

Rachel Ataman

From: Paul Matli
Sent: Monday, March 08, 2010 4:02 PM
To: Rachel Ataman
Subject: FW: FW: NYSDEC Spill# 07-00175 _ 920-924 Westchester Ave, Bnx, NY

Rachel - FYI...

From: Ryan Piper [mailto:rmpiper@gw.dec.state.ny.us]
Sent: Monday, March 08, 2010 4:01 PM
To: Paul Matli
Subject: Re: FW: NYSDEC Spill# 07-00175 _ 920-924 Westchester Ave, Bnx, NY

Paul,
The New York State Department of Environmental Conservation has received and reviewed the Proposed Remedial Action Work Plan prepared by Hydro Tech Environmental, Corp. dated Feb. 24, 2010 for the above referenced site. The Department approves the plan. Upon the completion of the RAWP, a detailed report must be submitted to the Department including: site plan, cause of the release, summary of cleanup activities, site observations, contaminated material disposal manifests and a summary of the findings of the subsurface investigation including boring logs, well installation logs, analytical sample results, conclusions and recommendations.
Please contact me with any questions or concerns that may arise throughout the project. Thank you for your attention this matter.

Ryan M. Piper
Engineering Geologist I
Spill Prevention and Response Programs
Division of Environmental Remediation
ph.718.482.4927
f. 718.482.4098
>>> Paul Matli <pmatli@hydrotechenvironmental.com> 3/2/2010 2:49 PM >>>
Ryan –

Attached please find the RAP prepared for the above referenced property. This RAP was prepared to address the remediation of the above spill numbers and following the preliminary acceptance of the Site in the NYC Local Bronwfield Cleanup Program.

A more detailed Remedial Action Work Plan will be prepared for this project to meet the requirement of the L-BCP.

Therefore, I appreciate if you can provide me with you approval of the remedial options to be undertaken during the remediation of this property and whether other remedial options will be needed to satisfy the NYSDEC requirements.

Sincerely,

Paul I. MATLI, Ph.D.

Sr. Project Manager

Hydro Tech Environmental, Corp.

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QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT

The sampling performed during this RI and previous environmental investigations is sufficient to complete a Qualitative Human Health Exposure Assessment (QHHEA). An off-Site QHHEA is included in this section and includes current and future use scenarios. The QHHEA has been prepared in accordance with NYSDEC and NYSDOH guidance (DER-10). Actual or potential human exposures to contaminated Site soil, groundwater, and vapor or dust emissions during and after the development of the Site were considered in the context of a Site Conceptual Exposure Model (SCEM). The SCEM describes potential links between the Site contaminant source(s) and human populations. The SCEM considers potential exposures to contamination present at the site, soil vapors associated with offsite groundwater contamination and potential transport of contamination from the Site to the off-Site environment.

Five elements are considered in the QHHEA in defining exposure pathways. Each element must be present in order for exposure pathways to be considered complete, and thus for a contaminated site to pose a risk to human health or the environment. These elements are discussed separately as follows:

Known and Potential Sources

AOC -1: The presence of VOCs in soil and groundwater at concentrations exceeding regulatory standards. These VOCs are associated with Open NYSDEC Spills **#06-13228** & **#07-00175** and the historical use of the site as a gasoline station.

AOC -2: The presence of contaminated urban fill material.

The soil, groundwater and soil vapors have been impacted from the historic release of gasoline and other petroleum constituents from the former USTs located at Lot 35 of the Site. The soil at the interface with perched groundwater currently contains primarily Ethylbenzene, Xylenes, Isopropylbenzene, n-Propylbenzene, 1,3,5-Trimethylbenzene, 1,2,4-Trimethylbenzene and Naphthalene at concentrations exceeding their respective UUSCO. Fill material impacted with levels of PAHs at concentrations exceeding their respective UUSCO is present in shallow as well as deep soil at Lot 35.

The volatile organic compounds listed below have exceeded their respective UUSCO. These compounds can be attributed to Site conditions, therefore, they were determined to be chemicals-of-interest for this assessment.

Volatile Organic Compounds

ethylbenzene	xylene	isopropylbenzene
1,3,5 - trimethylbenzene	1,2,4-trimethylbenzene	n-propylbenzene
naphthalene		

Nature, Extent, Fate and Transport of Contaminants

The environmental media that currently may serve as pathways for contaminant migration are soil, groundwater, and soil gas.

SOIL CONTAMINATION

Although 366 tons of contaminated soil were disposed of during the closure and removal of gasoline USTs and fuel oil/waste oil UST, residual soil contamination consisting of gasoline constituents is currently located at the interface with perched water on top of bedrock beneath the eastern and southern portions of Lot 35. If left in place, gasoline present in soil beneath the Site would continue to be a source of groundwater and vapor phase contamination. Over time, concentrations of these constituents in the soil will decrease due to this flushing action and other processes including biodegradation. As groundwater passes through soil, gasoline compounds will desorb from the soil and dissolve into groundwater. The gasoline compounds will then be carried over time in groundwater along the prevailing groundwater flow path (beneath the adjacent property to the south-southeast) and serve as a source of soil vapors.

GROUNDWATER PLUME

Based on the RI and past groundwater investigations, groundwater impacts associated with historical uses is present at the Site are to Lot 35. No evidence of off-Site migration of the plume was identified during the groundwater sampling. This plume of dissolved gasoline constituents will be remediated through soil excavation activities and the application of biochemical agents.

A groundwater remedial plan will be discussed in detail in a Remedial Action Work Plan (RAWP).

SOIL VAPORS

Soil vapors are located beneath the site and also off-Site to the east of Rogers Place in and upgradient to the south of Westchester Avenue. The soil vapors beneath Lot 35 and its immediate vicinity may be related to the on-Site groundwater plume. Vapors have the potential to migrate into structures that exhibit negative pressure when compared to the pressure conditions in the subsurface.

Potential Routes of Exposure

The following exposure pathways are considered most applicable to the Site:

- Dermal absorption through direct contact with soil and water;
- Incidental soil ingestion; and,
- Inhalation of airborne volatiles and particulates.

Existence of Human Health Exposure

POTENTIAL EXPOSURE PATHWAYS FOR SOIL

Human exposure to contaminants in Site soils may occur through direct contact or airborne transport during remedial excavation and construction activities. Construction and remedial workers are expected to be exposed to surface and subsurface soils and groundwater. Their greatest exposure to contaminated materials will be during excavation. Therefore, all construction activities related to excavation should be subject to strict health and safety and air monitoring procedures.

There will be no future human exposures to contaminated soils at the Site. All soils will be excavated to below the bedrock and disposed off-Site. The soils which contained exceedances of VOCs will be isolated from the Site through the implementation of a soil vapor mitigation plan.

Therefore, potential surface soil exposure pathways are considered incomplete for future conditions.

As such, potential exposures would only occur during site remediation and construction but not under future use scenarios, thus not impacting future occupants of the Site.

POTENTIAL EXPOSURE PATHWAYS FOR GROUNDWATER

The primary human health concern associated with groundwater contamination is the use of groundwater as a potable water supply. No significant human exposure to contaminated groundwater from the Site is occurring at present nor will it occur in the future because the area is served by a public water supply.

Incidental exposure to the groundwater plume contamination beneath the Site could occur to construction workers during excavation below the perched level and during subsequent construction activities. Exposure would occur via incidental ingestion or dermal contact. Therefore, excavation and construction activities beneath Site will be subject to strict health and safety and air monitoring procedures.

POTENTIAL EXPOSURE PATHWAYS FOR SOIL GAS AND AIR

During future remedial excavation and construction activities at the Site, construction workers could be exposed to airborne contamination (volatile organics or fugitive dust) during construction activities. To protect construction workers from ingestion and inhalation of dust or volatiles, dust monitoring and dust suppression measures should be implemented

based on the procedures outlined in the Site HASP and NYSDEC's TAGM-4031, titled "Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites".

Under future conditions, there will be no potential exposures via transport of fugitive dust or vapors in ambient air because the Site will be covered by buildings, pavement or clean fill. Additionally, a vapor barrier sheeting should be installed around the excavation at the site in

order to prevent future subsurface vapor infiltration into the Site, hence future exposures, from the off-Site portion of the gasoline plume.

Nearby residents (i.e., those living along adjoining sides of the site) may be exposed to either volatile or dust emissions during the construction activities via the inhalation exposure route. As such, continuous air monitoring will be conducted during construction. Measures to suppress either volatile or dust emissions will be also implemented based on the monitoring data.

Residents living at in the buildings located to the south and east of Lot 35 may be impacted upon the low levels of soil gas identified at the Site. An indoor air survey should be conducted in these buildings to determine if the soil gas has impacted upon the indoor air quality. The indoor air quality survey will be conducted with a PID. If levels of organic vapors are detected then indoor air quality should be investigated with a SUMMA Canisters. The potential source of the soil gas will be remediated under a Remedial Action Work Plan (RAWP).

It should be noted that visitors to the site could also be exposed to vapors or fugitive dust released during construction activities. However, their exposures would be occasional (during a visit) and for relatively short periods of time (e.g., one to two hours) so that their overall exposures would be less than the exposures to construction workers and nearby residents.



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HEALTH AND SAFETY PLAN

**920-924 Westchester Avenue
Block 2697; Lots 35 & 38
Bronx, New York**

Prepared For: MJM Construction Services
242-01 Braddock Avenue
Bellerose, New York 11426

Prepared By: Hydro Tech Environmental, Corp.
1111 Fulton Street, 2nd Floor
Brooklyn, New York 11238

HEALTH AND SAFETY PLAN

**920-924 Westchester Avenue
Block 2697; Lots 35 & 38
Bronx, New York**

Hydro Tech Environmental, Corp. has prepared this Investigation Health & Safety Plan on behalf of MJM Construction Services as a part of the Remedial Action Work Plan (RAWP) for the property located at 922-924 Westchester Avenue, (Block 4223, Lots 30 and 36), Bronx, New York.

Should you require any additional information or have any comments regarding the contents of this report, please feel free to contact our office at your convenience.

Very Truly Yours,
Hydro Tech Environmental, Corp.



Paul I Matli
Senior Project Manager



X
Rachel Ataman
Vice President of Technical Services



X
Mark E. Robbins, C.P.G., C.E.I.
Senior Vice President

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1.0 INTRODUCTION

This Health & Safety Plan (HASP) has been prepared by Hydro Tech Environmental, Corp. (Hydro Tech) as a part of the Remedial Action Work Plan (RAWP) for the property located at 920-924 Westchester Avenue (Block 2697; Lots 35 & 38), Bronx, New York . Lot 35 is associated with New York State Department of Environmental Conservation (NYSDEC) Spill **#06-13228** & **#07-00175**. The HASP will conform to applicable regulations, safe work practices and the project's requirements, and addresses those activities associated with the construction of an eight (8)-story mixed use residential and commercial building with a full basement at the Site.

The Hydro Tech 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 HASP can be obtained from the SSO. The content of this HASP 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 HASP 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, Hydro Tech 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 HASP that specifically apply to the activities at the Site will be enacted by authorized personnel of Hydro Tech. 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 HASP 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 Hydro Tech.

2.0 SCOPE OF WORK

This HASP has been prepared as a part of the RAWP to be implemented during the upcoming development of the Site. Prior environmental assessments identified Volatile Organic Compounds (VOCs), Semi-Volatile Organic Compounds (SVOCs) and heavy Metals in the soil beneath Lot 35 at the Site exceeding their respective Unrestricted Use Soil Cleanup Objectives (UUSCOs). VOCs were also indentified in the groundwater beneath Lot 35 at concentrations exceeding NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1.1.

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 soil excavation
- Performance of Dewatering Activities
- Performance of groundwater bioremediation
- Supervision of the installation of a vapor barrier and concrete foundations

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 both the client and the NYCOER.

2.1 Site Description

The Site is approximately 26,030 square feet in area and consists of two irregularly-shaped adjacent parcels defined as Block 2697; Lots 35 and 38. The Site is located on the southern side of Westchester Avenue, to the east of Rogers Place and to the west of Intervale Avenue in Bronx, New York. The Site is currently vacant and does not have any building improvements.

2.2 Soil Excavation

The soil excavation will be coordinated and performed by the property owner. A Hydro Tech geologist will be onsite during all excavation activities to supervise the excavation, document the fieldwork and provide progress report(s).

All soil that is excavated will be visually examined by an HTE Geologist for the presence of visual/olfactory evidence of contamination. Additionally, select soil samples will be screened for the presence of organic vapors utilizing a Photoionization Detector (PID). A PID makes use of the principle of photoionization for the detection and qualitative measurement of organic vapors. A PID does not respond to all compounds similarly, rather, each compound has its own response factor relative to its calibration. For this investigation, the PID will be calibrated to the compound isobutylene, which is published by the manufacturer. The PID has a minimum detection limit of 0.1 parts per million (ppm). This meter measures the hydrocarbon concentrations in isolated portions of the secured samples.

Based upon our previous Site Investigation, Hydro Tech anticipates the presence of non-hazardous soil contamination at Lot 35 of the Site. The soil contamination at Lot 35 is anticipated from the ground surface to bedrock, which is present beneath the Site at an average depth of 9 feet. The soil excavation at the Site will extend below the bedrock, thereby encountering a gasoline plume identified in perched groundwater on top of bedrock in the central portion of Lot 35 as well as groundwater contamination from off-site sources beneath Lot 38. Therefore, interim unsaturated soil will also be excavated beneath Lot 35 and Lot 38 from the level of bedrock (or perched groundwater level) to 15 feet below grade. It is anticipated that the soil excavation will extend throughout the entire perimeter of the property. All contaminated soil will be either direct-loaded or segregated on-site for later disposal at a licensed waste disposal facility. Final volumes for all waste(s) or soil that is disposed will be provided in the form of waste manifests. All waste manifests, transportation tickets and facility recycling/disposal certificates will be provided to the NYCOER as part of a Remedial Closure Report or a Final Engineering Report.

Endpoint soil samples will be obtained from the bottom and sidewalls of the soil excavation. All field sampling will be performed in accordance with DER-10 guidelines. These guidelines mandate sidewall sampling for every thirty (30) feet of each side, and bottom sampling for every nine hundred (900) feet of bottom.

2.3 Dewatering

Discharge of dewatering liquid into the NYC sanitary system is required during the construction phase of the project. Liquids discharged into the New York City sewer system will be addressed through approval by NYCDEP. Discharge of water generated during remedial construction to surface waters (i.e. a local pond, stream or river) is prohibited without a SPDES permit.

2.4 Groundwater Remediation

The proposed remediation of groundwater plume is documented in a separate Groundwater Remedial Action Plan (GRAP), which contains the details and specifications of the proposed groundwater remediation program.

Based upon groundwater sampling data published in the Remedial Investigation Report (RIR) dated February 5th, 2010 by Hydro Tech, *in-situ* bioremediation will be proposed to remediate the petroleum constituents in the groundwater. Oxygen Releasing compounds (ORC) will be injected at the level of perched water beneath the Site to provide a long-term source of oxygen to the aquifer. The oxygen flows within the aquifer, spreads out over time, and will promote the natural biodegradation of the petroleum hydrocarbons. The solution will be injected in a semi-viscous, slurry form.

2.5 Vapor Barrier

The proposed development at the Site includes the construction of an eight (8)-story mixed use residential and commercial building with a full basement. The basement slab/foundation will be constructed at an approximate depth of 13 feet. The depth to water beneath the Site ranges approximately from 7.78 to 10.98 feet below grade. In order to prevent groundwater vapors from impacting the interior air of the proposed building, a vapor barrier consisting of a 46-mil low permeability Preprufe® 300R liner will be installed beneath the basement foundation. The vapor barrier will be installed under the direct oversight of a Hydro Tech Environmental, Corp. (Hydro Tech) Engineer. A vapor barrier design will be submitted to the NYSDEC and NYCOER under separate cover. This design will contain details and specifications for the installation of the Preprufe® 300R liner. The Vapor Barrier Design Specifications will be presented in a separate document.

2.6 Other Considerations

- When necessary, Hydro Tech personnel will take measures to suppress the generation of dust. See Sections 6.0 and 11.0 for further details pertaining to dust mitigation measures.
- Any hazardous materials, PCBs, mercury, lead-based paint (LBP) , etc., identified at the Site will be properly removed, handled/managed, and disposed of in accordance with all applicable Federal, State and Local regulations.
- Two (2) feet of certified clean fill material will be placed at any portion(s) of the property that would remain undeveloped. The fill will be imported from an approved facility/source. Hydro Tech will collect one (1) sample of the fill material for every 250 cubic yards of material. Each sample will be analyzed for Target Compound List (TCL) VOCs, SVOCs, Pesticides/PCBs and Target Analyte List Metals by an ELAP-certified laboratory. Written approval of the fill material will be obtained from the NYCOER prior to its use. The clean fill material shall not contain any construction/demolition material.

- Any excavated soil that is temporarily stockpiled onsite will be placed on and covered with polyethylene sheeting.
- A NYCDEP Sewer Discharge Permit will be obtained prior to any water discharges into the NYC sanitary system during the construction phase of the project.
- Upon NYSDEC approval of the RAP, Monthly Monitoring Reports and Quarterly Status Reports will be prepared and submitted to the NYSDEC over a period of 12 months. A “No Further Action” determination should eventually be issued by the NYSDEC, and the NYSDEC Spill **#06-13228** & **#07-00175** should be closed.
- Upon completion of all NYCOER requested remedial requirements, a P.E. certified Remedial Closure Report or Final Engineering Report will be submitted to the NYCOER. This report will document that all remedial activities have been properly implemented. At a minimum, the report will include all transportation manifests, soil disposal/recycling certificates, proof of importing and grading certified clean fill/top soil for all undeveloped areas as well as all pre-approved soil analytical testing results for the imported fill/top soil. Once the P.E. certified Remedial Closure Report is received/approved by the NYCOER and a Notice of Satisfaction letter or a Certificate of Completion will be forwarded to the NYC Department of Buildings.

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>
Lincoln Medical & Mental Health Center	(718) 993-3860
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
Shaminder Chawla	(212)- 442-3007

Project Management/Health and Safety Personnel

<u>Title</u>	<u>Contact</u>	<u>Phone Number</u>	<u>Cell Phone</u>
Senior Geologist	Rachel Ataman	(631) 462-5866	(631) 457-0032
Site Safety Officer	Paul I. Matli	(718) 636-0800	(631) 241-7264
Project Manager	Paul I. Matli	(718) 636-0800	(631) 241-7165
OER Case Manager	Shaminder Chawla	(212)- 442-3007	

Directions to Lincoln Medical & Mental Health Center (see attached map)

Upon leaving the Site, start going southwest on Westchester Avenue toward Rev. James A Polite Avenue. Turn left onto St. Anns Avenue and after approximately 0.1 miles turn right onto East 149th Street/St. Eugenio Maria de Hostos Boulevard. Arrive at the Hospital after approximately 0.6 miles. **Figure 1** provides directions to hospital.

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 and metals are based on the results of the recent subsurface investigation:

Volatile Organic Compounds:

- Ethylbenzene
- Xylenes
- Isopropylbenzene
- 1,3,5 - trimethylbenzene
- 1,2,4-trimethylbenzene
- n-propylbenzene
- Naphthalene

Semi Volatile Organic Compounds:

- Naphthalene
- Benzo (a) Anthracene
- Chrysene
- Benzo (b) Fluoranthene
- Benzo (k) Fluoranthene
- Benzo (a) Pyrene
- Indeno (1,2,3-cd) Pyrene
- Dibenzo (a,h) Anthracene

Heavy Metals:

- Barium
- Copper
- Cadmium
- Lead
- Nickel
- Magnesium
- Zinc

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
- Dewatering
- Pouring of concrete foundation(s)
- Placement of vapor barrier
- Diluting and injection of ORC slurry

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 utilizing real-time dust-monitoring equipment will be performed. 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. 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 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.

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.

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.

7.0 MEDICAL SURVEILLANCE

GENERAL

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

8.0 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 be the Support Zone (SZ). Appropriate sanitary facilities and safety equipment will be located in SZ. Potentially contaminated personnel or materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples.

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.

Level C – Dust Mask.

Initial Levels of Protection

Levels of protection for the activities may be upgraded or downgraded depending on direct-reading instruments or personnel monitoring. The following are the initial levels of protection that shall be used for each planned field activity.

LEVEL OF PERSONAL PROTECTIVE EQUIPMENT REQUIRED

Level of Protection

Activity	Respiratory/PPE
Excavations	C/D
Foundation Construction & Capping	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

9.0 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 Hydro Tech'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.

10.0 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 Hydro Tech'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

No soil, groundwater or liquid waste sampling is required.

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.

11.0 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

A segregating system of non-hazardous waste and hazardous waste will be developed by the SSO and Project Manager. 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.

12.0 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

13.0 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 Lincoln Medical & Mental Health Center



MAPQUEST.

