/1987, Developmental Toxin 12/19/2008, Female Reproductive Toxin 12/19/2008, Male Reproductive Toxin 12/19/2008

US State Regulations list: See Section III for contents and weight percent

Alaska-Designated Toxic and Hazardous Substances: Aluminum Welding Fumes, Manganese,

California-Permissible Exposure Limits for Chemical Contaminants: Aluminum, Aluminum oxide, Beryllium, Nickel, Manganese, Silicon, Magnesium, Magnesium Oxide, Copper, Iron, Iron oxide, Zinc and Zinc oxide

Florida-Substance List: Aluminum, Manganese,

Illinois-Toxic Substance List: Aluminum, Copper, Manganese, and Silicon.

Kansas-Section 302/313 List: Aluminum, Copper, and Manganese.

Massachusetts-Substance List: Aluminum, Aluminum oxide, Beryllium, Nickel, Copper, Magnesium, Magnesium Oxide, Manganese, Iron oxide, Silicon, Zinc, Zinc oxide

Michigan - Critical Materials Register: Copper.

Minnesota-List of Hazardous Substances: Aluminum Welding Fumes, Beryllium, Nickel, Copper, Manganese, and Silicon.

Missouri-Employer Information/Toxic Substance List: Aluminum, Copper, Manganese, Molybdenum, Silicon,

New Jersey-Right to Know Hazardous Substance List Aluminum, Aluminum oxide, Copper, Iron oxide, Magnesium, Magnesium Oxide, Manganese, Silicon, Beryllium, Nickel, Zinc oxide

North Dakota-List of Hazardous Chemicals, Reportable Quantities: Copper.

Pennsylvania-Hazardous Substance List: Aluminum, Aluminum oxide, Copper, Iron oxide, Iron oxide, Magnesium, Manganese, Silicon, Welding Fume, Zinc oxide Beryllium, Nickel,

Rhode Island-Hazardous Substance List: Aluminum Welding Fumes, Manganese, Silicon, and Zirconium.

Texas-Hazardous Substance List: Manganese,

West Virginia-Hazardous Substance List: Manganese,

Wisconsin-Toxic and Hazardous Substances: Manganese,

SECTION XVI- OTHER INFORMATION

Approval Date:5-29-2018 NEW SDS Number: 014-MAG

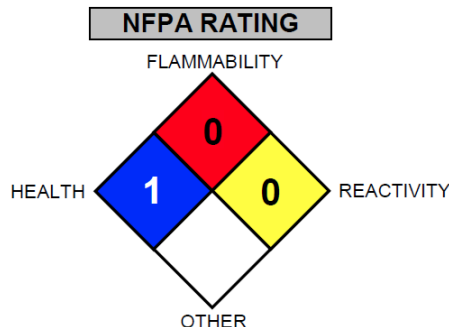
NFPA CODES: FIRE: 0 HEALTH: 1 REACTIVITY: 0

U.S. DOT = Material is not hazardous and is not considered as a dangerous item.

Washington Alloy Co. Believes that the information contained in this (SDS) Safety Data Sheet is accurate. However,

Washington Alloy Co. does not express or implies any warranty with respect to this information.

Download the most current SDS and product information @ www.weldingwire.com



SAFETY DATA SHEET

Creation Date 08-Nov-2010

Revision Date 16-Jan-2019

Revision Number 6

1. Identification

Product Name Fluoranthene

Cat No. : AC119170000; AC119170250; AC119171000; AC119175000

CAS-No 206-44-0
Synonyms Benzo[j,k]fluorene

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)

Acute oral toxicity

Category 4

Label Elements

Signal Word

Warning

Hazard Statements

Harmful if swallowed



Precautionary Statements**Prevention**

Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product

Ingestion

IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell

Rinse mouth

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

3. Composition/Information on Ingredients

| Component | CAS-No | Weight % |
|--------------|----------|----------|
| Fluoranthene | 206-44-0 | >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. If skin irritation persists, call a physician. |
| Inhalation | Move to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur. |
| Ingestion | Clean mouth with water and drink afterwards plenty of water. Get medical attention if symptoms occur. |
| Most important symptoms and effects | None reasonably foreseeable. |
| Notes to Physician | Treat symptomatically |

5. Fire-fighting measures

| | |
|---|--|
| Suitable Extinguishing Media | Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. |
| Unsuitable Extinguishing Media | No information available |
| Flash Point | Not applicable |
| Method - | No information available |
| Autoignition Temperature | No information available |
| 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

Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO₂)

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
2

Flammability
0

Instability
0

Physical hazards
N/A

6. Accidental release measures

Personal Precautions

Ensure adequate ventilation. Use personal protective equipment. Avoid dust formation.

Environmental Precautions

Should not be released into the environment.

Methods for Containment and Clean Up

Sweep up or vacuum up spillage and collect in suitable container for disposal. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling

Ensure adequate ventilation. Wear personal protective equipment. Avoid dust formation. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation.

Storage

Keep in a dry, cool and well-ventilated place. Keep container tightly closed.

8. Exposure controls / personal protection

Exposure Guidelines

This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.

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

Long sleeved clothing.

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

Light green

Odor

Odorless

Odor Threshold

No information available

pH

Not applicable

Melting Point/Range

109 - 111 °C / 228.2 - 231.8 °F

Boiling Point/Range

384 °C / 723.2 °F

Flash Point

Not applicable

Evaporation Rate

No information available

Flammability (solid,gas)

No information available

Flammability or explosive limits

No information available

| | |
|--|--------------------------|
| Upper | No data available |
| Lower | No data available |
| Vapor Pressure | No information available |
| Vapor Density | No information available |
| Specific Gravity | No information available |
| Solubility | insoluble |
| Partition coefficient; n-octanol/water | No data available |
| Autoignition Temperature | No information available |
| Decomposition Temperature | No information available |
| Viscosity | No information available |
| Molecular Formula | C16 H10 |
| Molecular Weight | 202.25 |

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 | Hazardous polymerization does not occur. |
| Hazardous Reactions | None under normal processing. |

11. Toxicological information

Acute Toxicity

| | |
|-----------------------|---|
| Product Information | No acute toxicity information is available for this product |
| Component Information | |

| Component | LD50 Oral | LD50 Dermal | LC50 Inhalation |
|--------------|-----------------------|------------------------------|-----------------|
| Fluoranthene | LD50 = 2 g/kg (Rat) | LD50 = 3180 mg/kg (Rabbit) | Not listed |

| | |
|--------------------------------------|--------------------------|
| 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 |
|--------------|----------|------------|------------|------------|------------|------------|
| Fluoranthene | 206-44-0 | 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. See actual entry in RTECS for complete information.