Trip to Lincoln Medical & Mental Hlth

234 E 149th St, Bronx, NY 10451 - (718) 993-3860

1.63 miles - about 5 minutes

Notes

CHEVROLET MALIBU 33 MPG¹ HWY

A "Best Buy" two years in a row.²
- Consumers Digest

*EPA estimated.
2. Named a Consumers Digest "Best Buy" for 2009 and 2010 model years.

[LEARN MORE](#) →



920 Westchester Ave, Bronx, NY 10459-3108



1. Start out going **SOUTHWEST** on **WESTCHESTER AVE** toward **ROGERS PL.**

go 0.9 mi



2. Turn **LEFT** onto **ST ANNS AVE.**

go 0.1 mi



3. Turn **RIGHT** onto **E 149TH ST / EUGENIO MARIA DE HOSTOS BLVD.**

go 0.6 mi



4. 234 E 149TH ST is on the **LEFT.**

go 0.0 mi

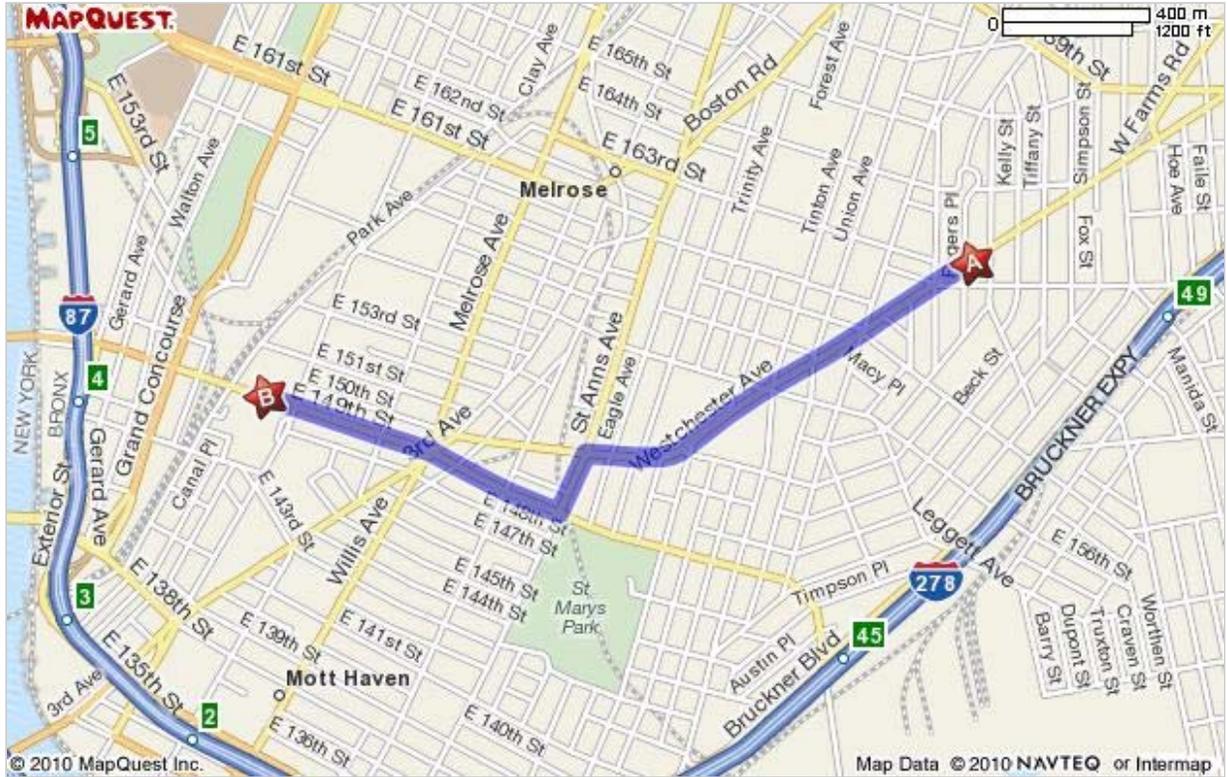


Lincoln Medical & Mental Hlth - (718) 993-3860

234 E 149th St, Bronx, NY 10451

Total Travel Estimate : 1.63 miles - about 5 minutes

Route Map [Hide](#)

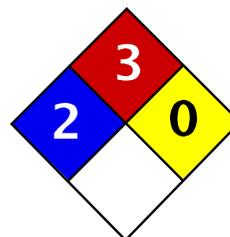


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Appendix A

Material Safety Data Sheets



Health	2
Fire	3
Reactivity	0
Personal Protection	H

Material Safety Data Sheet p-Xylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: p-Xylene

Catalog Codes: SLX1120

CAS#: 106-42-3

RTECS: ZE2625000

TSCA: TSCA 8(b) inventory: p-Xylene

CI#: Not applicable.

Synonym: p-Methyltoluene

Chemical Name: 1,4-Dimethylbenzene

Chemical Formula: C₆H₄(CH₃)₂

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{p-}Xylene	106-42-3	100

Toxicological Data on Ingredients: p-Xylene: ORAL (LD50): Acute: 5000 mg/kg [Rat.]. DERMAL (LD50): Acute: 12400 mg/kg [Rabbit.]. VAPOR (LC50): Acute: 4550 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of skin contact (irritant), of eye contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant).

Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to blood, kidneys, the nervous system, liver.

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:

Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 527°C (980.6°F)

Flash Points: CLOSED CUP: 25°C (77°F). OPEN CUP: 28.9°C (84°F) (Cleveland).

Flammable Limits: LOWER: 1.1% UPPER: 7%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable liquid, insoluble in water.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:

Explosive in the form of vapor when exposed to heat or flame. Vapor may travel considerable distance to source of ignition and flash back. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Toxic flammable liquid, insoluble or very slightly soluble in water.

Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage**Precautions:**

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.

Storage:

Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection**Engineering Controls:**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 100 STEL: 150 (ppm) from ACGIH (TLV)

TWA: 434 STEL: 651 (mg/m³) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 138°C (280.4°F)

Melting Point: 12°C (53.6°F)

Critical Temperature: Not available.

Specific Gravity: 0.86 (Water = 1)

Vapor Pressure: 9 mm of Hg (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.62 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether.

Solubility:

Easily soluble in methanol, diethyl ether.

Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.

Acute oral toxicity (LD50): 5000 mg/kg [Rat].

Acute dermal toxicity (LD50): 12400 mg/kg [Rabbit].

Acute toxicity of the vapor (LC50): 4550 ppm 4 hour(s) [Rat].

Chronic Effects on Humans: The substance is toxic to blood, kidneys, the nervous system, liver.

Other Toxic Effects on Humans:

Very hazardous in case of skin contact (irritant).

Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

0347 Animal: embryotoxic, foetotoxic, passes through the placental barrier.
0900 Detected in maternal milk in human.
Narcotic effect; may cause nervous system disturbances.

Special Remarks on other Toxic Effects on Humans: Material is irritating to mucous membranes and upper respiratory tract.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Xylene : UN1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: p-Xylene

Florida: p-Xylene

Massachusetts RTK: p-Xylene

New Jersey: p-Xylene

TSCA 8(b) inventory: p-Xylene

SARA 313 toxic chemical notification and release reporting: p-Xylene

CERCLA: Hazardous substances.: p-Xylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).

CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R10- Flammable.

R38- Irritating to skin.

R41- Risk of serious damage to eyes.

R48/20- Harmful: danger of serious

damage to health by prolonged exposure through inhalation.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Splash goggles.

Section 16: Other Information

References:

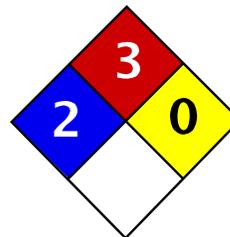
- Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
- Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec.
- SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
- The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
- Guide de la loi et du règlement sur le transport des marchandises dangereuses au Canada. Centre de conformité international Ltée. 1986.

Other Special Considerations: Not available.

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Health	2
Fire	3
Reactivity	0
Personal Protection	J

Material Safety Data Sheet m-Xylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: m-Xylene

Catalog Codes: SLX1066

CAS#: 108-38-3

RTECS: ZE2275000

TSCA: TSCA 8(b) inventory: m-Xylene

CI#: Not applicable.

Synonym: m-Methyltoluene

Chemical Name: 1,3-Dimethylbenzene

Chemical Formula: C₆H₄(CH₃)₂

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{m-}Xylene	108-38-3	100

Toxicological Data on Ingredients: m-Xylene: ORAL (LD50): Acute: 5000 mg/kg [Rat.]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of skin contact (irritant), of eye contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant).

Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to blood, kidneys, the nervous system, liver.

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:

Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 527°C (980.6°F)

Flash Points: CLOSED CUP: 25°C (77°F). OPEN CUP: 28.9°C (84°F) (Cleveland).

Flammable Limits: LOWER: 1.1% UPPER: 7%

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable liquid, insoluble in water.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:

Explosive in the form of vapor when exposed to heat or flame. Vapor may travel considerable distance to source of ignition and flash back. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Flammable liquid, insoluble in water.

Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents.

Storage:

Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection: Splash goggles. Lab coat. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 100 STEL: 150 (ppm) from ACGIH (TLV)

TWA: 434 STEL: 651 (mg/m³) from ACGIH Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 139.3°C (282.7°F)

Melting Point: -47.87°C (-54.2°F)

Critical Temperature: Not available.

Specific Gravity: 0.86 (Water = 1)

Vapor Pressure: 6 mm of Hg (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.62 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether.

Solubility:

Easily soluble in methanol, diethyl ether.

Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact.

Toxicity to Animals:

Acute oral toxicity (LD50): 5000 mg/kg [Rat.].

Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit.].

Chronic Effects on Humans: The substance is toxic to blood, kidneys, the nervous system, liver.

Other Toxic Effects on Humans:

Very hazardous in case of skin contact (irritant).

Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

0347 Animal: embryotoxic, foetotoxic, passes through the placental barrier.

0900 Detected in maternal milk in human.

Narcotic effect; may cause nervous system disturbances.

Special Remarks on other Toxic Effects on Humans: Material is irritating to mucous membranes and upper respiratory tract.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Xylene : UN1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: m-Xylene

Massachusetts RTK: m-Xylene

TSCA 8(b) inventory: m-Xylene

SARA 313 toxic chemical notification and release reporting: m-Xylene

CERCLA: Hazardous substances.: m-Xylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).

CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R10- Flammable.

R38- Irritating to skin.

R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Wear appropriate respirator when ventilation is inadequate.

Splash goggles.

Section 16: Other Information

References:

-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.

-Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec.

-SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.

-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.

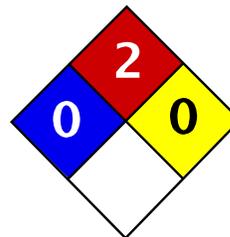
-Guide de la loi et du règlement sur le transport des marchandises dangereuses au Canada. Centre de conformité international Ltée. 1986.

Other Special Considerations: Not available.

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Health	0
Fire	2
Reactivity	0
Personal Protection	H

Material Safety Data Sheet Mesitylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Mesitylene

Catalog Codes: SLM2410

CAS#: 108-67-8

RTECS: OX6825000

TSCA: TSCA 8(b) inventory: Mesitylene

CI#: Not available.

Synonym: 1,3,5-Trimethylbenzene

Chemical Formula: C9H12

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Mesitylene	108-67-8	100

Toxicological Data on Ingredients: Mesitylene: VAPOR (LC50): Acute: 4881.9 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of eye contact (irritant), of ingestion, of inhalation (lung irritant). Slightly hazardous in case of skin contact (irritant, permeator), .

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes,

keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 559°C (1038.2°F)

Flash Points: CLOSED CUP: 43°C (109.4°F).

Flammable Limits: Not available.

Products of Combustion: These products are carbon oxides (CO, CO₂).

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use alcohol foam, water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Flammable liquid.

Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Be careful that the product is not present at a

concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. Avoid contact with eyes. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label.

Storage:

Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 25 CEIL: 35 (ppm)

TWA: 125 CEIL: 170 (mg/m³)

Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Aromatic.

Taste: Not available.

Molecular Weight: 120.2 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: 164.7°C (328.5°F)

Melting Point: -44.8°C (-48.6°F)

Critical Temperature: Not available.

Specific Gravity: 0.8637 (Water = 1)

Vapor Pressure: 1.86 mm of Hg (@ 20°C)

Vapor Density: 4.14 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.23 ppm

Water/Oil Dist. Coeff.: The product is equally soluble in oil and water; $\log(\text{oil/water}) = 0$

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.
Acute toxicity of the vapor (LC50): 4881.9 ppm 4 hour(s) [Rat].

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans:

Hazardous in case of ingestion, of inhalation (lung irritant).
Slightly hazardous in case of skin contact (irritant, permeator), .

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : 1,3,5-Trimethylbenzene : UN2325 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information**Federal and State Regulations:**

Florida: Mesitylene

New Jersey: Mesitylene

TSCA 8(b) inventory: Mesitylene

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:**WHMIS (Canada):**

CLASS B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F).

DSCL (EEC):

R10- Flammable.

R36/37- Irritating to eyes and respiratory system.

HMIS (U.S.A.):

Health Hazard: 0

Fire Hazard: 2

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 0

Flammability: 2

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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International Chemical Safety Cards

BENZO(B)FLUORANTHENE

ICSC: 0720

BENZO(B)FLUORANTHENE Benzo(e)acephenanthrylene 2,3-Benzofluoroanthene $C_{20}H_{12}$ Molecular mass: 252.3 CAS # 205-99-2 RTECS # CU1400000 ICSC # 0720			
TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
• SKIN	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
• EYES		Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION		Do not eat, drink, or smoke during work.	Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Tightly closed.	Unbreakable packaging; put breakable packaging into closed unbreakable container.	
SEE IMPORTANT INFORMATION ON BACK			
ICSC: 0720	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993		

International Chemical Safety Cards

BENZO(B)FLUORANTHENE

ICSC: 0720

I M P O R T A N T D A T A	<p>PHYSICAL STATE; APPEARANCE: COLOURLESS TO YELLOW CRYSTALS.</p> <p>PHYSICAL DANGERS:</p> <p>CHEMICAL DANGERS: Upon heating, toxic fumes are formed.</p> <p>OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established.</p>	<p>ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol and through the skin.</p> <p>INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.</p> <p>EFFECTS OF SHORT-TERM EXPOSURE:</p> <p>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: This substance is possibly carcinogenic to humans.</p>		
PHYSICAL PROPERTIES	Melting point: 168°C Solubility in water: none	Vapour pressure, Pa at 20°C: <10 Octanol/water partition coefficient as log Pow: 6.04		
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats.			
NOTES				
Depending on the degree of exposure, periodic medical examination is indicated. Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.				
ADDITIONAL INFORMATION				
<table border="1" style="width: 100%; height: 20px;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> </table>				
ICSC: 0720		BENZO(B)FLUORANTHENE		
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International Chemical Safety Cards

BENZO(K)FLUORANTHENE

ICSC: 0721

BENZO(K)FLUOROANTHENE 11,12-Benzofluoroanthene Dibenzo(b,j,k)fluorene $C_{20}H_{12}$ Molecular mass: 252.3 CAS # 207-08-9 RTECS # DF6350000 ICSC # 0721			
TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
• INHALATION		Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
• SKIN	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
• EYES		Safety goggles or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION		Do not eat, drink, or smoke during work.	Wear protective gloves when inducing vomiting. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Separated from strong oxidants. Tightly closed.		
SEE IMPORTANT INFORMATION ON BACK			
ICSC: 0721	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities © IPCS CEC 1993		

International Chemical Safety Cards

BENZO(K)FLUORANTHENE

ICSC: 0721

I M P O R T A N T D A T A	<p>PHYSICAL STATE; APPEARANCE: YELLOW CRYSTALS.</p> <p>PHYSICAL DANGERS:</p> <p>CHEMICAL DANGERS: Upon heating, toxic fumes are formed. Reacts with strong oxidants.</p> <p>OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established.</p>	<p>ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation of its aerosol and through the skin.</p> <p>INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.</p> <p>EFFECTS OF SHORT-TERM EXPOSURE:</p> <p>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: This substance is possibly carcinogenic to humans.</p>		
PHYSICAL PROPERTIES	Boiling point: 480°C Melting point: 215.7°C	Solubility in water: none Octanol/water partition coefficient as log Pow: 6.84		
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats.			
NOTES				
Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.				
ADDITIONAL INFORMATION				
<table border="1" style="width: 100%; height: 20px;"> <tr> <td style="width: 50%;"></td> <td style="width: 50%;"></td> </tr> </table>				
ICSC: 0721		BENZO(K)FLUORANTHENE		
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International Chemical Safety Cards

BENZ(a)ANTHRACENE

ICSC: 0385

BENZ(a)ANTHRACENE

1,2-Benzoanthracene

Benzo(a)anthracene

2,3-Benzphenanthrene

Naphthanthracene

C₁₈H₁₂

Molecular mass: 228.3

CAS # 56-55-3

RTECS # CV9275000

ICSC # 0385

EC # 601-033-00-9

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.		Water spray, powder. In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		AVOID ALL CONTACT!	
• INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
• SKIN		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• EYES		Safety goggles, face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• INGESTION		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Well closed.	T symbol R: 45 S: 53-45	

SEE IMPORTANT INFORMATION ON BACK

ICSC: 0385

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International Chemical Safety Cards

BENZ(a)ANTHRACENE

ICSC: 0385

I M P O R T A N T D A T A	<p>PHYSICAL STATE; APPEARANCE: COLOURLESS TO YELLOW-BROWN FLUORESCENT FLAKES OR POWDER.</p> <p>PHYSICAL DANGERS: Dust explosion possible if in powder or granular form, mixed with air.</p> <p>CHEMICAL DANGERS:</p> <p>OCCUPATIONAL EXPOSURE LIMITS (OELs): TLV not established.</p>	<p>ROUTES OF EXPOSURE: The substance can be absorbed into the body by inhalation, through the skin and by ingestion.</p> <p>INHALATION RISK: Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.</p> <p>EFFECTS OF SHORT-TERM EXPOSURE:</p> <p>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE: This substance is probably carcinogenic to humans.</p>
	<p>PHYSICAL PROPERTIES</p>	<p>Sublimation point: 435°C Melting point: 162°C Relative density (water = 1): 1.274</p>
ENVIRONMENTAL DATA	In the food chain important to humans, bioaccumulation takes place, specifically in seafood.	
NOTES		
This substance is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. Tetraphene is a common name.		
ADDITIONAL INFORMATION		
ICSC: 0385		BENZ(a)ANTHRACENE
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**IMPORTANT
LEGAL
NOTICE:**

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Material Safety Data Sheet

Benzo[a]pyrene, 98%

ACC# 37175

Section 1 - Chemical Product and Company Identification

MSDS Name: Benzo[a]pyrene, 98%**Catalog Numbers:** AC105600000, AC105600010, AC105601000, AC377200000, AC377200010, AC377201000 AC377201000**Synonyms:** 3,4-Benzopyrene; 3,4-Benzpyrene; Benzo[def]chrysene.**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
50-32-8	Benzo[a]pyrene	>96	200-028-5

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: yellow to brown powder.

Danger! 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. Cancer hazard. May cause allergic skin reaction. 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: 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.

Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam.

Flash Point: Not available.

Autoignition Temperature: Not available.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) 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

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

Benzo[a]pyrene	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 (as benzene soluble fraction) (listed under Coal tar pitches).
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OSHA Vacated PELs: Benzo[a]pyrene: 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: 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

Appearance: 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

Freezing/Melting Point:175 - 179 deg C

Decomposition Temperature:Not available.

Solubility: 1.60x10⁻³ mg/l @25°C

Specific Gravity/Density:Not available.

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:

Not available.

Carcinogenicity:

CAS# 50-32-8:

- **ACGIH:** A2 - Suspected Human Carcinogen
- **California:** carcinogen, initial date 7/1/87
- **NTP:** Suspect carcinogen
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

Epidemiology: No information found

Teratogenicity: No information found

Reproductive Effects: Adverse reproductive effects have occurred in experimental animals.

Mutagenicity: Mutagenic effects have occurred in humans. Mutagenic effects have occurred in experimental animals.

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:

CAS# 50-32-8: waste number U022.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	NOT REGULATED FOR DOMESTIC TRANSPORT	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOL (Benzo{a} pyrene)
Hazard Class:		9
UN Number:		UN3077
Packing Group:		III

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 50-32-8 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# 50-32-8: 1 lb final RQ; 0.454 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPO.

SARA Codes

CAS # 50-32-8: immediate, delayed.

Section 313

This material contains Benzo[a]pyrene (CAS# 50-32-8, >96%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

CAS# 50-32-8 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# 50-32-8 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 Benzo[a]pyrene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: CAS# 50-32-8: 0.06 æg/day NSRL

European/International Regulations**European Labeling in Accordance with EC Directives****Hazard Symbols:**

T N

Risk Phrases:

R 43 May cause sensitization by skin contact.

R 45 May cause cancer.

R 46 May cause heritable genetic damage.

R 60 May impair fertility.

R 61 May cause harm to the unborn child.

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# 50-32-8: No information available.

Canada - DSL/NDSL

CAS# 50-32-8 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# 50-32-8 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information
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MSDS Creation Date: 9/02/1997

Revision #7 Date: 6/30/2006

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.

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 hands before eating. 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 (as 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:	Not regulated as a hazardous material	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 TPO.

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 æg/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
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MSDS Creation Date: 6/30/1999

Revision #4 Date: 10/03/2005

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.

Material Safety Data Sheet

Fluoranthene, 98%

ACC# 80991

Section 1 - Chemical Product and Company Identification

MSDS Name: Fluoranthene, 98%**Catalog Numbers:** AC119170000, AC119170250, AC119171000, AC119175000**Synonyms:** 1,2-(1,8-Naphthalenediyl)benzene; 1,2-(1,8-Naphthylene)benzene; 1,2-Benzacenaphthene; Benzene, 1,2-(1,8-naphthylene)-; Benzo(j,k)fluorene; Benzo(jk)fluoranthene; Benzo(jk)fluorene**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
206-44-0	Fluoranthene	98	205-912-4

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: yellow needles.

Caution! Harmful. Causes eye and skin irritation and possible burns. May be harmful if absorbed through the skin. May be harmful if swallowed. May cause heart and liver injury.**Target Organs:** Heart, liver, lungs.**Potential Health Effects****Eye:** Causes eye irritation and possible burns.**Skin:** May be harmful if absorbed through the skin. Causes severe skin irritation and possible burns.**Ingestion:** May be harmful if swallowed. May cause rapid heartbeat and cardiac arrhythmias. May cause liver injury, pulmonary edema, and respiratory arrest. May cause gastrointestinal disturbances such as nausea.**Inhalation:** May cause effects similar to those described for ingestion. May produce cardiac failure and pulmonary edema.**Chronic:** Prolonged or repeated skin contact may cause defatting and dermatitis.

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. Do NOT allow victim to rub eyes or keep eyes closed. Extensive irrigation with water is required (at least 30 minutes).

Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Remove contaminated clothing and shoes.

Ingestion: Never give anything by mouth to an unconscious person. Get medical aid immediately. 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: 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.

Extinguishing Media: In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.

Flash Point: Not applicable.

Autoignition Temperature: Not applicable.

Explosion Limits, Lower: Not available.

Upper: Not available.

NFPA Rating: (estimated) 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: 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. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Do not get in eyes, on skin, or on clothing. Do not ingest or inhale. Use only in a chemical fume hood. Do not breathe dust.

Storage: Keep containers tightly closed. 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 adequate ventilation to keep airborne concentrations low.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Fluoranthene	none listed	none listed	none listed

OSHA Vacated PELs: Fluoranthene: 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 and clothing 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: Needles

Appearance: yellow

Odor: None reported.

pH: Not available.

Vapor Pressure: 0.01 mm Hg @ 20 deg C

Vapor Density: Not available.

Evaporation Rate: Not available.

Viscosity: Not available.

Boiling Point: 384 deg C @ 760.00mmHg

Freezing/Melting Point: 107.00 - 110.00 deg C

Decomposition Temperature: Not available.

Solubility: insoluble

Specific Gravity/Density: 1.252 g/cm³

Molecular Formula: C₁₆H₁₀

Molecular Weight: 202.25

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.

Conditions to Avoid: Incompatible materials, strong oxidants.

Incompatibilities with Other Materials: Strong oxidizing agents.

Hazardous Decomposition Products: Carbon monoxide, carbon dioxide, acrid smoke and fumes.

Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#:

CAS# 206-44-0: LL4025000

LD50/LC50:

CAS# 206-44-0:

Oral, rat: LD50 = 2 gm/kg;

Skin, rabbit: LD50 = 3180 mg/kg;

Carcinogenicity:

CAS# 206-44-0: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: IARC Group 3: Limited or insufficient evidence for carcinogenicity in both animals and humans. Experimental tumorigenic data has been reported.

Teratogenicity: No information found

Reproductive Effects: No information found

Mutagenicity: Mutation in microorganisms: Salmonella typhimurium = 5ug/plate. Mutation in mammalian somatic cells: Human Lymphocyte = 2 umol/L.

Neurotoxicity: No information found

Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Fish: Bluegill/Sunfish: 3980 um/L; 96 H; (not specified) No data available.

Environmental: Remains in the upper few cm of soil, but can be transported to groundwater. Biodegrades from soil in a few years. Will not volatilize from soil or water. Rapidly absorbed to sediment and particulates and will readily bioconcentrate. Unadsorbed substance in water will degrade by photolysis in a days to weeks. Stable in sediment for decades or more. In the atmosphere, photodegrades with half life of 4 - 5 days, but may transport long distances without settling or raining out.

Physical: No information available.

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# 206-44-0: waste number U120.

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# 206-44-0 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# 206-44-0: 100 lb final RQ; 45.4 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPO.

SARA Codes

CAS # 206-44-0: immediate.

Section 313

This material contains Fluoranthene (CAS# 206-44-0, 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 depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

CAS# 206-44-0 is listed as a Priority Pollutant under the Clean Water Act. CAS# 206-44-0 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 206-44-0 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, 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

Risk Phrases:

R 21/22 Harmful in contact with skin and if swallowed.

Safety Phrases:

S 22 Do not breathe dust.

S 24/25 Avoid contact with skin and eyes.

WGK (Water Danger/Protection)

CAS# 206-44-0: No information available.

Canada - DSL/NDSL

CAS# 206-44-0 is listed on Canada's NDSL 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# 206-44-0 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information
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MSDS Creation Date: 9/02/1997

Revision #5 Date: 10/03/2005

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.

MSDS Number: **L2347** * * * * * *Effective Date: 08/10/04* * * * * * *Supersedes: 11/02/01*

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

LEAD METAL

1. Product Identification

Synonyms: Granular lead, pigment metal; C.I. 77575

CAS No.: 7439-92-1

Molecular Weight: 207.19

Chemical Formula: Pb

Product Codes:

J.T. Baker: 2256, 2266

Mallinckrodt: 5668

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Lead	7439-92-1	95 - 100%	Yes

3. Hazards Identification

Emergency Overview

POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Life)

Flammability Rating: 0 - None

Reactivity Rating: 0 - None

Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES

Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:

Lead can be absorbed through the respiratory system. Local irritation of bronchia and lungs can occur and, in cases of acute exposure, symptoms such as metallic taste, chest and abdominal pain, and increased lead blood levels may follow. See also Ingestion.

Ingestion:

POISON! The symptoms of lead poisoning include abdominal pain and spasms, nausea, vomiting, headache. Acute poisoning can lead to muscle weakness, "lead line" on the gums, metallic taste, definite loss of appetite, insomnia, dizziness, high lead levels in blood and urine with shock, coma and death in extreme cases.

Skin Contact:

Lead and lead compounds may be absorbed through the skin on prolonged exposure; the symptoms of lead poisoning described for ingestion exposure may occur. Contact over short periods may cause local irritation, redness and pain.

Eye Contact:

Absorption can occur through eye tissues but the more common hazards are local irritation or abrasion.

Chronic Exposure:

Lead is a cumulative poison and exposure even to small amounts can raise the body's content to toxic levels. The symptoms of chronic exposure are like those of ingestion poisoning; restlessness, irritability, visual disturbances, hypertension and gray facial color may also be noted.

Aggravation of Pre-existing Conditions:

Persons with pre-existing kidney, nerve or circulatory disorders or with skin or eye problems may be more susceptible to the effects of this substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Ingestion:

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

Immediately flush skin with plenty of soap and water for at least 15 minutes. Remove contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard. Powder/dust is flammable when heated or exposed to flame.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Can produce toxic lead fumes at elevated temperatures and also react with oxidizing materials.

6. Accidental Release Measures

Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Sweep up and containerize for reclamation or disposal. Vacuuming or wet sweeping may be used to avoid dust dispersal. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from incompatible substances. Areas in which exposure to lead

metal or lead compounds may occur should be identified by signs or appropriate means, and access to the area should be limited to authorized persons. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

For lead, metal and inorganic dusts and fumes, as Pb:

-OSHA Permissible Exposure Limit (PEL): 0.05 mg/m³ (TWA)

For lead, elemental and inorganic compounds, as Pb:

-ACGIH Threshold Limit Value (TLV): 0.05 mg/m³ (TWA), A3 animal carcinogen

ACGIH Biological Exposure Indices (BEI): 30 ug/100ml, notation B (see actual Indices for more information).

For lead, inorganic:

-NIOSH Recommended Exposure Limit (REL): 0.1 mg/m³ (TWA)

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, a half-face high efficiency particulate respirator (NIOSH type N100 filter) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece high efficiency particulate respirator (NIOSH type N100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. If oil particles (e.g. lubricants, cutting fluids, glycerine, etc.) are present, use a NIOSH type R or P filter. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

Other Control Measures:

Eating, drinking, and smoking should not be permitted in areas where solids or liquids containing lead compounds are handled, processed, or stored. See OSHA substance-specific standard for more information on personal protective equipment, engineering and work practice controls, medical surveillance, record keeping, and reporting requirements. (29 CFR 1910.1025).

9. Physical and Chemical Properties

Appearance:

Small, white to blue-gray metallic shot or granules.

Odor:

Odorless.

Solubility:

Insoluble in water.

Density:

11.34

pH:

No information found.

% Volatiles by volume @ 21C (70F):

0

Boiling Point:

1740C (3164F)

Melting Point:

327.5C (622F)

Vapor Density (Air=1):

No information found.

Vapor Pressure (mm Hg):

1.77 @ 1000C (1832F)

Evaporation Rate (BuAc=1):

No information found.

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

Does not decompose but toxic lead or lead oxide fumes may form at elevated temperatures.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Ammonium nitrate, chlorine trifluoride, hydrogen peroxide, sodium azide, zirconium, disodium acetylide, sodium acetylide and oxidants.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Toxicological Data:

Investigated as a tumorigen, mutagen, reproductive effector.

Reproductive Toxicity:

Lead and other smelter emissions are human reproductive hazards. (Chemical Council on

Environmental Quality; Chemical Hazards to Human Reproduction, 1981).

Carcinogenicity:

EPA / IRIS classification: Group B2 - Probable human carcinogen, sufficient animal evidence.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Lead (7439-92-1)	No	No	2B

12. Ecological Information

Environmental Fate:

When released into the soil, this material is not expected to leach into groundwater. This material may bioaccumulate to some extent.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be managed in an appropriate and approved waste facility. Although not a listed RCRA hazardous waste, this material may exhibit one or more characteristics of a hazardous waste and require appropriate analysis to determine specific disposal requirements. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Not regulated.

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----				
Ingredient	TSCA	EC	Japan	Australia
Lead (7439-92-1)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----				
	--Canada--			

Ingredient	Korea	DSL	NDSL	Phil.
Lead (7439-92-1)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----				
Ingredient	-SARA 302-		-----SARA 313-----	
	RQ	TPQ	List	Chemical Catg.
Lead (7439-92-1)	No	No	Yes	No

-----\Federal, State & International Regulations - Part 2\-----			
Ingredient	CERCLA	-RCRA-	-TSCA-
		261.33	8(d)
Lead (7439-92-1)	10	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
 SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
 Reactivity: No (Pure / Solid)

WARNING:

THIS PRODUCT CONTAINS CHEMICALS KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER AND BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: None allocated.

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **1** Reactivity: **0**

Label Hazard Warning:

POISON! DANGER! MAY BE FATAL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. NEUROTOXIN. AFFECTS THE GUM TISSUE, CENTRAL NERVOUS SYSTEM, KIDNEYS, BLOOD AND REPRODUCTIVE SYSTEM. POSSIBLE CANCER HAZARD. MAY CAUSE CANCER BASED ON ANIMAL DATA. Risk of cancer depends on duration and level of exposure.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe dust.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Label First Aid:

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not

breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.

Product Use:

Laboratory Reagent.

Revision Information:

No Changes.

Disclaimer:

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: **M1599** * * * * * *Effective Date: 12/19/05* * * * * * *Supersedes: 08/10/04*

MSDS Material Safety Data Sheet

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-582-2537) for assistance.

MERCURY

1. Product Identification

Synonyms: Quicksilver; hydrargyrum; Liquid Silver

CAS No.: 7439-97-6

Molecular Weight: 200.59

Chemical Formula: Hg

Product Codes:

J.T. Baker: 2564, 2567, 2569

Mallinckrodt: 1278, 1280, 1288

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Mercury	7439-97-6	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

DANGER! CORROSIVE. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. MAY BE FATAL IF SWALLOWED OR INHALED. HARMFUL IF ABSORBED THROUGH SKIN. AFFECTS THE KIDNEYS AND CENTRAL NERVOUS SYSTEM. MAY CAUSE ALLERGIC SKIN REACTION.

SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 4 - Extreme (Life)

Flammability Rating: 0 - None

Reactivity Rating: 1 - Slight

Contact Rating: 3 - Severe (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

Storage Color Code: White (Corrosive)

Potential Health Effects

Inhalation:

Mercury vapor is highly toxic via this route. Causes severe respiratory tract damage. Symptoms include sore throat, coughing, pain, tightness in chest, breathing difficulties, shortness of breath, headache, muscle weakness, anorexia, gastrointestinal disturbance, ringing in the ear, liver changes, fever, bronchitis and pneumonitis. Can be absorbed through inhalation with symptoms similar to ingestion.

Ingestion:

May cause burning of the mouth and pharynx, abdominal pain, vomiting, corrosive ulceration, bloody diarrhea. May be followed by a rapid and weak pulse, shallow breathing, paleness, exhaustion, tremors and collapse. Delayed death may occur from renal failure. Gastrointestinal uptake of mercury is less than 5% but its ability to penetrate tissues presents some hazard. Initial symptoms may be thirst, possible abdominal discomfort.

Skin Contact:

Causes irritation and burns to skin. Symptoms include redness and pain. May cause skin allergy and sensitization. Can be absorbed through the skin with symptoms to parallel ingestion.

Eye Contact:

Causes irritation and burns to eyes. Symptoms include redness, pain, blurred vision; may cause serious and permanent eye damage.

Chronic Exposure:

Chronic exposure through any route can produce central nervous system damage. May cause muscle tremors, personality and behavior changes, memory loss, metallic taste, loosening of the teeth, digestive disorders, skin rashes, brain damage and kidney damage. Can cause skin allergies and accumulate in the body. Repeated skin contact can cause the skin to turn gray in color. A suspected reproductive hazard; may damage the developing fetus and decrease fertility in males and females.

Aggravation of Pre-existing Conditions:

Persons with nervous disorders, or impaired kidney or respiratory function, or a history of allergies or a known sensitization to mercury may be more susceptible to the effects of the substance.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion:

Induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Contact:

Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention immediately. Wash clothing before reuse. Thoroughly clean shoes before reuse.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Not considered to be a fire hazard.

Explosion:

Not considered to be an explosion hazard.

Fire Extinguishing Media:

Use any means suitable for extinguishing surrounding fire. Do not allow water runoff to enter sewers or waterways.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Undergoes hazardous reactions in the presence of heat and sparks or ignition. Smoke may contain toxic mercury or mercuric oxide. Smoke may contain toxic mercury or mercuric oxide.

6. Accidental Release Measures

Ventilate area of leak or spill. Clean-up personnel require protective clothing and respiratory protection from vapor.

Spills: Pick up and place in a suitable container for reclamation or disposal in a method that does not generate misting. Sprinkle area with sulfur or calcium polysulfide to suppress mercury. Do not flush to sewer. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

J. T. Baker CINNASORB® and RESISORB® are recommended for spills of this product.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Do not use or store on porous work surfaces (wood, unsealed concrete, etc.). Follow strict hygiene practices. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

- OSHA Acceptable Ceiling Concentration:

mercury and mercury compounds: 0.1 mg/m³ (TWA), skin

- ACGIH Threshold Limit Value (TLV):

inorganic and metallic mercury, as Hg: 0.025 mg/m³ (TWA) skin, A4 Not classifiable as a human carcinogen.

- ACGIH Biological Exposure Indices:

total inorganic mercury in urine (preshift): 35 ug/g creatinine;

total inorganic mercury in blood (end of shift): 15 ug/l.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded and engineering controls are not feasible, a half-face respirator with a mercury vapor or chlorine gas cartridge may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece respirator with a mercury vapor or chlorine gas cartridge may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator.

WARNING: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

Silver-white, heavy, mobile, liquid metal.

Odor:

Odorless.

Solubility:

Insoluble in water.

Density:

13.55

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

356.7C (675F)

Melting Point:

-38.87C (-38F)

Vapor Density (Air=1):

7.0

Vapor Pressure (mm Hg):

0.0018 @ 25C (77F)

Evaporation Rate (BuAc=1):

4

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage.

Hazardous Decomposition Products:

At high temperatures, vaporizes to form extremely toxic fumes.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Acetylenes, ammonia, ethylene oxide, chlorine dioxide, azides, metal oxides, methyl silane, lithium, rubidium, oxygen, strong oxidants, metal carbonyls.

Conditions to Avoid:

Heat, flames, ignition sources, metal surfaces and incompatibles.

11. Toxicological Information

Toxicological Data:

Investigated as a tumorigen, mutagen, reproductive effector.

Reproductive Toxicity:

All forms of mercury can cross the placenta to the fetus, but most of what is known has

been learned from experimental animals. See Chronic Health Hazards.

Carcinogenicity:

EPA / IRIS classification: Group D1 - Not classifiable as a human carcinogen.

Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Mercury (7439-97-6)	No	No	3

12. Ecological Information

Environmental Fate:

This material has an experimentally-determined bioconcentration factor (BCF) of greater than 100. This material is expected to significantly bioaccumulate.

Environmental Toxicity:

This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are less than 1 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: RQ, MERCURY

Hazard Class: 8

UN/NA: UN2809

Packing Group: III

Information reported for product/size: 1LB

International (Water, I.M.O.)

Proper Shipping Name: MERCURY

Hazard Class: 8

UN/NA: UN2809

Packing Group: III

Information reported for product/size: 1LB

International (Air, I.C.A.O.)

Proper Shipping Name: MERCURY
Hazard Class: 8
UN/NA: UN2809
Packing Group: III
Information reported for product/size: 1LB

15. Regulatory Information

```
-----\Chemical Inventory Status - Part 1\-----
Ingredient                                     TSCA   EC     Japan  Australia
-----
Mercury (7439-97-6)                          Yes   Yes   No     Yes
```

```
-----\Chemical Inventory Status - Part 2\-----
Ingredient                                     Korea  DSL    NDSL   Phil.
-----
Mercury (7439-97-6)                          Yes   Yes   No     Yes
```

```
-----\Federal, State & International Regulations - Part 1\-----
Ingredient                                     -SARA 302-  -SARA 313-
RQ      TPQ      List  Chemical Catg.
-----
Mercury (7439-97-6)                          No     No     Yes    No
```

```
-----\Federal, State & International Regulations - Part 2\-----
Ingredient                                     -RCRA-    -TSCA-
CERCLA  261.33    8(d)
-----
Mercury (7439-97-6)                          1        U151    No
```

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

WARNING:

THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE BIRTH DEFECTS OR OTHER REPRODUCTIVE HARM.

Australian Hazchem Code: 2Z

Poison Schedule: S7

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: **3** Flammability: **0** Reactivity: **0**

Label Hazard Warning:

DANGER! CORROSIVE. CAUSES BURNS TO SKIN, EYES, AND RESPIRATORY TRACT. MAY BE FATAL IF SWALLOWED OR INHALED. HARMFUL IF ABSORBED THROUGH SKIN. AFFECTS THE KIDNEYS AND CENTRAL NERVOUS SYSTEM. MAY CAUSE ALLERGIC SKIN REACTION.

Label Precautions:

Do not get in eyes, on skin, or on clothing.

Do not breathe vapor.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

Label First Aid:

If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases get medical attention immediately.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 3.

Disclaimer:

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Prepared by: Environmental Health & Safety

Phone Number: (314) 654-1600 (U.S.A.)

Material Safety Data Sheet

Phenanthrene, 90%

ACC# 59921

Section 1 - Chemical Product and Company Identification

MSDS Name: Phenanthrene, 90%**Catalog Numbers:** AC130100000, AC130100010, AC130102500**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	90.0	201-581-5

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: brown solid.

Caution! Powdered material may form explosive dust-air mixtures. May cause allergic skin reaction. May cause eye and skin irritation. May cause respiratory tract irritation. Cancer suspect agent.

Target Organs: None.