12. Ecological information

Ecotoxicity

Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

| Component | Freshwater Algae | Freshwater Fish | Microtox | Water Flea |
|--------------|------------------|--|------------|---------------------|
| Fluoranthene | Not listed | Oncorhynchus mykiss: LC50=0.0077 mg/L 96h | Not listed | EC50: 0.78 mg/L 20h |

Persistence and Degradability No information available

Bioaccumulation/ Accumulation No information available.

Mobility .

| Component | log Pow |
|--------------|---------|
| Fluoranthene | 5.1 |

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 |
|-------------------------|------------------------|------------------------|
| Fluoranthene - 206-44-0 | U120 | - |

14. Transport information

DOT

UN-No UN3077
 Proper Shipping Name ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
 Proper technical name Fluoranthene
 Hazard Class 9
 Packing Group III

TDG

UN-No UN3077
 Proper Shipping Name ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
 Hazard Class 9
 Packing Group III

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 SUBSTANCE, SOLID, N.O.S.
 Hazard Class 9
 Packing Group III

15. Regulatory information

All of the components in the product are on the following Inventory lists: The product is classified and labeled according to EC directives or corresponding national laws. The product is classified and labeled in accordance with Directive 1999/45/EC Europe China Canada TSCA Japan X = listed Australia U.S.A. (TSCA) Canada (DSL/NDSL) Europe (EINECS/ELINCS/NLP) Australia (AICS) Korea (ECL) China (IECSC) Japan (ENCS) Philippines (PICCS) Complete Regulatory Information contained in following SDS's

International Inventories

| Component | TSCA | DSL | NDSL | EINECS | ELINCS | NLP | PICCS | ENCS | AICS | IECSC | KECL |
|--------------|------|-----|------|-----------|--------|-----|-------|------|------|-------|------|
| Fluoranthene | X | - | X | 205-912-4 | - | | - | X | X | X | - |

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

| Component | CAS-No | Weight % | SARA 313 - Threshold Values % |
|--------------|----------|----------|-------------------------------|
| Fluoranthene | 206-44-0 | >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 |
|--------------|----------------------------|-----------------------------|------------------------|---------------------------|
| Fluoranthene | - | - | X | 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 |
|--------------|--------------------------|----------------|
| Fluoranthene | 100 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 |
|--------------|---------------|------------|--------------|----------|--------------|
| Fluoranthene | 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 |
|--------------------|--|

| | |
|----------------------|-------------|
| Creation Date | 08-Nov-2010 |
|----------------------|-------------|

| | |
|----------------------|-------------|
| Revision Date | 16-Jan-2019 |
|----------------------|-------------|

| | |
|-------------------|-------------|
| Print Date | 16-Jan-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

Material Safety Data Sheet

Phenanthrene, 98+%

ACC# 96981

Section 1 - Chemical Product and Company Identification

MSDS Name: Phenanthrene, 98+%**Catalog Numbers:** AC130090000, AC130090050, AC130090500, AC130091000, AC130095000**Synonyms:****Company Identification:**

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01**For emergencies in the US, call CHEMTREC:** 800-424-9300

Section 2 - Composition, Information on Ingredients

| CAS# | Chemical Name | Percent | EINECS/ELINCS |
|---------|---------------|---------|---------------|
| 85-01-8 | Phenanthrene | >98.0 | 201-581-5 |

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: brown.

Warning! Harmful if swallowed. May cause allergic skin reaction. May cause eye, skin, and respiratory tract irritation. Cancer suspect agent.**Target Organs:** Skin.

Potential Health Effects

Eye: May cause eye irritation.**Skin:** May cause skin irritation. May be harmful if absorbed through the skin. May cause an allergic reaction in certain individuals.**Ingestion:** Harmful if swallowed. May cause irritation of the digestive tract.**Inhalation:** May be harmful if inhaled. Inhalation of dust may cause respiratory tract irritation.**Chronic:** Limited evidence of a carcinogenic effect.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.**Skin:** Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.**Ingestion:** If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.**Notes to Physician:** Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts at sufficient concentrations can form explosive mixtures with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media: Use water spray or dry chemical.

Flash Point: Not available.

Autoignition Temperature: Not available.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: 2; Flammability: 1; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks: Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation. Do not let this chemical enter the environment.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

| Chemical Name | ACGIH | NIOSH | OSHA - Final PELs |
|---------------|---|---|---|
| Phenanthrene | 0.2 mg/m ³ TWA (as benzene soluble aerosol) (listed under Coal tar pitches). | 0.1 mg/m ³ TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m ³ IDLH (listed under Coal tar pitches). | 0.2 mg/m ³ TWA (benzene soluble fraction) (listed under Coal tar pitches). |

OSHA Vacated PELs: Phenanthrene: No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes: 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: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: 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.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance: brown

Odor: None reported

pH: Not available.

Vapor Pressure: 1 mm Hg @116c

Vapor Density: Not available.

Evaporation Rate: Not available.

Viscosity: Not available.

Boiling Point: 340 deg C

Freezing/Melting Point: 101 deg C

Decomposition Temperature: Not available.

Solubility: insoluble

Specific Gravity/Density: 1.0630g/cm³

Molecular Formula: C₁₄H₁₀

Molecular Weight: 178.23

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: Incompatible materials, dust generation, strong oxidants.

Incompatibilities with Other Materials: Strong oxidizing agents.

Hazardous Decomposition Products: Carbon monoxide, carbon dioxide.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:

CAS# 85-01-8: SF7175000

LD50/LC50:

CAS# 85-01-8:

Oral, mouse: LD50 = 700 mg/kg;

Oral, rat: LD50 = 1.8 gm/kg;

Carcinogenicity:

CAS# 85-01-8:

- **ACGIH:** A1 - Confirmed Human Carcinogen (listed as 'Coal tar pitches').
- **California:** Not listed.
- **NTP:** Known carcinogen (listed as Coal tar pitches).
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

Epidemiology: No information found

Teratogenicity: No information found

Reproductive Effects: No information found

Mutagenicity: No information found

Neurotoxicity: No information found

Other Studies:

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

Section 14 - Transport Information

| | US DOT | Canada TDG |
|-----------------------|---------------------------------------|---------------------------|
| Shipping Name: | Not regulated as a hazardous material | No information available. |
| Hazard Class: | | |
| UN Number: | | |
| Packing Group: | | |

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 85-01-8 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs

CAS# 85-01-8: 5000 lb final RQ; 2270 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 85-01-8: immediate.

Section 313

This material contains Phenanthrene (CAS# 85-01-8, >98.0%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 85-01-8 is listed as a Priority Pollutant under the Clean Water Act.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 85-01-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, (listed as Coal tar pitches), Massachusetts.

California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations**European Labeling in Accordance with EC Directives****Hazard Symbols:**

XN N

Risk Phrases:

R 22 Harmful if swallowed.

R 40 Limited evidence of a carcinogenic effect.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 29 Do not empty into drains.

S 36/37 Wear suitable protective clothing and gloves.

S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger/Protection)

CAS# 85-01-8: No information available.

Canada - DSL/NDSL

CAS# 85-01-8 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2B.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 85-01-8 is listed on the Canadian Ingredient Disclosure List.

| |
|--|
| Section 16 - Additional Information |
|--|

MSDS Creation Date: 7/14/1998

Revision #5 Date: 5/05/2009

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.

The ToxGuide™ is developed to be used as a pocket guide. Tear off at perforation and fold along lines.

Sources of Exposure

Toxicokinetics and Normal Human Levels

Biomarkers/Environmental Levels

ToxGuide™

for

Lead

Pb

CAS# 7439-92-1

October 2007

U.S. Department of Health and
Human Services
Public Health Service
Agency for Toxic Substances
and Disease Registry
www.atsdr.cdc.gov

Contact Information:
Division of Toxicology
and Environmental Medicine
Applied Toxicology Branch

1600 Clifton Road NE, F-32
Atlanta, GA 30333
1-800-CDC-INFO
1-800-232-4636

www.atsdr.cdc.gov/toxoro2.html



General Populations

- The most likely source of exposure is ingestion of contaminated food and drinking water. Exposure can also occur via inadvertent ingestion of contaminated soil/dust or lead-based paint.
- Lead can leach into drinking water from lead-soldered joints or leaded pipes in water distribution systems or individual houses. Lead may also enter foods if they are put into improperly glazed pottery or ceramic dishes.
- Some non-Western folk remedies may contain substantial amounts of lead. Some types of hair dyes and cosmetics may contain lead compounds.
- Other potential sources of exposure are hobbies that use lead: casting ammunition and m fishing weights; soldering with lead solder; making stained glass; using firing ranges. Leaded gasoline is still used in some race cars, airplanes, and off-road vehicles.

Occupational Populations

- Potentially high levels of lead may occur in the following industries: lead smelting and refining industries, battery manufacturing plants, steel welding or cutting operations, construction, rubber products and plastics industries, printing industries, firing ranges, radiator repair shops and other industries requiring flame soldering of lead solder.

Toxicokinetics

- Approximately 95% of deposited inorganic lead that is inhaled is absorbed.
- The extent and rate of gastrointestinal absorption of inorganic lead are influenced by the physiological state of the exposed individual and the species of the lead compound.
- Gastrointestinal absorption of lead is higher in children (40–50%) than in adults (3–10%). The presence of food in the gastrointestinal tract decreases absorption.
- Absorption of lead from soil is less than that of dissolved lead, but is similarly depressed by meals (26% fasted; 2.5% when ingested with a meal).
- In adults, about 94% of the total amount of lead in the body is contained in the bones and teeth versus about 73% in children.
- The elimination half-lives for inorganic lead in blood and bone are approximately 30 days and 27 years, respectively.
- Independent of the route of exposure, absorbed lead is excreted primarily in urine and feces.

Normal Human Levels

- Lead levels in blood (geometric mean, 1999-2002):
 - 1.9 µg/dL for children 1-5 years
 - 1.5 µg/dL for adults 20–59 years
- Lead levels in urine (geometric mean, 2001-2002):
 - 0.677 µg/L for ≥6 years of age

Biomarkers

- Analysis of lead in whole blood is the most common and accurate method of assessing lead exposure. Erythrocyte protoporphyrin (EP) tests can also be used, but are not as sensitive at low blood lead levels (<20 µg/dL). Lead in blood reflects recent exposure.
- Bone lead measurements are an indicator of cumulative exposure.
- Measurements of urinary lead levels and hair have been used to assess lead exposure; however, they are not as reliable.

Environmental Levels

Air

- The concentration of lead in air samples (2002) is <0.05 µg/m³.

Sediment and Soil

- The natural lead content of soil typically ranges from <10 to 30 µg/g. However, lead levels in the top layers of soil vary widely due to deposition and accumulation of atmospheric particulates from anthropogenic sources.

Water

- Levels of lead in surface water and groundwater in the U.S. range between 5 and 30 µg/L.

Reference

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

Chemical and Physical Information

Routes of Exposure

Relevance to Public Health (Health Effects)

Lead is a metal

- Lead is a naturally-occurring bluish-gray metal that is rarely found in its elemental form, but occurs in the Earth's crust primarily as the mineral galena (PbS), and to a lesser extent as anglesite (PbSO₄) and cerussite (PbCO₃).
- Lead is not a particularly abundant element, but its ore deposits are readily accessible and widely distributed throughout the world. Its properties, such as corrosion resistance, density, and low melting point, make it a familiar metal in pipes, solder, weights, and storage batteries.
- Natural lead is a mixture of four stable isotopes, ²⁰⁸Pb (51–53%), ²⁰⁶Pb (23.5–27%), ²⁰⁷Pb (20.5–23%), and ²⁰⁴Pb (1.35–1.5%). Lead isotopes are the stable decay product of three naturally radioactive elements: ²⁰⁵Pb from uranium, ²⁰⁷Pb from actinium, and ²⁰⁸Pb from thorium.

- Inhalation** – Primary route for occupational exposure. Larger particles (>2.5 µm) that are deposited in the ciliated airways (nasopharyngeal and tracheobronchial regions) can be transferred by mucociliary transport into the esophagus and swallowed.
- Oral** – Primary route of exposure for the general population.
- Dermal** – Studies in animals have shown that organic lead is well absorbed through the skin.