Potential Health Effects

Eye: May cause eye irritation.**Skin:** May cause skin irritation. May cause photosensitive skin reactions in certain individuals.**Ingestion:** May cause irritation of the digestive tract.**Inhalation:** Inhalation of dust may cause respiratory tract irritation.**Chronic:** No information found.

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.

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: 1; Flammability: 1; 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. 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: Keep container closed when not in use. 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: 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 (as 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 (as benzene soluble aerosol) (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 data available.

Teratogenicity: No data available.

Reproductive Effects: No data available.

Mutagenicity: No data available.

Neurotoxicity: No data available.

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, 90.0%), 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 depletors.

This material does not contain any Class 2 Ozone depletors.

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:**

T

Risk Phrases:

R 45 May cause cancer.

Safety Phrases:

S 24/25 Avoid contact with skin and eyes.

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

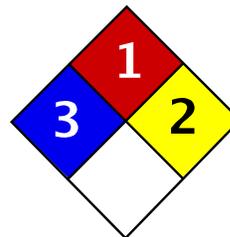
CAS# 85-01-8 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information
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MSDS Creation Date: 7/14/1998

Revision #3 Date: 10/03/2005

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.



Health	3
Fire	1
Reactivity	2
Personal Protection	E

Material Safety Data Sheet Arsenic MSDS

Section 1: Chemical Product and Company Identification

Product Name: Arsenic

Catalog Codes: SLA1006

CAS#: 7440-38-2

RTECS: CG0525000

TSCA: TSCA 8(b) inventory: Arsenic

CI#: Not applicable.

Synonym:

Chemical Name: Arsenic

Chemical Formula: As

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Arsenic	7440-38-2	100

Toxicological Data on Ingredients: Arsenic: ORAL (LD50): Acute: 763 mg/kg [Rat]. 145 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant).

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to kidneys, lungs, the nervous system, mucous membranes.

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks, of heat, of oxidizing materials.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:

Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits highly toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not

present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.01 from ACGIH (TLV) [United States] [1995]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 74.92 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: Not available.

Melting Point: Sublimation temperature: 615°C (1139°F)

Critical Temperature: Not available.

Specific Gravity: 5.72 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 145 mg/kg [Mouse].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH.

Causes damage to the following organs: kidneys, lungs, the nervous system, mucous membranes.

Other Toxic Effects on Humans:

Very hazardous in case of ingestion, of inhalation.

Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Arsenic UNNA: UN1558 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Arsenic

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Arsenic

Pennsylvania RTK: Arsenic

Massachusetts RTK: Arsenic

TSCA 8(b) inventory: Arsenic

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):

CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).

CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R22- Harmful if swallowed.

R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 2

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 1

Reactivity: 2

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Safety glasses.

Section 16: Other Information**References:**

-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.

-Liste des produits purs tératogènes, mutagènes, cancérogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec.

-Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec.

-SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.

-The Sigma-Aldrich Library of Chemical Safety Data, Edition II.

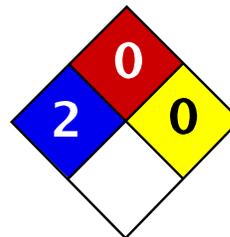
-Guide de la loi et du règlement sur le transport des marchandises dangereuses au Canada. Centre de conformité international Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 04:16 PM

Last Updated: 10/09/2005 04:16 PM

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Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet Nickel metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nickel metal

Catalog Codes: SLN2296, SLN1342, SLN1954

CAS#: 7440-02-0

RTECS: QR5950000

TSCA: TSCA 8(b) inventory: Nickel metal

CI#: Not applicable.

Synonym: Nickel Metal shot; Nickel metal foil.

Chemical Name: Nickel

Chemical Formula: Ni

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
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Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Nickel metal	7440-02-0	100

Toxicological Data on Ingredients: Nickel metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (sensitizer), of ingestion, of inhalation (lung sensitizer).

CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to skin.

The substance may be toxic to kidneys, lungs, liver, upper respiratory tract.

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable solid.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Material in powder form, capable of creating a dust explosion. This material is flammable in powder form only.

Special Remarks on Explosion Hazards:

Material in powder form, capable of creating a dust explosion.

Mixtures containing Potassium Perchlorate with Nickel & Titanium powders & infusorial earth can explode.

Adding 2 or 3 drops of approximately 90% peroxyformic acid to powdered nickel will result in explosion.

Powdered nickel reacts explosively upon contact with fused ammonium nitrate at temperatures below 200 deg. C.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents, combustible materials, metals, acids.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 1 (mg/m³) from ACGIH (TLV) [United States] Inhalation Respirable.

TWA: 0.5 (mg/m³) [United Kingdom (UK)]

TWA: 1 (mg/m³) from OSHA (PEL) [United States] Inhalation Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid. Lustrous solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 58.71 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: 2730°C (4946°F)

Melting Point: 1455°C (2651°F)

Critical Temperature: Not available.

Specific Gravity: Density: 8.908 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Insoluble in cold water, hot water.

Insoluble in Ammonia.

Soluble in dilute Nitric Acid.

Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, combustible materials, metals, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Incompatible with strong acids, selenium, sulfur, wood and other combustibles, nickel nitrate, aluminum, aluminum trichloride, ethylene, p-dioxan, hydrogen, methanol, non-metals, oxidants, sulfur compounds, aniline, hydrogen sulfide, flammable solvents, hydrazine, and metal powders (especially zinc, aluminum, and magnesium), ammonium nitrate, nitryl fluoride, bromine pentafluoride, potassium perchlorate + titanium powder + industrial earth.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available.

LC50: Not available.

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.

Causes damage to the following organs: skin.

May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

Other Toxic Effects on Humans:

Hazardous in case of inhalation.
Slightly hazardous in case of skin contact (irritant, sensitizer), of ingestion.

Special Remarks on Toxicity to Animals:

Lowest Published Lethal Dose/Conc:
LDL [Rat] - Route: Oral; Dose: 5000 mg/kg
LDL [Guinea Pig] - Route: Oral; Dose: 5000 mg/kg

Special Remarks on Chronic Effects on Humans: May cause cancer based on animal test data

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects:
Skin: Nickel dust and fume can irritate skin.
Eyes: Nickel dust and fume can irritate eyes.
Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis.
Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal , and diarrhea. Nickel may damage the kidneys(proteinuria), and may affect liver function. It may also affect behavior (somnia), and cardiovascular system (increased coronary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venus dilation).
Chronic Potential Health Effects:
Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis.
Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count).
Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy. Chronic ingestion of Nickel may also affect respiration and cause pneumoconiosis or fibrosis.
Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Nickel metal

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Nickel metal

Connecticut hazardous material survey.: Nickel metal

Illinois toxic substances disclosure to employee act: Nickel metal

Illinois chemical safety act: Nickel metal

New York release reporting list: Nickel metal

Rhode Island RTK hazardous substances: Nickel metal

Pennsylvania RTK: Nickel metal

Michigan critical material: Nickel metal

Massachusetts RTK: Nickel metal

Massachusetts spill list: Nickel metal

New Jersey: Nickel metal

New Jersey spill list: Nickel metal

Louisiana spill reporting: Nickel metal

California Director's List of Hazardous Substances: Nickel metal

TSCA 8(b) inventory: Nickel metal

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R40- Possible risks of irreversible effects.

R43- May cause sensitization by skin contact.

S22- Do not breathe dust.

S36- Wear suitable protective clothing.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Safety glasses.

Section 16: Other Information

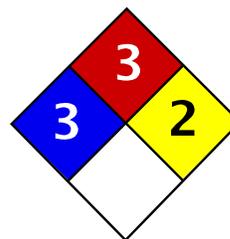
References: Not available.

Other Special Considerations: Not available.

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Health	3
Fire	3
Reactivity	2
Personal Protection	J

Material Safety Data Sheet Calcium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Calcium

Catalog Codes: SLC2782

CAS#: 7440-70-2

RTECS: EV8040000

TSCA: TSCA 8(b) inventory: Calcium

CI#: Not available.

Synonym:

Chemical Formula: Ca

Contact Information:

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Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Calcium	7440-70-2	100

Toxicological Data on Ingredients: Calcium LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Corrosive to eyes and skin. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to lungs, mucous membranes.

Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:

If the chemical got onto the clothed portion of the body, remove the contaminated clothes as quickly as possible, protecting your own hands and body. Place the victim under a deluge shower. If the chemical got on the victim's exposed skin, such as the hands : Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable solid.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray or fog.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Corrosive solid. Flammable solid that, in contact with water, emits flammable gases. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal.

Section 7: Handling and Storage**Precautions:**

Keep under inert atmosphere. Keep container dry. Do not breathe dust. Never add water to this product. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Avoid contact with skin and eyes. Keep away from incompatibles such as acids, moisture.

Storage:

Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

Section 8: Exposure Controls/Personal Protection**Engineering Controls:**

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 40.08 g/mole

Color: Not available.

pH (1% soln/water): Not available.

Boiling Point: 1484°C (2703.2°F)

Melting Point: 839°C (1542.2°F)

Critical Temperature: Not available.

Specific Gravity: 1.54 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Not available.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances:

Highly reactive with acids.

Reactive with moisture.

The product reacts violently with water to emit flammable but non toxic gases.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available.

LC50: Not available.

Chronic Effects on Humans: The substance is toxic to lungs, mucous membranes.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 4.3: Material that emits flammable gases on contact with water.

Identification: : Calcium : UN1401 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: Calcium

Massachusetts RTK: Calcium

TSCA 8(b) inventory: Calcium

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):

CLASS B-6: Reactive and very flammable material.

CLASS E: Corrosive solid.

DSCL (EEC): R36/38- Irritating to eyes and skin.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 3

Reactivity: 2

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 3

Reactivity: 2

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Splash goggles.

Section 16: Other Information

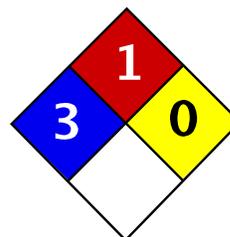
References: Not available.

Other Special Considerations: Not available.

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Health	3
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet Cadmium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Cadmium

Catalog Codes: SLC3484, SLC5272, SLC2482

CAS#: 7440-43-9

RTECS: EU9800000

TSCA: TSCA 8(b) inventory: Cadmium

CI#: Not applicable.

Synonym:

Chemical Name: Cadmium

Chemical Formula: Cd

Contact Information:

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Houston, Texas 77396

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Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Cadmium	7440-43-9	100

Toxicological Data on Ingredients: Cadmium: ORAL (LD50): Acute: 2330 mg/kg [Rat.]. 890 mg/kg [Mouse]. DUST (LC50): Acute: 50 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant). Severe over-exposure can result in death.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to kidneys, lungs, liver.

Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact: No known effect on eye contact, rinse with water for a few minutes.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 570°C (1058°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:

Non-flammable in presence of open flames and sparks, of heat, of oxidizing materials, of reducing materials, of combustible materials, of moisture.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:

Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Highly toxic or infectious materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.01 (ppm)

Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 112.4 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: 765°C (1409°F)

Melting Point: 320.9°C (609.6°F)

Critical Temperature: Not available.

Specific Gravity: 8.64 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity: Reacts violently with potassium.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE.

Acute oral toxicity (LD50): 890 mg/kg [Mouse].

Acute toxicity of the dust (LC50): 229.9 mg/m³ 4 hour(s) [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP.

The substance is toxic to kidneys, lungs, liver.

Other Toxic Effects on Humans:

Hazardous in case of ingestion, of inhalation.

Slightly hazardous in case of skin contact (irritant, sensitizer).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: An allergen. 0047 Animal: embryotoxic, passes through the placental barrier.

Special Remarks on other Toxic Effects on Humans: May cause allergic reactions, exzema and/or dehydration of the skin.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification:

Identification:

Special Provisions for Transport:

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute:

Cadmium

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Cadmium

Pennsylvania RTK: Cadmium

Massachusetts RTK: Cadmium

TSCA 8(b) inventory: Cadmium

SARA 313 toxic chemical notification and release reporting: Cadmium

CERCLA: Hazardous substances.: Cadmium

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):

CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC).

CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R26- Very toxic by inhalation.

R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.

Safety glasses.

Section 16: Other Information

References:

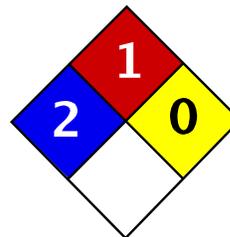
- Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
- Liste des produits purs tératogènes, mutagènes, cancérogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec.
- Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec.
- SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984.
- The Sigma-Aldrich Library of Chemical Safety Data, Edition II.
- Guide de la loi et du règlement sur le transport des marchandises dangereuses au Canada. Centre de conformité international Ltée. 1986.

Other Special Considerations: Not available.

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Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet Copper MSDS

Section 1: Chemical Product and Company Identification

Product Name: Copper

Catalog Codes: SLC4939, SLC2152, SLC3943, SLC1150, SLC2941, SLC4729, SLC1936, SLC3727, SLC5515

CAS#: 7440-50-8

RTECS: GL5325000

TSCA: TSCA 8(b) inventory: Copper

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: Cu

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Copper	7440-50-8	100

Toxicological Data on Ingredients: Copper LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of ingestion. Hazardous in case of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (irritant).

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to lungs, mucous membranes.

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:

Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not breathe dust. Avoid contact with eyes. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible.

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self-contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 1 (mg/m³) from ACGIH [1990]
Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 63.54 g/mole

Color: Not available.

pH (1% soln/water): Not applicable.

Boiling Point: 2595°C (4703°F)

Melting Point: 1083°C (1981.4°F)

Critical Temperature: Not available.

Specific Gravity: 8.94 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available.

LC50: Not available.

Chronic Effects on Humans: The substance is toxic to lungs, mucous membranes.

Other Toxic Effects on Humans:

Very hazardous in case of ingestion.

Hazardous in case of inhalation.

Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Human: passes through the placenta, excreted in maternal milk.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: Copper

Massachusetts RTK: Copper

TSCA 8(b) inventory: Copper

CERCLA: Hazardous substances.: Copper

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC): R36- Irritating to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.

Lab coat.

Dust respirator. Be sure to use an

approved/certified respirator or

equivalent. Wear appropriate respirator

when ventilation is inadequate.
Splash goggles.

Section 16: Other Information

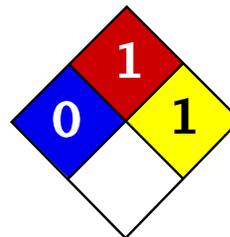
References: Not available.

Other Special Considerations: Not available.

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Health	1
Fire	3
Reactivity	2
Personal Protection	E

Material Safety Data Sheet Magnesium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Magnesium

Catalog Codes: SLM4408, SLM2263, SLM3637

CAS#: 7439-95-4

RTECS: OM2100000

TSCA: TSCA 8(b) inventory: Magnesium

CI#: Not applicable.

Synonym: Magnesium ribbons, turnings or sticks

Chemical Name: Magnesium

Chemical Formula: Mg

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Magnesium	7439-95-4	100

Toxicological Data on Ingredients: Magnesium LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at

least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:

Highly flammable in presence of open flames and sparks, of heat.

Flammable in presence of acids, of moisture.

Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Explosive in presence of acids, of moisture.

Fire Fighting Media and Instructions:

Flammable solid.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:

Magnesium turnings, chips or granules, ribbons, are flammable. They can be easily ignited. They may reignite after fire is extinguished. Produces flammable gases on contact with water and acid. May ignite on contact with water or moist air.

Magnesium fires do not flare up violently unless moisture is present.

Special Remarks on Explosion Hazards: Reacts with acids and water to form hydrogen gas with is highly flammable and explosive

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Flammable solid.

Stop leak if without risk. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage:

Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Moisture sensitive. Dangerous when wet.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 24.31 g/mole

Color: Silver-white

pH (1% soln/water): Not applicable.

Boiling Point: 1100°C (2012°F)

Melting Point: 651°C (1203.8°F)

Critical Temperature: Not available.

Specific Gravity: 1.74 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Very slightly soluble in hot water.

Insoluble in cold water.

Insoluble in chromium trioxides, and mineral acids, alkalis.

Slightly soluble with decomposition in hot water.

Soluble in concentrated hydrogen fluoride, and ammonium salts.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, incompatible materials, water or moisture, moist air.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Violent chemical reaction with oxidizing agents.

Reacts with water to create hydrogen gas and heat. Must be kept dry.

Reacts with acids to form hydrogen gas which is highly flammable and explosive.

Magnesium forms hazardous or explosive mixtures with aluminum and potassium perchlorate; ammonium nitrate; barium nitrate, barium dioxide and zinc; beryllium oxide; boron phosphodiiodide; bromobenzyl trifluoride; cadmium cyanide; cadmium oxide; calcium carbide; carbonates; carbon tetrachloride; chlorine; chlorine trifluoride; chloroform; cobalt cyanide; copper cyanide; copper sulfate(anhydrous), ammonium nitrate, potassium chlorate and water; cupric oxide; cupric sulfate; fluorine; gold cyanide; hydrogen and calcium carbonate; hydrogen iodide; hydrogen peroxide; iodine; lead cyanide; mercuric oxide; mercury cyanide; methyl chloride; molybdenum trioxide; nickel cyanide; nitric acid; nitrogen dioxide; oxygen (liquid); performic acid; phosphates; potassium chlorate; potassium perchlorate; silver nitrate; silver oxide; sodium perchlorate; sodium peroxide; sodium peroxide and carbon dioxide; stannic oxide; sulfates; trichloroethylene; zinc cyanide; zinc oxide.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available.

LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects:

Skin: May cause skin irritation by mechanical action. May get mechanical injury or embedding of chips/particles in skin. The particles that are embedded in the wounds may retard healing.

Eyes: May cause eye irritation by mechanical action. Mechanical injury may occur. Particles or chips may embed in eye and retard healing.

Inhalation: Low hazard for usual industrial handling. It may cause respiratory tract irritation. However, it is unlikely due to physical form. When Magnesium metal is heated during welding or smelting process, Metal Fume Fever may result from inhalation of magnesium fumes. Metal Fume Fever is a flu-like condition consisting of fever, chills, sweating, aches, pains, cough, weakness, headache, nausea, vomiting, and breathing difficulty. Other symptoms may include metallic taste, increased white blood cell count. There is no permanent ill-effect.

Ingestion: Low hazard for usual industrial handling. There are no known reports of serious industrial poisonings with Magnesium. Ingestion of large amounts of chips, turnings or ribbons may cause gastrointestinal tract irritation with nausea, vomiting, and diarrhea. Acute ingestion may also result in Hypermagnesia.

Hypermagnesia may cause hypotension, bradycardia, CNS depression, respiratory depression, and impairment of neuromuscular transmission (hyporeflexia, paralysis).

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 4.1: Flammable solid.

Identification: : Magnesium UNNA: 1869 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Connecticut hazardous material survey.: Magnesium

Rhode Island RTK hazardous substances: Magnesium

Pennsylvania RTK: Magnesium

Massachusetts RTK: Magnesium
Massachusetts spill list: Magnesium
New Jersey: Magnesium
TSCA 8(b) inventory: Magnesium

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).
EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS B-4: Flammable solid.
CLASS B-6: Reactive and very flammable material.

DSCL (EEC):

R11- Highly flammable.
R15- Contact with water liberates extremely flammable gases.
S7/8- Keep container tightly closed and dry.
S43- In case of fire, use dry chemical. Never use water.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 3

Reactivity: 2

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 0

Flammability: 1

Reactivity: 1

Specific hazard:

Protective Equipment:

Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

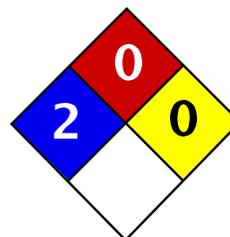
References: Not available.

Other Special Considerations: Not available.

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Health	2
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet Nickel metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Nickel metal

Catalog Codes: SLN2296, SLN1342, SLN1954

CAS#: 7440-02-0

RTECS: QR5950000

TSCA: TSCA 8(b) inventory: Nickel metal

CI#: Not applicable.

Synonym: Nickel Metal shot; Nickel metal foil.

Chemical Name: Nickel

Chemical Formula: Ni

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Nickel metal	7440-02-0	100

Toxicological Data on Ingredients: Nickel metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant), of ingestion.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (sensitizer), of ingestion, of inhalation (lung sensitizer).

CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to skin.

The substance may be toxic to kidneys, lungs, liver, upper respiratory tract.

Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable solid.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Material in powder form, capable of creating a dust explosion. This material is flammable in powder form only.

Special Remarks on Explosion Hazards:

Material in powder form, capable of creating a dust explosion.

Mixtures containing Potassium Perchlorate with Nickel & Titanium powders & infusorial earth can explode.

Adding 2 or 3 drops of approximately 90% peroxyformic acid to powdered nickel will result in explosion.