Lead in the Environment

- Lead is dispersed throughout the environment primarily as the result of anthropogenic activities. In the air, lead is in the form of particles and is removed by rain or gravitational settling.
- The fate of lead in soil is affected by the adsorption at mineral interfaces, which are dependent upon physical and chemical characteristics of the soil (e.g., pH, soil type, particle size, organic matter content).
- Sources of lead in dust and soil can include lead from weathering and chipping of lead-based paint from buildings, bridges, and other structures.
- The solubility of lead compounds in water is a function of pH, hardness, salinity, and the presence of humic material. Solubility is highest in soft, acidic water.

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

Minimal Risk Levels (MRLs)

- MRLs were not derived for lead because a clear threshold for some of the more sensitive effects in humans has not been identified.
- In lieu of MRLs, ATSDR has developed a framework to guide decisions at lead sites. This approach utilizes site-specific exposure data to estimate internal doses as measured by blood lead levels (PbBs) (see Appendix D in the Toxicological Profile).

Health Effects

Hematological

- Decreased activity of several heme biosynthesis enzymes at PbB <10 µg/dL.

Gastrointestinal

- Colic in children – PbB 60–100 µg/dL.

Cardiovascular

- Elevated blood pressure – PbB <10 µg/dL.

Renal

- Decreased glomerular filtration rate at mean PbB <20 µg/dL.

Neurological

- Encephalopathy – PbB 100–120 µg/dL (adults) 70–100 µg/dL (children).
- Peripheral neuropathy – PbB 40 µg/dL.
- Neurobehavioral and neuropsychological effects in adults – PbB 40–80 µg/dL.
- Cognitive and neurobehavioral effects in children at PbB <10 µg/dL.

Reproductive

- Reduced fertility – PbB >40 µg/dL.

Children's Health

- Children are more vulnerable to the effects of lead than adults.
- The most common source of lead exposure for children is lead-based paint.
- Lead exposures during infancy or childhood may result in anemia, neurological impairment, renal alterations, colic, and impaired metabolism of vitamin D.
- Lead exposures either *in utero*, during infancy, or during childhood may result in delays or impairment of neurological development, neurobehavioral deficits including IQ deficits, low birth weight, and low gestational age, growth retardation, and delayed sexual maturation in girls.
- Ensuring a diet that is nutritionally adequate in calcium and iron may decrease the absorbed dose of lead.

This fact sheet answers the most frequently asked health questions (FAQs) about mercury. 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: Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain, kidneys, and developing fetus. This chemical has been found in at least 714 of 1,467 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is mercury?

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

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

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

What happens to mercury when it enters the environment?

- Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants.
- It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity.
- Methylmercury may be formed in water and soil by small organisms called bacteria.

- Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury.

How might I be exposed to mercury?

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

How can mercury affect my health?

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

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

Mercury

CAS # 7439-97-6

How likely is mercury to cause cancer?

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

How can mercury affect children?

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

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

How can families reduce the risk of exposure to mercury?

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

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

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

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

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

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

Has the federal government made recommendations to protect human health?

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

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

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

References

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

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology 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.

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

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

What is arsenic?

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

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

What happens to arsenic when it enters the environment?

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

How might I be exposed to arsenic?

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

How can arsenic affect my health?

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

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

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

Skin contact with inorganic arsenic may cause redness and swelling.

Almost nothing is known regarding health effects of organic arsenic compounds in humans. Studies in animals show that some simple organic arsenic

Arsenic

CAS # 7440-38-2

compounds are less toxic than inorganic forms. Ingestion of methyl and dimethyl compounds can cause diarrhea and damage to the kidneys.

How likely is arsenic to cause cancer?

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

How can arsenic affect children?

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

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

How can families reduce the risks of exposure to arsenic?

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

- If you work in a job that may expose you to arsenic, be aware that you may carry arsenic home on your clothing, skin, hair, or tools. Be sure to shower and change clothes before going home.

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

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

Has the federal government made recommendations to protect human health?

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

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

References

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

Where can I get more information?

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

Phone: 1-800-232-4636

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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.

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

Polychlorinated Biphenyls

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.

<http://www.epa.gov/pesticides/factsheets/riskassess.htm>

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Pesticides: Topical & Chemical Fact Sheets

You are here: [EPA Home](#) [Pesticides](#) [Fact Sheets](#) [Health and Safety](#) Assessing Health Risks from Pesticides

Assessing Health Risks from Pesticides

Este Web page está disponible [en español](#)

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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.

Questions on Pesticides?

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

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,

$$\text{RISK} = \text{TOXICITY} \times \text{EXPOSURE}.$$

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](#).

[Español \(https://www.atsdr.cdc.gov/es/index.html\)](https://www.atsdr.cdc.gov/es/index.html)

<https://atsdr.cdc.gov>



Substance Priority List

ATSDR’s Substance Priority List

What is the Substance Priority List (SPL)?

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) section 104 (i), as amended by the Superfund Amendments and Reauthorization Act (SARA), requires ATSDR and the EPA to prepare a list, in order of priority, of substances that are most commonly found at facilities on the National Priorities List (NPL) and which are determined to pose the most significant potential threat to human health due to their known or suspected toxicity and potential for human exposure at these NPL sites. CERCLA also requires this list to be revised periodically to reflect additional information on hazardous substances. In CERCLA, it is called the priority list of hazardous substances that will be candidates for toxicological profiles. This substance priority list is revised and published on a 2-year basis, with a yearly informal review and revision. (No list was published in 2009 while ATSDR transitioned to a new agency science database.) Each substance on the list is a candidate to become the subject of a toxicological profile prepared by ATSDR. The listing algorithm prioritizes substances based on frequency of occurrence at NPL sites, toxicity, and potential for human exposure to the substances found at NPL sites.

2017 Substance Priority List

[Click here to view the ATSDR 2017 Substance Priority List](#)

It should be noted that this priority list is not a list of “most toxic” substances, but rather a prioritization of substances based on a combination of their frequency, toxicity, and potential for human exposure at NPL sites.

Thus, it is possible for substances with low toxicity but high NPL frequency of occurrence and exposure to be on this priority list. The objective of this priority list is to rank substances across all NPL hazardous waste sites to provide guidance in selecting which substances will be the subject of toxicological profiles prepared by ATSDR.

Where can I find more information on the Substance Priority List?