Powdered nickel reacts explosively upon contact with fused ammonium nitrate at temperatures below 200 deg. C.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Keep away from incompatibles such as oxidizing agents, combustible materials, metals, acids.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 1 (mg/m³) from ACGIH (TLV) [United States] Inhalation Respirable.

TWA: 0.5 (mg/m³) [United Kingdom (UK)]

TWA: 1 (mg/m³) from OSHA (PEL) [United States] Inhalation Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid. Lustrous solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 58.71 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: 2730°C (4946°F)

Melting Point: 1455°C (2651°F)

Critical Temperature: Not available.

Specific Gravity: Density: 8.908 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Insoluble in cold water, hot water.

Insoluble in Ammonia.

Soluble in dilute Nitric Acid.

Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, combustible materials, metals, acids.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Incompatible with strong acids, selenium, sulfur, wood and other combustibles, nickel nitrate, aluminum, aluminum trichloride, ethylene, p-dioxan, hydrogen, methanol, non-metals, oxidants, sulfur compounds, aniline, hydrogen sulfide, flammable solvents, hydrazine, and metal powders (especially zinc, aluminum, and magnesium), ammonium nitrate, nitryl fluoride, bromine pentafluoride, potassium perchlorate + titanium powder + industrial earth.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available.

LC50: Not available.

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP.

Causes damage to the following organs: skin.

May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

Other Toxic Effects on Humans:

Hazardous in case of inhalation.
Slightly hazardous in case of skin contact (irritant, sensitizer), of ingestion.

Special Remarks on Toxicity to Animals:

Lowest Published Lethal Dose/Conc:
LDL [Rat] - Route: Oral; Dose: 5000 mg/kg
LDL [Guinea Pig] - Route: Oral; Dose: 5000 mg/kg

Special Remarks on Chronic Effects on Humans: May cause cancer based on animal test data

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects:
Skin: Nickel dust and fume can irritate skin.
Eyes: Nickel dust and fume can irritate eyes.
Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis.
Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal , and diarrhea. Nickel may damage the kidneys(proteinuria), and may affect liver function. It may also affect behavior (somnia), and cardiovascular system (increased coronary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venus dilation).
Chronic Potential Health Effects:
Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis.
Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count).
Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy. Chronic ingestion of Nickel may also affect respiration and cause pneumoconiosis or fibrosis.
Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Nickel metal

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Nickel metal

Connecticut hazardous material survey.: Nickel metal

Illinois toxic substances disclosure to employee act: Nickel metal

Illinois chemical safety act: Nickel metal

New York release reporting list: Nickel metal

Rhode Island RTK hazardous substances: Nickel metal

Pennsylvania RTK: Nickel metal

Michigan critical material: Nickel metal

Massachusetts RTK: Nickel metal

Massachusetts spill list: Nickel metal

New Jersey: Nickel metal

New Jersey spill list: Nickel metal

Louisiana spill reporting: Nickel metal

California Director's List of Hazardous Substances: Nickel metal

TSCA 8(b) inventory: Nickel metal

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R40- Possible risks of irreversible effects.

R43- May cause sensitization by skin contact.

S22- Do not breathe dust.

S36- Wear suitable protective clothing.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate.
Safety glasses.

Section 16: Other Information

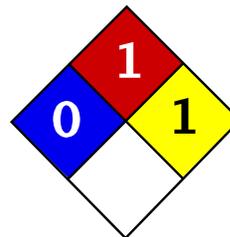
References: Not available.

Other Special Considerations: Not available.

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Health	1
Fire	1
Reactivity	1
Personal Protection	E

Material Safety Data Sheet Zinc Metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Zinc Metal

Catalog Codes: SLZ1054, SLZ1159, SLZ1267, SLZ1099, SLZ1204

CAS#: 7440-66-6

RTECS: ZG8600000

TSCA: TSCA 8(b) inventory: Zinc Metal

CI#: Not applicable.

Synonym: Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips

Chemical Name: Zinc Metal

Chemical Formula: Zn

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Zinc Metal	7440-66-6	100

Toxicological Data on Ingredients: Zinc Metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances:

Slightly flammable to flammable in presence of open flames and sparks, of heat, of oxidizing materials, of acids, of alkalis, of moisture.

Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available.

Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable solid.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:

Zinc + NaOH causes ignition.

Oxidation of zinc by potassium proceeds with incandescence.

Residues from zinc dust /acetic acid reduction operations may ignite after long delay if discarded into waste bins with paper.

Incandescent reaction when Zinc and Arsenic or Tellurium, or Selenium are combined.

When hydrazine mononitrate is heated in contact with zinc, a flaming decomposition occurs at temperatures a little above its melting point.

Contact with acids and alkali hydroxides (sodium hydroxide, potassium hydroxide, calcium hydroxide, etc.) results in evolution of hydrogen with sufficient heat of reaction to ignite the hydrogen gas.

Zinc foil ignites if traces of moisture are present.

It is water reactive and produces flammable gases on contact with water. It may ignite on contact with water or

moist air.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Flammable solid that, in contact with water, emits flammable gases.
Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, alkalis, moisture.

Storage:

Keep container tightly closed. Keep container in a cool, well-ventilated area. Keep from any possible contact with water. Do not allow water to get into container because of violent reaction.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid. Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 65.39 g/mole

Color: Bluish-grey

pH (1% soln/water): Not applicable.

Boiling Point: 907°C (1664.6°F)

Melting Point: 419°C (786.2°F)

Critical Temperature: Not available.

Specific Gravity: Not available.

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials, moisture

Incompatibility with various substances:

Reactive with oxidizing agents, acids, alkalis.

Slightly reactive to reactive with moisture.

The product may react violently with water to emit flammable but non toxic gases.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Incompatible with acids, halogenated hydrocarbons, NH₄NO₃, barium oxide, Ba(NO₃)₂, Cadmium, CS₂, chlorates, Cl₂, CrO₃, F₂, Hydroxylamine, Pb(N₃)₂, MnCl₂, HNO₃, performic acid, KClO₃, KNO₃, N₂O₂, Selenium, NaClO₃, Na₂O₂, Sulfur, Te, water, (NH₄)₂S, As₂O₃, CS₂, CaCl₂, chlorinated rubber, catalytic metals, halocarbons, o-nitroanisole, nitrobenzene, nonmetals, oxidants, paint primer base, pentacarbonoyliron, transition metal halides, seleninyl bromide, HCl, H₂SO₄, (Mg +Ba(NO₃)₂ +BaO₂), (ethyl acetoacetate +tribromoneopentyl alcohol.

Contact with Alkali Hydroxides(Sodium Hydroxide, Potassium Hydroxide, Calcium Hydroxide, etc) results in evolution of hydrogen.

Ammonium nitrate + zinc + water causes a violent reaction with evolution of steam and zinc oxide.

May react with water.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available.

LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects:

Skin: May cause skin irritation. Dermal exposure to zinc may produce leg pains, fatigue, anorexia and weight loss.

Eyes: May cause eye irritation.

Ingestion: May be harmful if swallowed. May cause digestive tract irritation with tightness in throat, nausea, vomiting, diarrhea, loss of appetite, malaise, abdominal pain, fever, and chills. May affect behavior/central nervous system and autonomic nervous system with ataxia, lethargy, staggering gait, mild derangement in cerebellar function, lightheadness, dizziness, irritability, muscular stiffness, and pain. May also affect blood.

Inhalation: Inhalation of zinc dust or fumes may cause respiratory tract and mucous membrane irritation with cough and chest pain. It can also cause "metal fume fever", a flu-like condition characterized appearance of chills, headachefever, malaise, fatigue, sweating, extreme thirst, aches in the legs and chest, and difficulty in breathing. A sweet taste may also be present in metal fume fever, as well as a dry throat, aches, nausea, and vomiting, and pale grey cyanosis.

The toxicological properties of this substance have not been fully investigated.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: Not available.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

New York release reporting list: Zinc Metal
Rhode Island RTK hazardous substances: Zinc Metal
Pennsylvania RTK: Zinc Metal
Florida: Zinc Metal
Michigan critical material: Zinc Metal
Massachusetts RTK: Zinc Metal
New Jersey: Zinc Metal
California Director's List of Hazardous Substances: Zinc Metal
TSCA 8(b) inventory: Zinc Metal
TSCA 12(b) one time export: Zinc Metal
SARA 313 toxic chemical notification and release reporting: Zinc Metal
CERCLA: Hazardous substances.: Zinc Metal: 1000 lbs. (453.6 kg)

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not Available

DSCL (EEC):

R15- Contact with water liberates extremely flammable gases.
R17- Spontaneously flammable in air.
S7/8- Keep container tightly closed and dry.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 1

Reactivity: 1

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 0

Flammability: 1

Reactivity: 1

Specific hazard:

Protective Equipment:

Gloves.
Lab coat.
Dust respirator. Be sure to use an approved/certified respirator or equivalent.
Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Lead

January 2006

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- [Who are the populations most at risk and how are they usually exposed?](#)
- [What are the possible toxic effects of lead?](#)
- [How can I reduce the risk of exposure to lead?](#)
- [What are the safety guidelines for lead exposure?](#)
- [What are the most important or common mediating factors?](#)
- [Is there a test to see if my child or I have been exposed to lead?](#)
- [Future Research Needs](#)
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What is lead?

Lead is a heavy, bluish-gray metal that has a low melting point. It occurs naturally in the Earth's crust, but it is not a particularly abundant element. It is rarely found naturally as a metal, but rather in its divalent (2+) oxidative state in ore deposits widely distributed throughout the world. The most important lead containing ores are galena (PbS), anglesite (PbSO₄), and cerussite (PbCO₃). 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%).

What are the forms of lead?

- Metallic lead
- Inorganic lead and lead compounds (or lead salts)
- Organic lead (containing carbon)

What are the common uses of lead?

The largest use for lead is in storage batteries in cars and other vehicles. Lead may be used as a pure metal, alloyed with other metals, or as chemical compounds.

Lead used by industry comes from mined ores ("primary") or from recycled scrap metal or batteries ("secondary"). However, most lead today is obtained from recovery of recycled scrap, mostly lead-acid batteries.

Human activities, such as lead mining and smelting operations and manufacturing and use of lead products (e.g., leaded gasoline, lead-based paint), have resulted in the contamination of many industrial and residential areas with lead.

Form	Uses
Metallic lead Lead and lead compounds (or lead salts), such as <ul style="list-style-type: none"> • lead acetate • lead chloride • lead nitrate • lead oxide • lead phosphate • lead acetate 	Certain uses of lead, such as leaded gasoline, lead-based paints for domestic use, lead-based solder in food cans and water pipes, lead sinkers, and ammunition, have been reduced or banned to minimize lead's harmful effects on people and animals. <ul style="list-style-type: none"> • Cosmetics and hair dye - Some hair dyes and some non-Western cosmetics, such as kohl and surma, contain lead. • Fishing equipment - Most fishing weights and sinkers are made from lead. • Folk remedies - Many non-Western folk remedies used to treat diarrhea or other ailments may contain substantial amounts of lead. Examples of these include alarcon, ghasard, alkohl, greta, azarcon,

- **lead sulfate**
- **lead sulfide**

- liga, bali goli, pay-loo-ah, coral, and rueda.
- **Glazing** - Applied to some ceramicware can contain lead.
 - **Lead based paint** - Although the sale of residential lead-based paint was banned in the United States in 1978, it remains a major source of lead exposure for young children residing in older houses.
 - **Lead batteries** - Production of lead-acid batteries is the major use of lead.
 - **Lead-based solder** - Has been banned for use in water distribution systems, but many buildings and homes contain lead pipes or lead-based solder. Lead-based solder also is used for electrical circuitry applications.
 - **Lead-shot and ammunition** - It is the second highest production use of lead.
 - Other uses of lead include the production of lead alloys, soldering materials, shielding for x-ray machines, and manufacturing of corrosion- and acid-resistant materials used in the building industry.

Organic

- **tetraethyl lead**
- **tetramethyl lead**

The use of lead in gasoline was phased out in the 1980s, and has been banned since January 1, 1996. The use of lead in gasoline has contributed to its dispersion throughout the environment. During the combustion of gasoline containing these alkyllead compounds, significant amounts of inorganic lead can be released to the surrounding areas.

Current Uses

- Gasoline for off-road vehicles, farm equipment, and airplanes

Past Uses

- Gasoline additives (to increase octane rating)

What are the routes of exposure for lead?

People are most likely to be exposed to lead by consuming contaminated food and drinking water. Exposure can also occur by inadvertently ingesting contaminated soil, dust, or lead-based paint.

Form	Routes of Exposure
<p>Metallic lead</p> <p>Lead and lead compounds (or lead salts), such as</p> <ul style="list-style-type: none"> • lead acetate • lead chloride • lead nitrate • lead oxide • lead phosphate • lead subacetate • lead sulfate • lead sulfide 	<ul style="list-style-type: none"> • Ingestion is the primary source of exposure to the general population. • Lead paint is a major source of environmental exposure for children who ingest flaking paint, paint chips, and weathered powdered paint (mostly from deteriorated housing units in urban areas). Lead paint can also contribute to soil/dust lead which can be inadvertently ingested via hand-to-mouth activity of young children. • Lead can leach into drinking water from lead-based solder used in water pipes. • Lead can leach into foods or liquids stored in ceramic containers made with lead glazing. • Engaging in hobbies such as casting ammunition, making fishing weights, and stained glass can result in exposure to lead. • Exposure by inhalation can result during activities such as soldering with lead solder or sanding or sandblasting lead-based paint.
<p>Organic</p> <ul style="list-style-type: none"> • tetraethyl lead • tetramethyl lead 	<ul style="list-style-type: none"> • Inhalation • Dermal studies in animals have shown that organic lead is well absorbed through the skin

Who are the populations most at risk and how are they usually exposed?

People living near hazardous waste sites, lead smelters or refineries, battery recycling or crushing centers, or other industrial lead sources may be exposed to lead and chemicals that contain lead. Workers in occupations that have sources of lead exposure (e.g., plumbers, miners, mechanics, and lead smelter or refinery workers).

Certain hobbies, folk remedies, home activities, and car repairs (e.g., radiator repair) can contribute to lead exposure. Smoking cigarettes or breathing second-hand smoke increases exposure because tobacco smoke contains small amounts of lead.

Pregnant women, the developing fetuses, and young children are particularly vulnerable to the effects of lead. Young children are more likely to play in dirt and to place their hands and other objects in their

mouths, thereby increasing the opportunity for exposure via ingestion of lead-contaminated soil and dust.

What are the possible toxic effects of lead?

The most sensitive targets for lead toxicity are the developing nervous system, the hematological and cardiovascular systems, and the kidney. However, because of lead's many modes of action in biological systems, lead could potentially affect any system or organs in the body. The effects are the same whether it is breathed or swallowed.

Blood Lead Concentrations Corresponding to Adverse Health Effects

Life Stage	Effect	Blood lead (µg/dL)
Children	Depressed ALAD* activity	<5
	Neurodevelopmental effects	<10
	Sexual maturation	<10
	Depressed vitamin D	>15
	Elevated EP**	>15
	Depressed NCV***	>30
	Depressed hemoglobin	>40
	Colic	>60
Adults	Depressed GFR****	<10
	Elevated blood pressure	<10
	Elevated EP (females)	>20
	Enzymuria/proteinuria	>30
	Peripheral neuropathy	>40
	Neurobehavioral effects	>40
	Altered thyroid hormone	>40
	Reduced fertility	>40
Elderly adults	Depressed hemoglobin	>50
	Depressed ALAD*	<5
	Neurobehavioral effects	>4

*aminolevulinic acid dehydratase (ALAD)

**erythrocyte porphyrin (EP)

***nerve conduction velocity (NCV)

****glomerular filtration rate (GFR)

Source: ATSDR Toxicological Profile for Lead (Draft for Public Comment), 2005.

How can I reduce the risk of exposure to lead?

- Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint (homes built before 1978).
- If you have a water lead problem, the U.S. Environmental Protection Agency (EPA) recommends that you flush your cold water pipes if they have not been used in over 6 hours by running water until it is cold (5 seconds to 2 minutes) before drinking or cooking with it.
- Avoid some types of paints and pigments that contain lead and are used as make-up or hair coloring; keep these kinds of products away from children.
- Hire a professional contractor, who is required to follow certain health safety requirements for remediation or renovation involving lead-based paint, (www.epa.gov/lead/pubs/leadinfo.htm#remodeling).
- Wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

What are the safety guidelines for lead exposure?

Air

- [National Institute for Occupational Safety and Health](#) (NIOSH)

Recommended exposure limit (REL) time-weighted average (TWA) - 0.05 mg/m³
Immediately dangerous to life or health (IDLH) - 100 mg/m³

- [Occupational Safety and Health Administration](#) (OSHA)

Air - workplace 50 µg/m³
Action level - 40 µg/100 g of whole blood

- The [American Conference of Governmental Industrial Hygienists](#) (ACGIH)

Threshold limit values (TLV)/(TWA) - 0.05 mg/m³
 TLV/TWA guideline for lead arsenate - 150 µg/m³
 TLV/TWA guideline for other forms of lead - 50 µg lead/m³

- [U.S. Environmental Protection Agency](#) (EPA)

National Primary and Secondary Ambient Air Quality Standards - 1.5 µg/m³

- [World Health Organization](#) (WHO)

Air quality guidelines -- 0.5 µg/m³

Water

- EPA

Maximum contaminant level (MCL) - action level 0.015 mg/L
 Action level for public supplies - 15 µg/L

- WHO

Drinking Water Quality Guidelines - 0.01 mg/L

Blood

- [Centers for Disease Control and Prevention](#) (CDC)

Level of concern for children - 10 µg/dL

- OSHA

Cause for written notification and medical exam - 40 µg/dL
 Cause for medical removal from exposure - 50 µg/dL

- ACGIH

Advisory; biological exposure index - 30 µg/dL

Food

- [Food and Drug Administration](#) (FDA)

Bottled drinking water - 0.005 mg/L

Other

- ACGIH

Biological exposure indices (lead in blood) - 30 µg/100 mL

- [Consumer Product Safety Commission](#)

Paint - 600 ppm

- FDA

Ceramicware (µg/mL leaching solution) - 0.5-3.0 µg/mL

µg/m³: micrograms per cubic meter
 µg/dL: micrograms per deciliter
 µg/L: micrograms per liter
 g: gram

mg/L: milligrams per liter
 mL: milliliter
 ppm: parts per million

What are the most important or common mediating factors?

Factors that determine the severity of the health effects from lead exposure include

- Dose
- Age of the person exposed
 - the developing nervous system is the most sensitive system to the effects of lead
 - the efficiency of lead absorption from the gastrointestinal tract is greater in children than in adults
- Life stages of women (childbirth, lactating, menopause)
- Occupational exposures
- Duration of exposure
- Health and lifestyle of the person exposed
- Nutritional status of the person exposed
 - a diet adequate in calcium and iron may decrease lead absorption

The toxic effects of lead exposure may be worse in individuals with inherited genetic diseases or gene polymorphisms such as thalassemia, individuals with glucose-6-phosphate dehydrogenase (G6PD) deficiency, and carriers of certain gene polymorphic forms (e.g., ALAD and vitamin D receptor). Research continues about this topic.

Is there a test to see if my child or I have been exposed to lead?

- Blood**
- The screening test of choice is blood lead levels.
 - Blood tests are commonly used to screen children for lead poisoning.
 - Analysis of lead in whole blood is the most common and accurate method of assessing lead exposure.
 - Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (µg/dL).
- Bone and Teeth**
- X-ray fluorescence techniques have been used to determine lead concentration in bones and teeth. It is not widely available and is used mostly in research.
 - Lead partitions to bone over a lifetime of exposure; therefore, bone lead measurements may be a better indicator of cumulative exposure than blood lead.
- Urine**
- Measurements of urinary lead levels have been used to assess lead exposure.
 - The measurement of lead excreted in urine following chelation with calcium disodium EDTA (EDTA provocation) has been used to detect elevated body burden of lead in adults and children.
- Hair and Nails**
- These are not reliable for testing due to errors external contamination. They are relatively poor predictors of blood lead, particularly at low concentrations.

Future Research Needs

To close current gaps in the scientific database on the health effects of lead, a long-term research program is needed that might include the following:

- Further short-term studies or studies in vitro designed to clarify mechanisms of action for the various toxicities might be useful.
- Studies identifying exposures during different developmental periods can help identify critical periods of vulnerability for immunocompetence, development of sex organs, or neurobehavioral parameters.
- Chronic-duration exposure studies in animals would expand information on the toxicity of lead. Special studies that examine biochemical and morphological effects of lead may provide new information on mechanisms of action of lead, particularly for the effects of greatest concern such as neurobehavioral changes in children.
- Development of new and more sensitive tests of specific neuropsychological functions.
- Further investigation of links between lead and amyotrophic lateral sclerosis, essential tremor, schizophrenia, and Parkinson's disease.
- Epidemiological studies designed in a manner that permits more rigorous assessments of effect modification.
- Studies about the long-term consequences of lead-related neurobehavioral deficits detected in infants and children and the manifestation of chronic neurobehavioral problems in adolescence and adulthood.
- Further characterization of bone lead concentration as a biomarker of exposure for various effect end points (e.g., blood pressure and renal effects).
- Studies of the potential prevalence of elevated bone lead stores in women of reproductive age and the associated risk that this poses to fetal development by mobilization of maternal bone stores during pregnancy.
- Further clarification of the role of some genetic polymorphisms.
- Evaluation of cohorts from prospective studies into adulthood for potential late-appearing effects including cancer.

For more information

- Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for Lead
<http://www.atsdr.cdc.gov/toxprofiles/tp13.html>
- ATSDR ToxFAQs™ for Lead
<http://www.atsdr.cdc.gov/tfacts13.html>
- ATSDR Case Studies in Environmental Medicine Lead Toxicity
<http://www.atsdr.cdc.gov/csem/lead/>
- ATSDR Interaction Profile for Chemical Mixtures for Arsenic, Cadmium, Chromium, and Lead
<http://www.atsdr.cdc.gov/interactionprofiles/ip04.html>

- ATSDR Interaction Profile for Chemical Mixtures for Lead, Manganese, Zinc, and Copper
<http://www.atsdr.cdc.gov/interactionprofiles/ip06.html>
- ATSDR Interaction Profile for Chemical Mixtures for Chlorpyrifos, Lead, Mercury, and Methylmercury
<http://www.atsdr.cdc.gov/interactionprofiles/ip11.html>
- Centers for Disease Control and Prevention Lead Web Page
<http://www.cdc.gov/lead/>
- U.S. Environmental Protection Agency Lead Web Page
<http://www.epa.gov/lead/>
- U.S. Department of Labor, Occupational Safety & Health Administration
<http://www.osha.gov/SLTC/lead/>

For more information, contact:

*Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
1600 Clifton Road NE, Mailstop F-32
Atlanta, GA 30333
Phone: 1-800-CDC-INFO (800-232-4636)
TTY 888-232-6348*

*FAX: (770)-488-4178
Email: CDCINFO@cdc.gov*

This page was updated on 01/04/2008



Mercury

Mercury is a naturally occurring metal found in air, water, and soil. It exists in several forms, including elemental (or metallic) mercury, inorganic mercury compounds, and organic mercury compounds:

- **Elemental mercury** is liquid at room temperature and is used in thermometers, fluorescent light bulbs, some electrical switches, and some industrial processes.
- **Inorganic mercury** compounds are formed when mercury combines with other elements to form salts, which are usually powders or crystals. Inorganic mercury compounds are found naturally in the environment. Some forms of inorganic mercury have been used in antiseptic creams, ointments, and preservatives.
- **Organic mercury** compounds are formed when mercury combines with carbon. Microscopic organisms can produce organic mercury compounds (methylmercury) in contaminated water and soil, which can accumulate in the food chain. Other special types of organomercurials have been used as medical preservatives and medicines.

How People Are Exposed to Mercury

- Eating fish or shellfish that is contaminated with methylmercury, which is the main source of general human exposures to mercury;
- Breathing air contaminated with elemental mercury vapors (e.g., in workplaces such as dental offices and industries that use mercury or in locations where a mercury spill or release has occurred);
- Having dental fillings that contain mercury; and
- Practicing cultural or religious rituals that use mercury.

How Mercury Affects People's Health

- Short-term exposure to extremely high levels of elemental mercury vapors can result in lung damage, nausea, diarrhea, increases in blood pressure or heart rate, skin rashes, eye irritation, and injury to the nervous system.
- Prolonged exposure to lower levels of elemental mercury can permanently damage the brain and kidneys.
- The developing brain of a fetus can be injured if the mother is exposed to methylmercury.

Levels of Mercury in U.S. Population

Scientists tested levels of mercury in the blood of 16,780 participants who took part in CDC's national study known as the National Health and Nutrition Examination Survey (NHANES). These findings are based on total blood mercury levels in the U.S. general

population for persons aged 1 year and older who participated in NHANES during 2003-2006, as well as trends in the total mercury of children aged 1-5 and females aged 16-49 during 1999-2006.

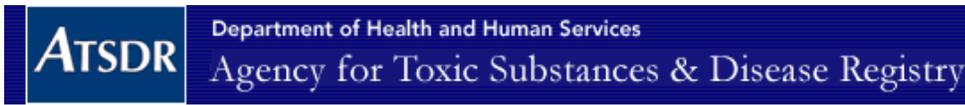
- In the total population during 2003-2006, the total blood mercury levels for non-Hispanic blacks and non-Hispanic whites were higher than those for Mexican Americans.
- Across the age groups in the total population during 2003-2006, total blood mercury levels increased with age, peaked at the fifth or sixth decade, depending on race/ethnicity, and then declined.
- In the most recent survey period of 2005-2006, the 95th percentile levels for total blood mercury in children aged 1-5 years and females aged 16-49 years were 1.43 µg/L and 4.48 µg/L, respectively. The 95th percentile means that 95 percent of the U.S. population's exposure is below this estimated level. Conversely, only 5 percent of the population will have values at this level or higher.
- Over the four survey periods from 1999-2006, blood mercury levels increased slightly for non-Hispanic white children and decreased slightly for non-Hispanic black and Mexican American children. Female children had slightly higher blood mercury levels than male children.

For More Information

- Agency for Toxic Substances and Disease Registry
Detailed information about mercury and public health is available at <http://www.atsdr.cdc.gov/alerts/970626.html> and <http://www.atsdr.cdc.gov/cabs/mercury/index.html>
- CDC Emergency Preparedness and Response
Case definitions of mercury, toxicology FAQs, and toxicological profile at <http://emergency.cdc.gov/agent/mercury/>

May 2009

The Centers for Disease Control and Prevention (CDC) protects people's health and safety by preventing and controlling diseases and injuries; enhances health decisions by providing credible information on critical health issues; and promotes healthy living through strong partnerships with local, national, and international organizations.



[ATSDR Home](#) > [ToxFAQs™ Arsenic](#)

ToxFAQs™

ToxFAQs™
for
Arsenic
(*Arsénico*)
August 2007

 [PDF Version, 92 KB](#)

CAS#: 7440-38-2

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

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- [What happens to arsenic when it enters the environment?](#)
- [How might I be exposed to arsenic?](#)
- [How can arsenic affect my health?](#)
- [How likely is arsenic to cause cancer?](#)
- [How does arsenic affect children?](#)
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- [Is there a medical test to show whether I've been exposed to arsenic?](#)
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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 sites identified by the Environmental Protection Agency (EPA).

What is arsenic?

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

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

What happens to arsenic when it enters the environment?

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

How might I be exposed to arsenic?

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

How can arsenic affect my health?

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

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

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

Skin contact with inorganic arsenic may cause redness and swelling.

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

How likely is arsenic to cause cancer?

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

How does 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 their risk for 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 show 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:

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
1600 Clifton Road NE, Mailstop F-62
Atlanta, GA 30333
Phone: 1-800-CDC-INFO • 888-232-6348 (TTY)
FAX: 770-488-4178
Email: cdcinfo@cdc.gov

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.

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U.S. Environmental Protection Agency

Pesticides: Topical & Chemical Fact Sheets

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Health & Safety
Specific Chemicals
Regulatory Actions

Assessing Health Risks from Pesticides

January 1999
735-F-99-002

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

Background

There are more than 865 active ingredients registered as pesticides, which are formulated into thousands of pesticide products that are available in the marketplace. About 350 pesticides are used on the foods we eat, and to protect our homes and pets.

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." At this time, EPA is developing a methodology for this type of assessment.
- **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](#).

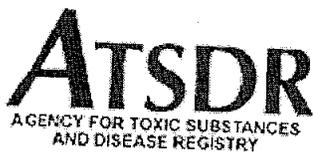
For more information on specific pesticides, or to inquire about the symptoms of pesticide poisoning, call the National Pesticide Information Center (NPIC), a toll-free hotline information at: 1-800-858-7378, or visit their [Web site](#) [\[EXIT Disclaimer\]](#).

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Last updated on Tuesday, May 2nd, 2006

URL: <http://www.epa.gov/pesticides/factsheets/riskassess.htm>



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February 2001

ToxFAQs™ for Polychlorinated Biphenyls (PCBs) *(Bifenilos Policlorados (BPCs))*

This fact sheet answers the most frequently asked health questions about polychlorinated biphenyls (PCBs). For more information, you may call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: 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 sites identified by the Environmental Protection Agency (EPA).

What are polychlorinated biphenyls (PCBs)?

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.

[Contact Information](#)**RELATED RESOURCES**[ToxFAQ™](#)  35k[ToxFAQ™ en Español](#)  32k[Public Health Statement](#)  125k[Public Health Statement en Español](#)  321k[Toxicological Profile](#)  13.6MB**A-Z INDEX**[A](#) [B](#) [C](#)[D](#) [E](#)[F](#) [G](#) [H](#) [I](#)[J](#) [K](#)[L](#) [M](#) [N](#) [O](#) [P](#)[Q](#) [R](#) [S](#)[T](#) [U](#)[V](#) [W](#) [X](#) [Y](#) [Z](#)**ATSDR RESOURCES**[ToxFAQs™](#)[ToxFAQs™ en Español](#)[Public Health Statements](#)[Toxicological Profiles](#)[Minimum Risk Levels](#)[MMGs](#)[MHMIs](#)[Interaction Profiles](#)[Priority List of](#)[Hazardous Substances](#)[Division of Toxicology](#)

and old microscope and hydraulic oils.

[back to top](#)**What happens to polychlorinated biphenyls (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.

[back to top](#)**How might I be exposed to polychlorinated biphenyls (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.

[back to top](#)**How can polychlorinated biphenyls (PCBs) affect my health?**

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

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

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How likely are polychlorinated biphenyls (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. The EPA and the International Agency for Research on Cancer (IARC) have determined that PCBs are probably carcinogenic to humans.

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How do polychlorinated biphenyls (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.

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How can families reduce the risk of exposure to polychlorinated biphenyls (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.

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Is there a medical test to show whether I've been exposed to polychlorinated biphenyls (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.

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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.

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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.

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Where can I get more information?

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.

For more information, contact:

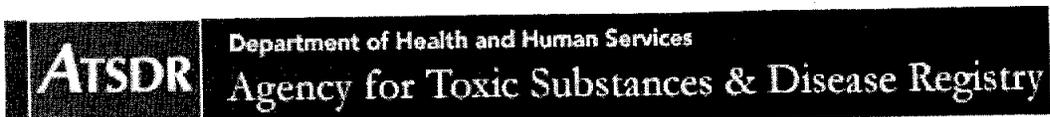
Agency for Toxic Substances and Disease Registry
Division of Toxicology
1600 Clifton Road NE, Mailstop F-32
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2007 CERCLA Priority List of Hazardous Substances

2007 RANK	SUBSTANCE NAME	TOTAL POINTS	2005 RANK	CAS #
1	ARSENIC	1672.58	1	007440-38-2
2	LEAD	1534.07	2	007439-92-1
3	MERCURY	1504.69	3	007439-97-6
4	VINYL CHLORIDE	1387.75	4	000075-01-4
5	POLYCHLORINATED BIPHENYLS	1365.78	5	001336-36-3
6	BENZENE	1355.96	6	000071-43-2
7	CADMIUM	1324.22	8	007440-43-9
8	POLYCYCLIC AROMATIC HYDROCARBONS	1316.98	7	130498-29-2
9	BENZO(A)PYRENE	1312.45	9	000050-32-8
10	BENZO(B)FLUORANTHENE	1266.55	10	000205-99-2
11	CHLOROFORM	1223.03	11	000067-66-3
12	DDT, P,P'-	1193.36	12	000050-29-3
13	AROCLOR 1254	1182.63	13	011097-69-1
14	AROCLOR 1260	1177.77	14	011096-82-5
15	DIBENZO(A,H)ANTHRACENE	1165.88	15	000053-70-3
16	TRICHLOROETHYLENE	1154.73	16	000079-01-6
17	DIELDRIN	1150.91	17	000060-57-1
18	CHROMIUM, HEXAVALENT	1149.98	18	018540-29-9
19	PHOSPHORUS, WHITE	1144.77	19	007723-14-0
20	CHLORDANE	1133.21	21	000057-74-9
21	DDE, P,P'-	1132.49	20	000072-55-9
22	HEXACHLOROBUTADIENE	1129.63	22	000087-68-3
23	COAL TAR CREOSOTE	1124.32	23	008001-58-9
24	ALDRIN	1117.22	25	000309-00-2
25	DDD, P,P'-	1114.83	24	000072-54-8
26	BENZIDINE	1114.24	26	000092-87-5
27	AROCLOR 1248	1112.20	27	012672-29-6
28	CYANIDE	1099.48	28	000057-12-5
29	AROCLOR 1242	1093.14	29	053469-21-9
30	AROCLOR	1091.52	62	012767-79-2
31	TOXAPHENE	1086.65	30	008001-35-2
32	HEXACHLOROCYCLOHEXANE, GAMMA-	1081.63	32	000058-89-9
33	TETRACHLOROETHYLENE	1080.43	31	000127-18-4
34	HEPTACHLOR	1072.67	33	000076-44-8
35	1,2-DIBROMOETHANE	1064.06	34	000106-93-4
36	HEXACHLOROCYCLOHEXANE, BETA-	1060.22	37	000319-85-7
37	ACROLEIN	1059.07	36	000107-02-8
38	DISULFOTON	1058.85	35	000298-04-4
39	BENZO(A)ANTHRACENE	1057.96	38	000056-55-3
40	3,3'-DICHLOROBENZIDINE	1051.61	39	000091-94-1

41	ENDRIN	1048.57	41	000072-20-8
42	BERYLLIUM	1046.12	40	007440-41-7
43	HEXACHLOROCYCLOHEXANE, DELTA-	1038.27	42	000319-86-8
44	1,2-DIBROMO-3-CHLOROPROPANE	1035.55	43	000096-12-8
45	PENTACHLOROPHENOL	1028.01	45	000087-86-5
46	HEPTACHLOR EPOXIDE	1027.12	44	001024-57-3
47	CARBON TETRACHLORIDE	1023.32	46	000056-23-5
48	AROCLOR 1221	1018.41	47	011104-28-2
49	COBALT	1015.57	50	007440-48-4
50	DDT, O,P'-	1014.71	49	000789-02-6
51	AROCLOR 1016	1014.33	48	012674-11-2
52	DI-N-BUTYL PHTHALATE	1007.49	52	000084-74-2
53	NICKEL	1005.40	55	007440-02-0
54	ENDOSULFAN	1004.65	54	000115-29-7
55	ENDOSULFAN SULFATE	1003.56	53	001031-07-8
56	DIAZINON	1002.08	57	000333-41-5
57	ENDOSULFAN, ALPHA	1001.30	58	000959-98-8
58	XYLENES, TOTAL	996.07	59	001330-20-7
59	CIS-CHLORDANE	995.08	51	005103-71-9
60	DIBROMOCHLOROPROPANE	994.87	60	067708-83-2
61	METHOXYCHLOR	994.47	61	000072-43-5
62	BENZO(K)FLUORANTHENE	981.26	63	000207-08-9
63	ENDRIN KETONE	978.99	64	053494-70-5
64	TRANS-CHLORDANE	973.99	56	005103-74-2
65	CHROMIUM(VI) OXIDE	969.58	66	001333-82-0
66	METHANE	959.78	67	000074-82-8
67	ENDOSULFAN, BETA	959.19	65	033213-65-9
68	AROCLOR 1232	955.64	68	011141-16-5
69	ENDRIN ALDEHYDE	954.86	69	007421-93-4
70	BENZOFUORANTHENE	951.48	70	056832-73-6
71	TOLUENE	947.50	71	000108-88-3
72	2-HEXANONE	942.02	72	000591-78-6
73	2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	938.11	73	001746-01-6
74	ZINC	932.89	74	007440-66-6
75	DIMETHYLARSINIC ACID	922.06	75	000075-60-5
76	DI(2-ETHYLHEXYL)PHTHALATE	919.02	76	000117-81-7
77	CHROMIUM	908.52	77	007440-47-3
78	NAPHTHALENE	896.67	78	000091-20-3
79	1,1-DICHLOROETHENE	891.19	79	000075-35-4
80	METHYLENE CHLORIDE	888.96	81	000075-09-2
81	AROCLOR 1240	888.11	80	071328-89-7
82	2,4,6-TRINITROTOLUENE	883.59	82	000118-96-7
83	BROMODICHLOROETHANE	870.00	83	000683-53-4
84	HYDRAZINE	864.41	85	000302-01-2
85	1,2-DICHLOROETHANE	863.99	84	000107-06-2
86	2,4,6-TRICHLOROPHENOL	863.71	86	000088-06-2
87	2,4-DINITROPHENOL	860.45	87	000051-28-5
88	BIS(2-CHLOROETHYL) ETHER	859.88	88	000111-44-4
89	THIOCYANATE	849.21	89	000302-04-5
90	ASBESTOS	841.54	90	001332-21-4
91	CHLORINE	840.37	92	007782-50-5
92	CYCLOTRIMETHYLENETRINITRAMINE (RDX)	840.28	91	000121-82-4
93	HEXACHLOROBENZENE	838.34	93	000118-74-1

94	2,4-DINITROTOLUENE	837.88	96	000121-14-2
95	RADIUM-226	835.93	94	013982-63-3
96	ETHION	834.03	97	000563-12-2
97	1,1,1-TRICHLOROETHANE	833.81	95	000071-55-6
98	URANIUM	833.41	98	007440-61-1
99	ETHYLBENZENE	832.13	99	000100-41-4
100	RADIUM	828.07	100	007440-14-4
101	THORIUM	825.17	101	007440-29-1
102	4,6-DINITRO-O-CRESOL	822.78	102	000534-52-1
103	1,3,5-TRINITROBENZENE	820.17	103	000099-35-4
104	CHLOROBENZENE	819.69	105	000108-90-7
105	RADON	817.89	104	010043-92-2
106	RADIUM-228	816.76	106	015262-20-1
107	THORIUM-230	814.72	107	014269-63-7
107	URANIUM-235	814.72	107	015117-96-1
109	BARIIUM	813.46	109	007440-39-3
110	FLUORANTHENE	812.40	113	000206-44-0
111	URANIUM-234	812.11	110	013966-29-5
112	N-NITROSODI-N-PROPYLAMINE	811.05	111	000621-64-7
113	THORIUM-228	810.36	112	014274-82-9
114	RADON-222	809.78	114	014859-67-7
115	HEXACHLOROCYCLOHEXANE, ALPHA-	809.56	116	000319-84-6
116	1,2,3-TRICHLOROBENZENE	808.41	143	000087-61-6
117	MANGANESE	807.90	115	007439-96-5
118	COAL TARS	807.07	117	008007-45-2
119	CHRYSTILE ASBESTOS	806.68	119	012001-29-5
119	STRONTIUM-90	806.68	119	010098-97-2
121	PLUTONIUM-239	806.67	118	015117-48-3
122	POLONIUM-210	806.39	122	013981-52-7
123	METHYLMERCURY	806.39	121	022967-92-6
124	PLUTONIUM-238	806.01	123	013981-16-3
125	LEAD-210	805.90	124	014255-04-0
126	PLUTONIUM	805.23	125	007440-07-5
127	CHLORPYRIFOS	804.93	125	002921-88-2
128	COPPER	804.86	133	007440-50-8
129	AMERICIUM-241	804.55	128	086954-36-1
130	RADON-220	804.54	127	022481-48-7
131	AMOSITE ASBESTOS	804.07	129	012172-73-5
132	IODINE-131	803.48	130	010043-66-0
133	HYDROGEN CYANIDE	803.08	132	000074-90-8
134	TRIBUTYL TIN	802.61	131	000688-73-3
135	GUTHION	802.32	134	000086-50-0
136	NEPTUNIUM-237	802.13	135	013994-20-2
137	CHRYSENE	802.10	139	000218-01-9
138	CHLORDECONE	801.64	136	000143-50-0
138	IODINE-129	801.64	136	015046-84-1
138	PLUTONIUM-240	801.64	136	014119-33-6
141	S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE	797.88	140	000078-48-8
142	BROMINE	789.15	142	007726-95-6
143	POLYBROMINATED BIPHENYLS	789.11	141	067774-32-7
144	DICOFOL	787.56	144	000115-32-2
145	PARATHION	784.14	145	000056-38-2
146	1,1,2,2-TETRACHLOROETHANE	782.15	146	000079-34-5