Substantial additional information can be found on the [SPL Resource](#) page, including:

- Past Substance Priority Lists
- A Support Document describing the algorithm in detail
- A comprehensive SPL spreadsheet with data for all current and past lists, including candidate substances that did not make the top of the list

The ATSDR 2017 Substance Priority List

[Hide/Show Table](#)

| 2017 Rank | Substance Name | Total Points | CAS RN |
|-----------|----------------------------------|--------------|-------------|
| 1 | ARSENIC | 1674 | 7440-38-2 |
| 2 | LEAD | 1531 | 7439-92-1 |
| 3 | MERCURY | 1458 | 7439-97-6 |
| 4 | VINYL CHLORIDE | 1358 | 75-01-4 |
| 5 | POLYCHLORINATED BIPHENYLS | 1345 | 1336-36-3 |
| 6 | BENZENE | 1329 | 71-43-2 |
| 7 | CADMIUM | 1320 | 7440-43-9 |
| 8 | BENZO(A)PYRENE | 1306 | 50-32-8 |
| 9 | POLYCYCLIC AROMATIC HYDROCARBONS | 1279 | 130498-29-2 |
| 10 | BENZO(B)FLUORANTHENE | 1251 | 205-99-2 |
| 11 | CHLOROFORM | 1203 | 67-66-3 |
| 12 | AROCLOR 1260 | 1191 | 11096-82-5 |
| 13 | DDT, P,P’- | 1183 | 50-29-3 |
| 14 | AROCLOR 1254 | 1172 | 11097-69-1 |
| 15 | DIBENZO(A,H)ANTHRACENE | 1156 | 53-70-3 |
| 16 | TRICHLOROETHYLENE | 1155 | 79-01-6 |
| 17 | CHROMIUM, HEXAVALENT | 1148 | 18540-29-9 |
| 18 | DIELDRIN | 1144 | 60-57-1 |
| 19 | PHOSPHORUS, WHITE | 1141 | 7723-14-0 |
| 20 | HEXACHLOROBUTADIENE | 1130 | 87-68-3 |
| 21 | DDE, P,P’- | 1127 | 72-55-9 |
| 22 | CHLORDANE | 1126 | 57-74-9 |
| 23 | AROCLOR 1242 | 1126 | 53469-21-9 |
| 24 | COAL TAR CREOSOTE | 1124 | 8001-58-9 |
| 25 | ALDRIN | 1116 | 309-00-2 |
| 26 | DDD, P,P’- | 1114 | 72-54-8 |
| 27 | AROCLOR 1248 | 1105 | 12672-29-6 |
| 28 | HEPTACHLOR | 1102 | 76-44-8 |
| 29 | AROCLOR | 1101 | 12767-79-2 |

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|----|-------------------------------|------|------------|
| 30 | BENZIDINE | 1093 | 92-87-5 |
| 31 | ACROLEIN | 1090 | 107-02-8 |
| 32 | TOXAPHENE | 1089 | 8001-35-2 |
| 33 | TETRACHLOROETHYLENE | 1078 | 127-18-4 |
| 34 | HEXACHLOROCYCLOHEXANE, GAMMA- | 1076 | 58-89-9 |
| 35 | CYANIDE | 1071 | 57-12-5 |
| 36 | HEXACHLOROCYCLOHEXANE, BETA- | 1054 | 319-85-7 |
| 37 | DISULFOTON | 1049 | 298-04-4 |
| 38 | BENZO(A)ANTHRACENE | 1047 | 56-55-3 |
| 39 | 1,2-DIBROMOETHANE | 1043 | 106-93-4 |
| 40 | ENDRIN | 1039 | 72-20-8 |
| 41 | DIAZINON | 1038 | 333-41-5 |
| 42 | HEXACHLOROCYCLOHEXANE, DELTA- | 1036 | 319-86-8 |
| 43 | BERYLLIUM | 1031 | 7440-41-7 |
| 44 | ENDOSULFAN | 1029 | 115-29-7 |
| 45 | AROCLOR 1221 | 1028 | 11104-28-2 |
| 46 | 1,2-DIBROMO-3-CHLOROPROPANE | 1027 | 96-12-8 |
| 47 | HEPTACHLOR EPOXIDE | 1022 | 1024-57-3 |
| 48 | ENDOSULFAN, ALPHA | 1019 | 959-98-8 |
| 49 | CIS-CHLORDANE | 1017 | 5103-71-9 |
| 50 | CARBON TETRACHLORIDE | 1014 | 56-23-5 |
| 51 | COBALT | 1013 | 7440-48-4 |
| 52 | AROCLOR 1016 | 1012 | 12674-11-2 |
| 53 | DDT, O,P'- | 1009 | 789-02-6 |
| 54 | PENTACHLOROPHENOL | 1008 | 87-86-5 |
| 55 | METHOXYCHLOR | 1007 | 72-43-5 |
| 56 | ENDOSULFAN SULFATE | 1005 | 1031-07-8 |
| 57 | NICKEL | 996 | 7440-02-0 |
| 58 | DI-N-BUTYL PHTHALATE | 995 | 84-74-2 |
| 59 | ENDRIN KETONE | 993 | 53494-70-5 |

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|----|-------------------------------------|-----|------------|
| 60 | DIBROMOCHLOROPROPANE | 984 | 67708-83-2 |
| 61 | BENZO(K)FLUORANTHENE | 970 | 207-08-9 |
| 62 | TRANS-CHLORDANE | 969 | 5103-74-2 |
| 63 | ENDOSULFAN, BETA | 968 | 33213-65-9 |
| 64 | CHLORPYRIFOS | 965 | 2921-88-2 |
| 65 | XYLENES, TOTAL | 964 | 1330-20-7 |
| 66 | CHROMIUM(VI) TRIOXIDE | 961 | 1333-82-0 |
| 67 | AROCOR 1232 | 959 | 11141-16-5 |
| 68 | ENDRIN ALDEHYDE | 959 | 7421-93-4 |
| 69 | METHANE | 952 | 74-82-8 |
| 70 | 3,3'-DICHLOROBENZIDINE | 942 | 91-94-1 |
| 71 | 2-HEXANONE | 941 | 591-78-6 |
| 72 | 2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN | 941 | 1746-01-6 |
| 73 | BENZOFLUORANTHENE | 937 | 56832-73-6 |
| 74 | TOLUENE | 917 | 108-88-3 |
| 75 | ZINC | 915 | 7440-66-6 |
| 76 | PENTACHLOROBENZENE | 907 | 608-93-5 |
| 77 | DI(2-ETHYLHEXYL)PHTHALATE | 906 | 117-81-7 |
| 78 | CHROMIUM | 895 | 7440-47-3 |
| 79 | AROCOR 1240 | 889 | 71328-89-7 |
| 80 | 2,4,6-TRINITROTOLUENE | 879 | 118-96-7 |
| 81 | NAPHTHALENE | 877 | 91-20-3 |
| 82 | 1,1-DICHLOROETHENE | 876 | 75-35-4 |
| 83 | BROMODICHLOROETHANE | 868 | 683-53-4 |
| 84 | DDD, O,P'- | 867 | 53-19-0 |
| 85 | 2,4,6-TRICHLOROPHENOL | 867 | 88-06-2 |
| 86 | BIS(2-CHLOROETHYL) ETHER | 867 | 111-44-4 |
| 87 | HYDRAZINE | 862 | 302-01-2 |
| 88 | METHYLENE CHLORIDE | 860 | 75-09-2 |
| 89 | 2,4-DINITROPHENOL | 859 | 51-28-5 |

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|-----|------------------------------------|-----|------------|
| 90 | 4,4'-METHYLENEBIS(2-CHLOROANILINE) | 859 | 101-14-4 |
| 91 | 1,2-DICHLOROETHANE | 852 | 107-06-2 |
| 92 | THIOCYANATE | 847 | 302-04-5 |
| 93 | HEXACHLOROBENZENE | 844 | 118-74-1 |
| 94 | ASBESTOS | 841 | 1332-21-4 |
| 95 | RDX (Cyclonite) | 833 | 121-82-4 |
| 96 | RADIUM-226 | 833 | 13982-63-3 |
| 97 | URANIUM | 832 | 7440-61-1 |
| 98 | 2,4-DINITROTOLUENE | 832 | 121-14-2 |
| 99 | ETHION | 831 | 563-12-2 |
| 100 | 4,6-DINITRO-O-CRESOL | 828 | 534-52-1 |
| 101 | RADIUM | 827 | 7440-14-4 |
| 102 | THORIUM | 824 | 7440-29-1 |
| 103 | DIMETHYLARSINIC ACID | 822 | 75-60-5 |
| 104 | CHLORINE | 821 | 7782-50-5 |
| 105 | 1,3,5-TRINITROBENZENE | 820 | 99-35-4 |
| 106 | RADON | 818 | 10043-92-2 |
| 107 | HEXACHLOROCYCLOHEXANE, ALPHA- | 817 | 319-84-6 |
| 108 | RADIUM-228 | 815 | 15262-20-1 |
| 109 | THORIUM-230 | 813 | 14269-63-7 |
| 110 | URANIUM-235 | 812 | 15117-96-1 |
| 111 | THORIUM-228 | 810 | 14274-82-9 |
| 112 | RADON-222 | 810 | 14859-67-7 |
| 113 | URANIUM-234 | 809 | 13966-29-5 |
| 114 | N-NITROSODI-N-PROPYLAMINE | 808 | 621-64-7 |
| 115 | COAL TARS | 808 | 8007-45-2 |
| 116 | METHYLMERCURY | 808 | 22967-92-6 |
| 117 | 1,1,1-TRICHLOROETHANE | 807 | 71-55-6 |
| 118 | COPPER | 807 | 7440-50-8 |
| 119 | CHRYSOTILE ASBESTOS | 806 | 12001-29-5 |

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|-----|------------------------------------|-----|------------|
| 120 | PLUTONIUM-239 | 806 | 15117-48-3 |
| 121 | POLONIUM-210 | 805 | 13981-52-7 |
| 122 | PLUTONIUM-238 | 805 | 13981-16-3 |
| 123 | LEAD-210 | 805 | 14255-04-0 |
| 124 | AMOSITE ASBESTOS | 804 | 12172-73-5 |
| 124 | PLUTONIUM | 804 | 7440-07-5 |
| 124 | STRONTIUM-90 | 804 | 10098-97-2 |
| 127 | RADON-220 | 804 | 22481-48-7 |
| 128 | CHLOROBENZENE | 804 | 108-90-7 |
| 129 | AMERICIUM-241 | 804 | 86954-36-1 |
| 130 | HYDROGEN CYANIDE | 803 | 74-90-8 |
| 131 | AZINPHOS-METHYL | 803 | 86-50-0 |
| 132 | ETHYLBENZENE | 802 | 100-41-4 |
| 133 | CHLORDECONE | 802 | 143-50-0 |
| 134 | BARIUM | 802 | 7440-39-3 |
| 135 | NEPTUNIUM-237 | 802 | 13994-20-2 |
| 136 | PLUTONIUM-240 | 801 | 14119-33-6 |
| 137 | 1,2,3-TRICHLOROBENZENE | 801 | 87-61-6 |
| 138 | FLUORANTHENE | 800 | 206-44-0 |
| 139 | S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE | 799 | 78-48-8 |
| 140 | MANGANESE | 798 | 7439-96-5 |
| 141 | CHRYSENE | 792 | 218-01-9 |
| 142 | 2,4,5-TRICHLOROPHENOL | 792 | 95-95-4 |
| 143 | PERFLUOROOCTANE SULFONIC ACID | 788 | 1763-23-1 |
| 144 | POLYBROMINATED BIPHENYLS | 785 | 67774-32-7 |
| 145 | DICOFOL | 785 | 115-32-2 |
| 146 | SELENIUM | 776 | 7782-49-2 |
| 147 | 1,1,2,2-TETRACHLOROETHANE | 776 | 79-34-5 |
| 148 | PARATHION | 774 | 56-38-2 |
| 149 | HEPTACHLORODIBENZO-P-DIOXIN | 774 | 37871-00-4 |