147	SELENIUM	778.98	147	007782-49-2
	148	HEXACHLOROCYCLOHEXANE, TECHNICAL GRADE	774.91	148 000608-73-1
149	TRICHLOROFLUOROETHANE	770.74	149	027154-33-2
150	TRIFLURALIN	770.12	150	001582-09-8
151	DDD, O,P'-	768.73	151	000053-19-0
152	4,4'-METHYLENEBIS(2-CHLOROANILINE)	766.66	152	000101-14-4
153	HEXACHLORODIBENZO-P-DIOXIN	760.42	153	034465-46-8
154	HEPTACHLORODIBENZO-P-DIOXIN	754.47	154	037871-00-4
155	PENTACHLOROBENZENE	753.58	155	000608-93-5
156	1,3-BUTADIENE	747.31	201	000106-99-0
157	AMMONIA	745.55	156	007664-41-7
158	2-METHYLNAPHTHALENE	743.24	157	000091-57-6
159	1,4-DICHLOROBENZENE	737.32	159	000106-46-7
160	1,1-DICHLOROETHANE	736.23	158	000075-34-3
161	ACENAPHTHENE	731.25	160	000083-32-9
162	1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN	726.14	161	039001-02-0
163	1,1,2-TRICHLOROETHANE	724.96	162	000079-00-5
164	TRICHLOROETHANE	723.32	163	025323-89-1
165	HEXACHLOROCYCLOPENTADIENE	719.01	164	000077-47-4
166	HEPTACHLORODIBENZOFURAN	718.58	165	038998-75-3
167	1,2-DIPHENYLHYDRAZINE	713.90	166	000122-66-7
168	2,3,4,7,8-PENTACHLORODIBENZOFURAN	710.71	167	057117-31-4
169	TETRACHLOROBIPHENYL	709.21	168	026914-33-0
170	CRESOL, PARA-	707.83	169	000106-44-5
171	OXYCHLORDANE	706.32	170	027304-13-8
172	1,2-DICHLOROBENZENE	704.91	171	000095-50-1
173	1,2-DICHLOROETHENE, TRANS-	704.04	178	000156-60-5
174	INDENO(1,2,3-CD)PYRENE	703.30	180	000193-39-5
175	GAMMA-CHLORDENE	702.59	172	056641-38-4
176	CARBON DISULFIDE	702.55	174	000075-15-0
177	TETRACHLOROPHENOL	702.54	173	025167-83-3
178	AMERICIUM	701.62	175	007440-35-9
178	URANIUM-233	701.62	175	013968-55-3
180	PALLADIUM	700.66	177	007440-05-3
181	HEXACHLORODIBENZOFURAN	700.56	179	055684-94-1
182	PHENOL	696.96	183	000108-95-2
183	CHLOROETHANE	693.90	182	000075-00-3
184	ACETONE	693.31	181	000067-64-1
185	P-XYLENE	690.20	185	000106-42-3
186	DIBENZOFURAN	689.19	187	000132-64-9
187	ALUMINUM	688.13	186	007429-90-5
188	2,4-DIMETHYLPHENOL	685.76	189	000105-67-9
189	CARBON MONOXIDE	684.49	188	000630-08-0
190	TETRACHLOROETHANE	677.97	190	025322-20-7
191	HYDROGEN SULFIDE	676.51	193	007783-06-4
192	PENTACHLORODIBENZOFURAN	673.21	192	030402-15-4
193	CHLOROMETHANE	670.19	191	000074-87-3
194	BIS(2-METHOXYETHYL) PHTHALATE	666.08	194	034006-76-3
195	BUTYL BENZYL PHTHALATE	659.38	195	000085-68-7
196	CRESOL, ORTHO-	658.66	196	000095-48-7
197	HEXACHLOROETHANE	653.10	199	000067-72-1
198	VANADIUM	651.70	198	007440-62-2

199	N-NITROSODIMETHYLAMINE	650.71	200	000062-75-9
200	1,2,4-TRICHLOROBENZENE	647.30	203	000120-82-1
201	BROMOFORM	643.53	202	000075-25-2
202	TETRACHLORODIBENZO-P-DIOXIN	635.74	204	041903-57-5
203	1,3-DICHLOROBENZENE	631.41	205	000541-73-1
204	PENTACHLORODIBENZO-P-DIOXIN	625.12	207	036088-22-9
205	N-NITROSODIPHENYLAMINE	624.79	208	000086-30-6
206	1,2-DICHLOROETHYLENE	622.49	206	000540-59-0
207	2,3,7,8-TETRACHLORODIBENZOFURAN	622.15	210	051207-31-9
208	2-BUTANONE	620.01	209	000078-93-3
209	2,4-DICHLOROPHENOL	616.45	212	000120-83-2
210	1,4-DIOXANE	616.29	215	000123-91-1
211	FLUORINE	613.28	214	007782-41-4
212	NITRITE	612.64	216	014797-65-0
213	CESIUM-137	612.50	217	010045-97-3
214	SILVER	612.19	213	007440-22-4
215	CHROMIUM TRIOXIDE	610.85	218	007738-94-5
216	NITRATE	610.66	219	014797-55-8
217	POTASSIUM-40	608.91	220	013966-00-2
218	DINITROTOLUENE	607.65	221	025321-14-6
219	ANTIMONY	605.37	222	007440-36-0
220	COAL TAR PITCH	605.33	224	065996-93-2
221	THORIUM-227	605.32	223	015623-47-9
222	2,4,5-TRICHLOROPHENOL	604.83	225	000095-95-4
223	ARSENIC ACID	604.45	226	007778-39-4
224	ARSENIC TRIOXIDE	604.36	227	001327-53-3
225	PHORATE	603.10	228	000298-02-2
226	BENZOPYRENE	603.00	230	073467-76-2
227	CRESOLS	602.74	229	001319-77-3
228	CHLORDANE, TECHNICAL	602.62	231	012789-03-6
229	DIMETHOATE	602.61	232	000060-51-5
230	ACTINIUM-227	602.57	233	014952-40-0
230	STROBANE	602.57	233	008001-50-1
232	4-AMINOBIIPHENYL	602.51	235	000092-67-1
232	PYRETHRUM	602.51	235	008003-34-7
234	ARSINE	602.42	237	007784-42-1
235	NALED	602.32	238	000300-76-5
236	DIBENZOFURANS, CHLORINATED	602.13	239	042934-53-2
236	ETHOPROP	602.13	239	013194-48-4
238	ALPHA-CHLORDENE	601.94	241	056534-02-2
238	CARBOPHENOTHION	601.94	241	000786-19-6
240	DICHLORVOS	601.64	243	000062-73-7
241	CALCIUM ARSENATE	601.45	244	007778-44-1
241	MERCURIC CHLORIDE	601.45	244	007487-94-7
241	SODIUM ARSENITE	601.45	244	007784-46-5
244	FORMALDEHYDE	599.64	247	000050-00-0
245	2-CHLOROPHENOL	599.62	248	000095-57-8
246	PHENANTHRENE	597.68	249	000085-01-8
247	HYDROGEN FLUORIDE	588.03	250	007664-39-3
248	2,4-D ACID	584.47	251	000094-75-7
249	DIBROMOCHLOROMETHANE	580.59	252	000124-48-1
250	DIURON	579.16	253	000330-54-1
251	BUTYLATE	578.43	254	002008-41-5

252	DIMETHYL FORMAMIDE	578.23		
253	PYRENE	577.95	255	000068-12-2
254	DICHLOROBENZENE	577.70	256	000129-00-0
255	ETHYL ETHER	572.47	211	025321-22-6
256	DICHLOROETHANE	570.46	257	000060-29-7
257	4-NITROPHENOL	567.79	258	001300-21-6
258	1,3-DICHLOROPROPENE, CIS-	561.82	259	000100-02-7
259	PHOSPHINE	559.74	184	010061-01-5
260	TRICHLOROBENZENE	557.96	260	007803-51-2
261	2,6-DINITROTOLUENE	555.20	261	012002-48-1
262	FLUORIDE ION	549.64	262	000606-20-2
263	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN	547.90	263	016984-48-8
264	METHYL PARATHION	545.83	264	035822-46-9
265	PENTAERYTHRITOL TETRANITRATE	545.59	265	000298-00-0
266	1,3-DICHLOROPROPENE, TRANS-	543.37	266	000078-11-5
267	BIS(2-ETHYLHEXYL)ADIPATE	540.20	267	010061-02-6
268	CARBAZOLE	534.52	268	000103-23-1
269	METHYL ISOBUTYL KETONE	533.24	269	000086-74-8
270	1,2-DICHLOROETHENE, CIS-	533.15	271	000108-10-1
271	STYRENE	532.70	270	000156-59-2
272	CARBARYL	530.98	272	000100-42-5
273	1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	529.45	273	000063-25-2
274	ACRYLONITRILE	528.28	274	067562-39-4
275	1-METHYLNAPHTHALENE	526.51	275	000107-13-1
			NEW	

Substances were assigned the same rank when two (or more) substances received equivalent total point scores.

CAS #- Chemical Abstracts Service Registry Number

This page was updated on 01/10/2008

COMMUNITY AIR MONITORING PLAN (CAMP)

The Community Air Monitoring Plan (CAMP) has been prepared to monitor the air quality during the excavation of contaminated soils from 920-924 Westchester Avenue in Bronx, New York. Air quality monitoring will include monitoring the presence of Volatile Organic Compounds (VOCs) and elevated levels of dust in the air.

Levels of VOCs and dust in the air will be monitored utilizing a Photo Ionization Detector (PID) and Real-Time Particulate Dust Tracker, respectively. A PID makes use of the principle of photo ionization for the detection and qualitative measurement of organic vapors. A PID does not respond to all compounds similarly, rather, each compound has its own response factor relative to its calibration. For this investigation, the PID will be calibrated to the compound isobutylene, which is published by the manufacturer. The PID has a minimum detection limit of 0.1 parts per million (ppm). The PID is a hand-held measuring device to detect total VOCs concentrations in a specific area. The Dust Tracker provides real-time measurement based on 90° light scattering. A pump draws the sample aerosol through an optics chamber where it is measured. The Dust Tracker has a minimum detection limit of 0.001 mg/m³. The Dust Tracker is a hand-held measuring device to measure particulate matters concentrations in a specific area.

Work Area Monitoring

During soil excavation, Hydro Tech will mobilize two environmental technicians in an equipped vehicle to the Subject Property on a daily basis. The technicians will utilize a PID and Dust Tracker at a 15 minutes interval during the excavation activities to monitor concentrations of VOCs and dust in the breathing zone of construction workers. Both technicians will remain on site for duration of soil excavation work. The monitoring will take place next to each excavator. Hydro Tech technicians will conduct a walk-through inspection at the excavation site every hour of the duration of the construction activities everyday.

If necessary, the technicians will direct construction workers to take actions to maintain acceptable air quality levels if VOCs concentrations in the air exceed the levels as shown in the table below, and dust concentrations in the air exceed the Threshold Limit Value (TLV).

Methods

A PID will be used to monitor total VOCs concentrations in the air. Dust particle monitoring will be performed using a Particulate Dust Track Real-Time Particle Counter for particles size ranging from 0.1 microns to 10 microns. Dust particle level will be monitored immediately downwind at the working site and integrated over a period not to exceed 15 minutes. Both monitoring devices will be calibrated daily and the measurements will be noted every 15 minutes. A background level will be established, at a minimum, on a daily basis, and record daily.

All work will be performed in level D Personal Protective Equipment (PPE) unless breathing zone VOCs concentrations exceed 5 ppm. The following response actions will be taken based on PID readings, as shown in the table below, once VOCs concentrations in soil exceed 5 ppm. All activities will be stopped once total VOCs concentrations in excavated soil exceed 25 ppm.

Table 1: Response Actions for VOCs levels in Excavated Soil

Constituents	Method of Detection	Concentration ppm	Corrective Action
VOCs	PID	> 5	Temporarily halt work activities and monitor until readings decrease to below 5 ppm
		> 5 < 25	Halt work activities, upgrade to Level C, continue monitoring
		> 25	Shutdown work activities

The action level for dust concentration in the air will be established at a TLV of 150 ug/m³ over the integrated period not to exceed 15 minutes. Soil excavation activities will be stopped once dust concentrations exceed 150 ug/m³.

I. PROJECT DETAILS

1. Project Description

The purpose of the project is to construct an 8-story residential, commercial and community building with a parking area in the cellar. The entire property will be disturbed during this construction period. The Site is approximately a 0.6-acre Site located at 920-922 Westchester Avenue in Borough of the Bronx in New York City). See Site Location map).

2. Site Description

The Site is currently vacant with no vegetation. There is no evidence of significant erosion under present site conditions. An 8-foot high plywood fence surrounds the Site. There is no current drainage system at the Site.

3. Adjacent Property

The predominant land use within ¼ mile radius of the project area is residential and commercial. The Site is bound to the north-northeast by Westchester Avenue and an elevated New York City Transit rail track, Rogers Place to the west and Interval Avenue to the east. The land immediately to the south, has been developed for residential and commercial use. The area to the west is utilized as a gasoline service station and has no vegetation. The area to the east consists of a residential building.

4. Soils

The soil in the project area is mapped as silty sand. Silty sand are considered to have a low degree of permeability, with the coefficient of permeability (k) ranging between $10^{-3} < k < 10^{-5}$. The soil erodibility factor (K value) ranges from 0.42 at the surface to 0.28 in the subsoil.

Due to the soil permeability of the subsoil that will be exposed during excavation, a surface wetness problem with moderate runoff is anticipated following significant rainfall events. The lower portion of excavations may fill with groundwater following significant rainfall events. However, dewatering will be performed during all subgrade construction activities.

II. PLANNED EROSION AND SEDIMENT CONTROL PRACTICES

1. Sediment Basin

No sediment basin will be required. All soils will be excavated and disposed of as a result of construction.

2. Temporary Gravel Construction Entrance/Exit

A temporary gravel construction entrance will be installed on the west side of the property towards Rogers Place. This will be done to reduce the amount of sediment transported on to roads by construction vehicles and run-off. During wet weather it may be necessary to wash vehicle tires at this location. The entrance will be graded so that runoff water will be directed to an inlet protection structure and away from the steep fill area.

3. Tree Preservation and Protection

No tree preservation and protection will be required.

4. Land Grading

No land grading will be required as all soils will be excavated and disposed of as a result of construction.

5. Temporary Sediment Trap

No temporary sediment trap will be required. All soils will be excavated and disposed of as a result of construction.

6. Sediment Fence

A sediment fence consisting of hay bales will be established around any temporary soil stockpiles and around the perimeter of the Site to prevent sediment from entering non-excavated areas or areas off-site.

7. Surface Stabilization

No surface stabilization will be required. All soils will be excavated and disposed of as a result of construction.

8. Dust Control

Dust control is not expected to be a problem due to the small area of exposure and the relatively short time of exposure (not exceeding 9 months). Should excessive dust be generated, it will be controlled by sprinkling. Street sweeping will also be employed wherever required. Additional details regarding dust control can be found in Section 5.8 of the RAWP (Community Air Monitoring Plan).

III. CONSTRUCTION SCHEDULE

1. Obtain plan approval and other applicable permits.
2. Maintain construction fence before start of any construction activity.
3. Hold construction meetings on a weekly basis prior and during construction.
4. Install temporary gravel construction entrance/exit.

5. Install & operate dewatering system.
6. Commence excavation and disposal.
7. Construct foundations.
8. Estimated time before final stabilization – 4 months

IV. MAINTENANCE PLAN

1. General Conditions

Any erosion and sediment control measures will be checked for stability and operation following every runoff-producing rainfall but in no case less than once every week. Any needed repairs will be made immediately to maintain all practices as designed.

2. Construction Fence

- a. A temporary construction fence will be maintained to prohibit the undesirable use of the construction area.
- b. The construction fence will surround the entire perimeter of the property.
- c. The construction fence will be built to a minimum height of 8 ft.

3. Temporary Gravel Construction Entrance/Exit

- d. A temporary gravel construction entrance will be constructed to reduce the amount of sediment transported on to roads by construction vehicles and run-off.
 - a. Clear the entrance and exit area from of all vegetation, roots and other material.
 - b. Grade the road foundation so that entrance/exit slopes towards the interior of the property.
 - c. The construction entrance will be built to a minimum width of 12 feet, minimum length of 20' and to minimum 6" thickness.
 - d. 2-inch to 3-inch washed stone will be used in the construction.
 - e. If wet conditions are anticipated a geotextile fabric will be placed over the graded foundation to improve stability.
 - f. Maintain the gravel pad in a condition to prevent mud or sediment from leaving the site. Mud tracked or washed onto road, will be removed immediately.

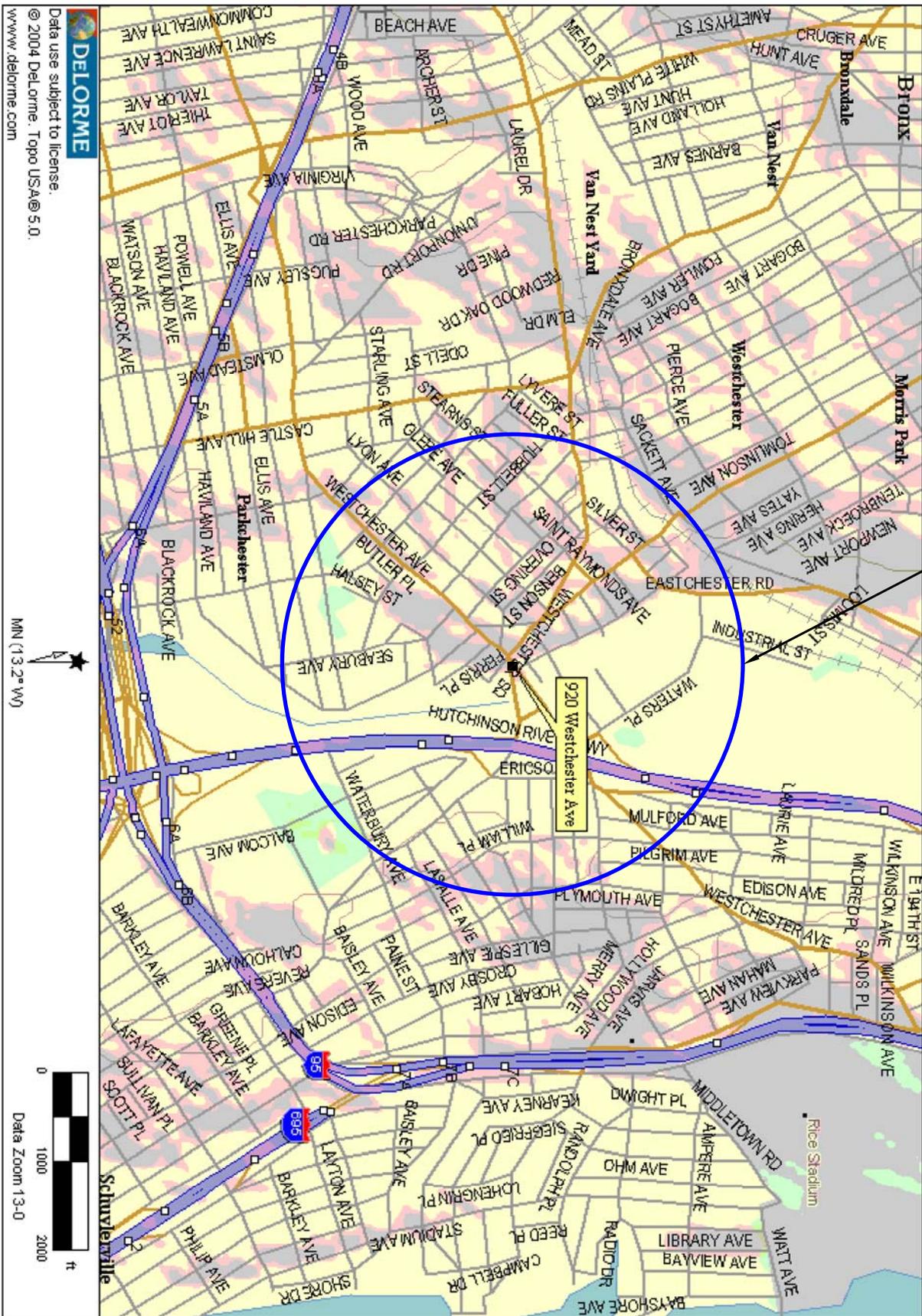
4. Sediment Fence

- a. A minimum of 300 linear feet of 18 inch high sediment fencing will be maintained to surround any temporary soil stockpiles, surface waters and other discharge points.
- b. Any sediment fence utilized will be inspected at the end of each day to ensure its integrity.

5. Dust Control

- a. A minimum 100 feet of garden hose with spray nozzle will be maintained in the vicinity of the construction entrance. The water will be supplied from an adjacent fire hydrant in accordance to a NYC Fire Department connection permit.
- b. All vehicles leaving property will be inspected for dust and sprayed as necessary.