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| 150 | HEXACHLOROCYCLOHEXANE, TECHNICAL GRADE | 774 | 608-73-1 |
| 151 | TRICHLOROFLUOROETHANE | 773 | 27154-33-2 |
| 152 | BROMINE | 771 | 7726-95-6 |
| 153 | AROCOR 1268 | 765 | 11100-14-4 |
| 154 | 1,3-BUTADIENE | 762 | 106-99-0 |
| 155 | PERFLUOROOCTANOIC ACID | 758 | 335-67-1 |
| 156 | HEPTACHLORODIBENZOFURAN | 756 | 38998-75-3 |
| 157 | TRIFLURALIN | 755 | 1582-09-8 |
| 158 | PERFLUOROHXANESULFONIC ACID | 749 | 355-46-4 |
| 159 | 1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN | 743 | 39001-02-0 |
| 160 | AMMONIA | 742 | 7664-41-7 |
| 161 | 2-METHYLNAPHTHALENE | 727 | 91-57-6 |
| 162 | 2,3,4,7,8-PENTACHLORODIBENZOFURAN | 724 | 57117-31-4 |
| 163 | 1,4-DICHLOROBENZENE | 724 | 106-46-7 |
| 164 | 1,1-DICHLOROETHANE | 721 | 75-34-3 |
| 165 | NALED | 721 | 300-76-5 |
| 166 | 1,1,2-TRICHLOROETHANE | 720 | 79-00-5 |
| 167 | HEXACHLOROCYCLOPENTADIENE | 719 | 77-47-4 |
| 168 | 1,2-DIPHENYLHYDRAZINE | 718 | 122-66-7 |
| 169 | PHORATE | 716 | 298-02-2 |
| 170 | TRICHLOROETHANE | 713 | 25323-89-1 |
| 171 | ACENAPHTHENE | 710 | 83-32-9 |
| 172 | TETRACHLOROBIPHENYL | 710 | 26914-33-0 |
| 173 | PALLADIUM | 706 | 7440-05-3 |
| 174 | OXYCHLORDANE | 705 | 27304-13-8 |
| 175 | CRESOL, PARA- | 704 | 106-44-5 |
| 176 | INDENO(1,2,3-CD)PYRENE | 702 | 193-39-5 |
| 177 | GAMMA-CHLORDENE | 702 | 56641-38-4 |
| 178 | TETRACHLOROPHENOL | 699 | 25167-83-3 |
| 179 | 1,2-DICHLOROBENZENE | 697 | 95-50-1 |

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| 180 | 1,2-DICHLOROETHENE, TRANS- | 691 | 156-60-5 |
| 181 | CHLOROETHANE | 687 | 75-00-3 |
| 182 | P-XYLENE | 687 | 106-42-3 |
| 183 | ALUMINUM | 687 | 7429-90-5 |
| 184 | PHENOL | 686 | 108-95-2 |
| 185 | CARBON MONOXIDE | 684 | 630-08-0 |
| 186 | CARBON DISULFIDE | 682 | 75-15-0 |
| 187 | 2,4-DIMETHYLPHENOL | 680 | 105-67-9 |
| 188 | DIBENZOFURAN | 676 | 132-64-9 |
| 189 | ACETONE | 672 | 67-64-1 |
| 190 | HEXACHLOROETHANE | 671 | 67-72-1 |
| 191 | BUTYL METHYL PHTHALATE | 668 | 34006-76-3 |
| 192 | CHLOROMETHANE | 665 | 74-87-3 |
| 193 | HEXACHLORODIBENZOFURAN | 660 | 55684-94-1 |
| 194 | BUTYL BENZYL PHTHALATE | 658 | 85-68-7 |
| 195 | HYDROGEN SULFIDE | 658 | 7783-06-4 |
| 196 | DICHLORVOS | 656 | 62-73-7 |
| 197 | DIBENZOFURANS, CHLORINATED | 653 | 42934-53-2 |
| 198 | CRESOL, ORTHO- | 653 | 95-48-7 |
| 199 | HEXACHLORODIBENZO-P-DIOXIN | 652 | 34465-46-8 |
| 200 | VANADIUM | 650 | 7440-62-2 |
| 201 | N-NITROSODIMETHYLAMINE | 649 | 62-75-9 |
| 202 | 1,2,4-TRICHLOROBENZENE | 647 | 120-82-1 |
| 203 | PERFLUORONONANOIC ACID | 647 | 375-95-1 |
| 204 | ETHOPROP | 644 | 13194-48-4 |
| 205 | TETRACHLORODIBENZO-P-DIOXIN | 641 | 41903-57-5 |
| 206 | BROMOFORM | 635 | 75-25-2 |
| 207 | PENTACHLORODIBENZOFURAN | 632 | 30402-15-4 |
| 208 | 1,3-DICHLOROBENZENE | 628 | 541-73-1 |
| 209 | PENTACHLORODIBENZO-P-DIOXIN | 626 | 36088-22-9 |

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| 210 | N-NITROSODIPHENYLAMINE | 625 | 86-30-6 |
| 211 | 2,4-DICHLOROPHENOL | 619 | 120-83-2 |
| 212 | 2,3-DIMETHYLNAPHTHALENE | 619 | 581-40-8 |
| 213 | 2,3,7,8-TETRACHLORODIBENZOFURAN | 619 | 51207-31-9 |
| 214 | 1,4-DIOXANE | 617 | 123-91-1 |
| 215 | FLUORINE | 613 | 7782-41-4 |
| 216 | NITRITE | 610 | 14797-65-0 |
| 217 | CESIUM-137 | 610 | 10045-97-3 |
| 217 | CHROMIC ACID | 610 | 7738-94-5 |
| 219 | 2-BUTANONE | 608 | 78-93-3 |
| 220 | 1,2-DICHLOROETHYLENE | 608 | 540-59-0 |
| 221 | POTASSIUM-40 | 608 | 13966-00-2 |
| 222 | DINITROTOLUENE | 607 | 25321-14-6 |
| 223 | NITRATE | 606 | 14797-55-8 |
| 224 | FORMALDEHYDE | 605 | 50-00-0 |
| 225 | SILVER | 605 | 7440-22-4 |
| 226 | COAL TAR PITCH | 605 | 65996-93-2 |
| 227 | THORIUM-227 | 605 | 15623-47-9 |
| 228 | ARSENIC ACID | 604 | 7778-39-4 |
| 229 | ARSENIC TRIOXIDE | 604 | 1327-53-3 |
| 230 | BENZOPYRENE | 603 | 73467-76-2 |
| 231 | CHLORDANE, TECHNICAL | 602 | 12789-03-6 |
| 232 | STROBANE | 602 | 8001-50-1 |
| 233 | 4-AMINOBIPHENYL | 602 | 92-67-1 |
| 233 | PYRETHRUM | 602 | 8003-34-7 |
| 235 | ARSINE | 602 | 7784-42-1 |
| 235 | DIMETHOATE | 602 | 60-51-5 |
| 237 | BIS(CHLOROMETHYL) ETHER | 602 | 542-88-1 |
| 237 | CARBOPHENOTHION | 602 | 786-19-6 |
| 239 | ALPHA-CHLORDENE | 601 | 56534-02-2 |

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| 239 | IODINE-131 | 601 | 10043-66-0 |
| 239 | MERCURIC CHLORIDE | 601 | 7487-94-7 |
| 239 | SODIUM ARSENITE | 601 | 7784-46-5 |
| 239 | URANIUM-233 | 601 | 13968-55-3 |
| 244 | ANTIMONY | 601 | 7440-36-0 |
| 245 | DIBROMOCHLOROMETHANE | 601 | 124-48-1 |
| 246 | CRESOLS | 598 | 1319-77-3 |
| 247 | DICHLOROBENZENE | 596 | 25321-22-6 |
| 248 | 2,4-D | 595 | 94-75-7 |
| 249 | 2-CHLOROPHENOL | 591 | 95-57-8 |
| 250 | BUTYLATE | 591 | 2008-41-5 |
| 251 | DIMETHYL FORMAMIDE | 585 | 68-12-2 |
| 252 | PHENANTHRENE | 585 | 85-01-8 |
| 253 | 4-NITROPHENOL | 580 | 100-02-7 |
| 254 | DIURON | 580 | 330-54-1 |
| 255 | TETRACHLOROETHANE | 577 | 25322-20-7 |
| 256 | DICHLOROETHANE | 568 | 1300-21-6 |
| 257 | ETHYL ETHER | 566 | 60-29-7 |
| 258 | DIMETHYLANILINE | 563 | 121-69-7 |
| 259 | 1,3-DICHLOROPROPENE, CIS- | 561 | 10061-01-5 |
| 260 | PYRENE | 561 | 129-00-0 |
| 261 | 1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN | 559 | 35822-46-9 |
| 262 | PHOSPHINE | 557 | 7803-51-2 |
| 263 | TRICHLOROBENZENE | 556 | 12002-48-1 |
| 264 | 2,6-DINITROTOLUENE | 555 | 606-20-2 |
| 265 | FLUORIDE ION | 550 | 16984-48-8 |
| 266 | PENTAERYTHRITOL TETRANITRATE | 549 | 78-11-5 |
| 267 | 1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN | 549 | 67562-39-4 |
| 268 | 1,3-DICHLOROPROPENE, TRANS- | 548 | 10061-02-6 |
| 269 | ACRYLONITRILE | 544 | 107-13-1 |

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| 270 | BIS(2-ETHYLHEXYL)ADIPATE | 543 | 103-23-1 |
| 271 | CARBAZOLE | 541 | 86-74-8 |
| 272 | 2-CHLOROANILINE | 539 | 95-51-2 |
| 273 | METOLACHLOR | 539 | 51218-45-2 |
| 274 | 1,2-DICHLOROETHENE, CIS- | 539 | 156-59-2 |
| 275 | 1,2,3-TRICHLOROPROPANE | 537 | 96-18-4 |

Substances were assigned the same rank when two (or more) substances received equivalent total point scores.

CAS RN= Chemical Abstracts Service Registry Number

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Contact Information

Further information can be obtained by contacting the ATSDR Information Center at:

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Human Health Sciences
1600 Clifton Road NE, Mailstop F-57
Atlanta, GA 30329
Phone: 1-800-CDC-INFO 888-232-6348 (TTY)
Email: Contact CDC-INFO (<https://www.cdc.gov/cdc-info/requestform.html>).

Page last reviewed: August 10, 2017

APPENDIX 6: PRODUCT CUT SHEETS FOR ENGINEERING CONTROLS



Stego® Wrap 20-Mil Vapor Barrier

STEGO INDUSTRIES, LLC



Vapor Retarders
07 26 00, 03 30 00

1. Product Name

Stego Wrap 20-Mil Vapor Barrier

2. Manufacturer

Stego Industries, LLC
216 Avenida Fabricante, Suite 101
San Clemente, CA 92672
Sales, Technical Assistance
Ph: (877) 464-7834
Fx: (949) 257-4113
www.stegoindustries.com

3. Product Description

USES: Stego Wrap 20-Mil Vapor Barrier is used as a below-slab vapor barrier, and as a protection course for below grade waterproofing applications.

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.

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 six inches and tape using Stego Tape or 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 nationally via building supply distributors. For current cost information, contact your local Stego Wrap distributor or Stego Industries' sales department.

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 and disclaims all liability from any loss or damage. NO WARRANTY, EXPRESS, IMPLIED OR STATUTORY, IS GIVEN AS TO THE MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR OTHERWISE WITH RESPECT TO THE PRODUCTS REFERRED TO. 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' technical assistance department or via the website.

10. Filing Systems

• www.stegoindustries.com



4. Technical Data

TABLE 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 |
| Puncture Resistance | ASTM D1709 – Test Methods 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. |
| Permeance After Conditioning (ASTM E1745 Sections 7.1.2 - 7.1.5) | ASTM E154 Section 8, F 1249 – Permeance after wetting, drying, and soaking ASTM E154 Section 11, F 1249 – Permeance after heat conditioning ASTM E154 Section 12, F 1249 – Permeance after low temperature conditioning ASTM E154 Section 13, F 1249 – Permeance after soil organism exposure | 0.0088 perms 0.0081 perms 0.0084 perms 0.0077 perms |
| Radon Diffusion Coefficient | K124/02/95 | 9.9 x 10 ⁻¹² m ² /second |
| Thickness | | 20 mils |
| Roll Dimensions | | 14 ft. wide x 105 ft. long or 1,470 ft ² |
| Roll Weight | | 140 lbs. |

Note: perm unit = grains/(ft² *hr* in.Hg)

* The material maxed out the testing equipment and did not fail at 3746 grams.





STEGO® TAPE

A STEGO INDUSTRIES, LLC INNOVATION | VAPOR RETARDERS 07 26 00, 03 30 00 | VERSION: DEC 10, 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)

STEGO® TAPE

A STEGO INDUSTRIES, LLC INNOVATION | VAPOR RETARDERS 07 26 00, 03 30 00 | VERSION: DEC10, 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

(877) 464-7834 | www.stegoindustries.com

DATA SHEETS ARE SUBJECT TO CHANGE. FOR MOST CURRENT VERSION, VISIT WWW.STEGOINDUSTRIES.COM