**1/2 MILES RADIUS AROUND
SUBJECT SITE**



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920-924 Westchester Avenue
Bronx, NY

Drawn By:	C.Q.	TITLE:
Reviewed By:	M.R.	
Approved By:	M.S.	
Date:	08/02/10	
Scale:	AS NOTED	

SITE LOCATION MAP



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July 15th, 2010

Mr. Ryan M. Piper
NYSDEC- Division of Environmental Remediation
47-40 21st Street
Long Island City, NY 11101-5407

**Re: Groundwater Remediation Action Plan
920-924 Westchester Avenue, Bronx, NY**

NYSDEC Spill # 07-00175 & 06-13228

Dear Mr. Piper:

This letter is intended to provide you with the Groundwater Remedial Action Plan (GRAP) for the above-referenced property (The Site) on behalf of the property owner, MJM Construction Services, LLC. The GRAP is prepared to complement our February 24th, 2010 Remedial Action Plan (RAP), which has been approved by the New York State Department of Environmental Conservation (NYSDEC) on May 10th, 2010 and the New York City Mayor's Office of Environmental Remediation (OER) Local Brownfield Cleanup Program (LBC) on March 3, 2010. These remedial activities are based upon the requirements of the NYSDEC to resolve the Spill **#07-00175 & 06-13228** assigned to this property. Specifically, the GRAP is designed to remediate the plume of dissolved gasoline constituents present in the groundwater beneath western portion the Site. **Attachment A** provides correspondences from the NYSDEC and MOER.

SITE DESCRIPTION AND HISTORY

The Site is approximately 26,030 square feet in area and consists of two irregularly shaped adjacent parcels defined as Block 2697; Lots 35 and 38. The Site is located on the southern side of Westchester Avenue, to the east of Rogers Place and to the west of Intervale Avenue in Bronx, New York.

Lot 35 was historically utilized as gasoline station from 1977 to 1981 and until most recently utilized as an auto maintenance facility. Lot 38 was previously utilized as 1-story warehouse with a basement. The site was recently demolished and is currently vacant. The Site Plan is provided as **Figure 1**.

Subsurface investigations performed by Hydro Tech at the site indicated the site-specific groundwater flow was determined to be towards the south. A plume of dissolved gasoline compounds at concentrations exceeding their respective *6NYCRR Part 703.5* is present beneath the northwestern and eastern portions of Lot 35. The greatest concentrations of dissolved VOCs (3,661 micrograms per Liter ($\mu\text{g/L}$)) were detected in MW-2 in the vicinity of the former gasoline UST in the northwestern portion of Lot 35. The plume of dissolved VOCs does not appear top extent to other portions of the Site or off-Site as evidenced by the results of MW-1 and MW-5. **Figure 2** provides a Groundwater VOC Contamination Diagram.

PROJECT GOALS

Groundwater Quality Standards established in 6 NYCRR 703.5 have been established as the interim groundwater cleanup goals. However, if groundwater contaminant concentrations reach asymptotic levels that are higher than the interim goals established here, then the asymptotic levels shall prevail, i.e. groundwater remediation shall be deemed to have been successfully completed when asymptotic levels are reached.

EVALUATION OF REMEDIAL ALTERNATIVES

In order to accomplish the objective of the Plan and to achieve the groundwater cleanup goals, several remedial alternatives were evaluated. The remedial alternatives that were evaluated are as follows:

- Pump & Treat
- Air Sparge/Vapor Extraction
- Bioremediation
- Monitored Natural Attenuation

The following sections provide the evaluation of each remedial alternative along with the selection of the optimum remedial alternative(s). The table below provides a qualitative summary of the remedial alternatives.

Summary of Remedial Alternatives

Remedial Alternative	System Process	Feasibility	Limitations	Cost
Pump & Treat	Active removal of contaminated groundwater	Low-Medium	Medium-High	Medium-High
AS/VES	<i>In-situ</i> treatment of soil and groundwater.	Low-Medium	High	Medium
Bioremediation	<i>In-situ</i> and/or <i>ex-situ</i> degradation of contamination.	Medium-High	Low	Low-Medium
Monitored Natural Attenuation	Decrease of contaminant through natural processes.	Medium-High	Low	Low

Stand-Alone Pump & Treat

A pump and treat system is typically operated when free product is present; groundwater requires *ex-situ* treatment or when the migration of a groundwater plume has to be hydraulically controlled. A pump and treat system would consist of the installation of groundwater recovery wells at select locations for the withdrawal of petroleum-impacted groundwater. The petroleum-impacted groundwater would be treated aboveground utilizing an active groundwater treatment system and then discharged to either the municipal sanitary system or at an approved off site discharge location.

The operation of a pump and treat system at the site would not be feasible for this site since free product is not present. Furthermore, since there are few potential receptors located in the vicinity of the site and the groundwater aquifer that is impacted is not used as a source of potable water, the need for hydraulically controlling the groundwater plume is minimal. Therefore, the use of a pump and treat system for the groundwater plume is not feasible.

Air Sparge/Vapor Extraction

Air sparging and vapor extraction removes contaminants from the subsurface in a similar manner to bioventing. Air sparging consists of the injection of clean air into the saturated zone through small diameter air sparging wells. The influx of clean air into the saturated zone changes the phase of the contamination from dissolved to vapor, at which point the vapor extraction wells remove the vapor from the vadose zone.

This remedial technology is not feasible since the installation of sub-grade components of the system would severely hinder future site construction. Therefore, the use of an air sparging system and vapor extraction system is not feasible.

Bioremediation

Bioremediation through the use of Oxygen-Releasing Compounds (ORCs) promotes the degradation of petroleum constituents through various conditions. In the Tri-State area, this degradation can be effectively achieved in aerobic conditions, which are promoted through the use of ORCs, which are typically injected into the plume in a slurry form. Once injected, the progress of the ORCs is evaluated through the implementation of a monthly groundwater and quarterly sampling program.

Given the size of the groundwater plume and the presence of perched groundwater on top of bedrock, the injection of ORCs would likely prove feasible since the injections of ORCs can be accomplished prior and during the planned remedial excavation at the Site without hindering future site construction. A cleanup using ORCs would likely result in a site closure being issued by NYSDEC. The injection of ORCs is also cost effective and would prove feasible to the Site.

Monitored Natural Attenuation

Monitored Natural Attenuation ("MNA") is a remedial technology by which the mass and concentration of the petroleum constituents are allowed to decrease to acceptable levels through physical, chemical and biological degradation processes. Some of these processes include dispersion, dilution, volatilization, sorption and biodegradation. Due to the relatively low to medium levels of petroleum constituents that comprise the groundwater plume, and the lack of potential receptors at and in the vicinity of the Site, the use of this technology on the groundwater plume would possibly prove feasible. However, the likely timeframe to perform a MNA program would prove unfeasible since the closure of the Spill is required to obtain a notice of satisfaction from other governmental agencies overseeing the Site remediation.

Based upon the above evaluations, the bioremediation technology consisting of ORC injections has been selected to remediate the plume of dissolved gasoline constituents present beneath the site.

DESCRIPTION OF SELECTED REMEDIAL OPTION

The selected remedial action described herein will consist of the remediation of the VOC groundwater plume through the application of ORC following excavation activities. The purpose of the ORC is to commence the *in-situ* bioremediation of the petroleum constituents in the groundwater. Depending on the Site conditions and the amount of soil present above the bedrock, the ORC will be either sprayed as powder or injected into the saturated zone as ORC slurry. The ORC slurry is a mixture of ORC powder and water. ORC will provide a long-term source of oxygen to the aquifer and soil. The oxygen flows within the aquifer and spreads out over time and will promote the natural biodegradation of the petroleum hydrocarbons.

Based upon groundwater data analytical data published by Hydro Tech, and as per the Manufacturer's specifications, it is estimated that approximately 180 pounds of ORC will be injected through twelve (12) evenly spaced direct push injection points in the northwestern and

eastern portions of the Lot 35. An anticipated 2.5 pounds of ORC will be applied per foot of the treatment zone with a 20-foot spacing between injection points within a row and 15-foot spacing between rows. A total of 15 pounds of ORC will be applied per point, considering a treatment zone of 10 foot thickness. As per the Manufacturer, the spacing between injection points is considered optimal and allows a better chance to address the area of contamination.

The solution will be injected in a semi-viscous, slurry form utilizing our Geoprobe® GS1000 Grout Machine. The Grout Machine will inject ORC directly through a Pressure Activated Injection Probe. This probe will be installed utilizing Hydro Tech's fleet of Geoprobe® units. The probes will be installed 6 feet below the excavation, approximately 8 feet deeper than the natural groundwater/soil interface. The ORC will then be injected under pressure from that depth to the level of excavation. **Figure 3** provides an ORC Injection Points Diagram. **Figure 3** also provides potential areas where ORC powder will be applied. **Attachment #2** provides the ORC calculation spreadsheets.

All monitoring wells will be sampled prior to ORC injections for the following ORC parameters:

- pH
- Dissolved Oxygen
- Total Organic Carbon
- Dissolved Manganese
- Redox Potential
- Ferrous Iron
- Groundwater Levels

The purpose of each parameter is as follows:

pH

pH is used to determine the longevity of the ORC. Longevity varies as a function of pH of the aquifer. ORC works well in a pH range of 7-12. pH is measured after the ORC is injected to track the progress of the ORC.

Dissolved Oxygen (DO)

DO is used to determine groundwater quality and if aerobic conditions have been established. DO is measured after the ORC is injected and sometimes cannot be measured until Carbon Levels are sufficiently reduced, because it may be used up as quickly as it is released from ORC.

Total Organic Carbon (TOC)

TOC is used to measure gross carbon levels in groundwater. TOC is related to the total oxygen demand. It is also used to track the progress of ORC over time. The TOC will be measured quarterly.

Dissolved Manganese (Mn)

Dissolved Mn will create an oxygen demand baseline. This is useful in estimating how much ORC is required. During the program, the dissolved Mn should decrease as conditions become more aerobic.

Redox potential

This is a measure of how the environment is reducing petroleum contaminants. As oxygen is released by the ORC, the redox levels typically increase. However, if redox conditions remain low, this is indicative that there is an additional oxygen demand, which is usually associated with petroleum hydrocarbons.

Ferrous Ion (Fe)

Ferrous ion will create an oxygen demand. As with Mn, the dissolved Fe will be reduced as the conditions become more aerobic.

Groundwater levels

All monitoring wells will be monitored in order to establish the current levels and determine if any fluctuations have occurred over time. This data will allow for a better understanding of the success of the remedial program. These results will verify that the groundwater has received the ORC injection and that the ORCs have affected the plume.

REMEDIAL ACTION REPORT

A Remedial Action Report (RAR) will be prepared upon the completion of the field work. The RAR will document the bioremedial injections and groundwater analytical results. The report will contain the results in the form of figures and tables, as applicable. All analytical results will be compared to NYSDEC groundwater Quality Standards (GQS) as listed in TOGS 1.1.1. This report will also outline the proposed monitoring schedule. The RAR will be submitted to the NYSDEC for their review and comment.

MONITORING AND SAMPLING SCHEDULE

The Site will be monitored on a monthly basis and sampled quarterly for a minimum period of 12 months following the ORC Advanced injection. Monthly monitoring and quarterly sampling data will be submitted to the NYSDEC in the form of Quarterly Status Reports for a minimum period of 12 months. Hydro Tech is prepared to commence work on this action plan upon your authorization.

ANTICIPATED PROJECT SCHEDULE

The table below provides a tentative schedule for the performance of the remediation project. This schedule is tentative based upon the approval of this RAP by the NYSDEC.

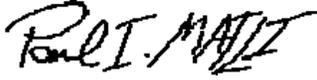
<u>Task</u>	<u>Time Interval</u>
<i>NYSDEC approval of RAP</i>	<i>N/A</i>
<i>Application of ORC Powder and ORC Injections</i>	<i>Immediately following remedial excavation</i>
<i>First Groundwater Sampling – Quarterly Status Report</i>	<i>Within 3 months of ORC injections</i>
<i>Second Groundwater Sampling – Quarterly Status Report</i>	<i>Within 6 months of ORC injections</i>
<i>Third Groundwater Sampling – Quarterly Status Report</i>	<i>Within 9 months of ORC injections</i>
<i>Fourth Groundwater Sampling – Quarterly Status Report</i>	<i>Within 12 months of ORC injections</i>

Groundwater remedial Action Plan
920-924 Westchester Avenue
Bronx, NY

Page 6 of 7

Should you have any questions, please feel free to contact our office at your convenience.

Very Truly Yours
Hydro Tech Environmental, Corp.

A handwritten signature in black ink, appearing to read "Paul I. Matli". The signature is stylized and somewhat cursive.

Paul I. Matli
Senior Project Engineer
PIM/ra

Enc.

cc: Hydro Tech File 100153 w/ Enc.
Mr. Emanuel Kanaris (MJM Construction Services, LLC.)

EXCLUSIONS & DISCLAIMER

The observations described in this report were made under the conditions stated therein. The conclusions presented in the report were based solely upon the services described therein, and not on scientific tasks or procedures beyond the scope of described services or the time and budgetary constraints imposed by the Client.

In preparing this report, **Hydro Tech Environmental, Corp.** may have relied on certain information provided by state and local officials and other parties referenced therein, and on information contained in the files of state and/or local agencies available to **Hydro Tech Environmental, Corp.** at the time of the subject property assessment. Although there may have been some degree of overlap in the information provided by these various sources, **Hydro Tech Environmental, Corp.** did not attempt to independently verify the accuracy or completeness of all information reviewed or received during the course of this subject property assessment.

Observations were made of the subject property and of structures on the subject property as indicated within the report. Where access to portions of the subject property or to structures on the subject property was unavailable or limited, **Hydro Tech Environmental, Corp.** renders no opinion as to the presence of non-hazardous or hazardous materials, or to the presence of indirect evidence relating to a non hazardous or hazardous materials, in that portion of the subject property or structure. In addition, **Hydro Tech Environmental, Corp.** renders no opinion as to the presence of hazardous materials, or the presence of indirect evidence relating to hazardous materials, where direct observation of the interior walls, floors, or ceiling of a structure on a subject property was obstructed by objects or coverings on or over these surfaces.

Hydro Tech Environmental, Corp. did not perform testing or analyses to determine the presence or concentration of asbestos at the subject property or in the environment of the subject property under the scope of the services performed.

The conclusions and recommendations contained in this report are based in part, where noted, upon the data obtained from a limited number of soil samples obtained from widely spaced subsurface explorations. The nature and extent of variations between these explorations may not become evident until further exploration. If variations or other latent conditions then appear evident, it will be necessary to reevaluate the conclusions and recommendations of this report.

Any water level reading made in test pits, borings, and/or observation wells were made at the times and under the conditions stated in the report. However, it must be noted that fluctuations in the level of groundwater may occur due to variations in rainfall and other factors different from those prevailing at the time measurements were made.

Except as noted within the text of the report, no qualitative laboratory testing was performed as part of the subject property assessment. Where such analyses have been conducted by an outside laboratory, **Hydro Tech Environmental, Corp.** has relied upon the data provided, and has not conducted an independent evaluation of the reliability of the data.

The conclusions and recommendations contained in this report are based in part, where noted, upon various types of chemical data and are contingent upon their validity. The data have been reviewed and interpretations were made in the report. As indicated within the report, some of the data may be preliminary "screening" level data, and should be confirmed with quantitative analyses if more specific information is necessary. Moreover, it should be noted that variations in the types and concentrations of contaminants and variations in their flow paths may occur due to seasonal water table fluctuations, past disposal practices, the passage of time, and other factors. Should additional chemical data become available in the future, the data should be reviewed, and the conclusions and recommendations presented herein modified accordingly.

Chemical analyses have been performed for specific constituents during the course of this subject property assessment, as described in the text. However, it should be noted that additional chemical constituents not searched for during the current study may be present in soil and/or groundwater at the subject property.

Any GPR survey described above was performed in accordance with good commercial and customary practice and generally accepted protocols within the consulting industry. **Hydro Tech Environmental, Corp.** does not accept responsibility for survey limitations due to inherent technological limitations or site specific conditions, however, **Hydro Tech Environmental, Corp.** made appropriate effort to identify and notify the client of such limitations and conditions. In particular, please note that the survey described above does not represent a full utility clearance survey, and does not relieve any party of applicable legal obligations to notify a utility one-call service prior to excavating or drilling.

FIGURE 1

SITE PLAN



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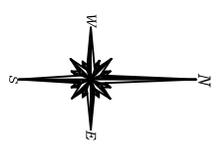
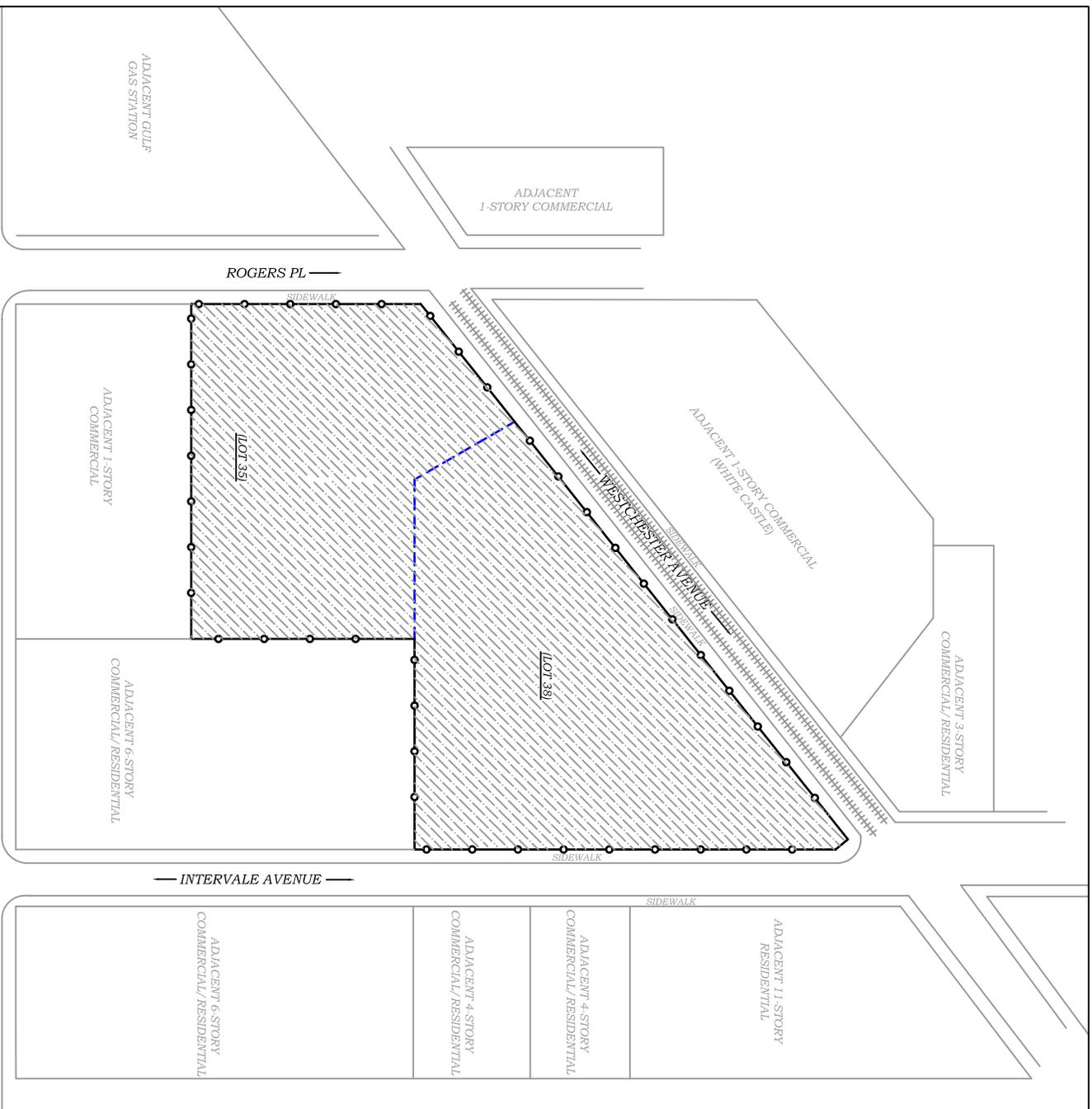
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920-924 Westchester Avenue
 Bronx, NY

Drawn By:	CQ
Reviewed By:	MR
Approved By:	MS
Date:	07/09/10
Scale:	AS NOTED

TITLE:

— EAST 163rd STREET —



- LEGEND:
- THE SITE
 - PLYWOOD FENCE
 - ELEVATED NYC TRANSIT RAILWAY
 - BOUNDARY LINE BETWEEN TWO LOTS



FIGURE 1: SITE PLAN

FIGURE 2

GROUNDWATER VOC CONTAMINATION DIAGRAM



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 Approved By: M.S.
 Date: 07/09/10
 Scale: AS NOTED

TITLE: **FIGURE 2. GROUNDWATER CONTAMINATION DIAGRAM**

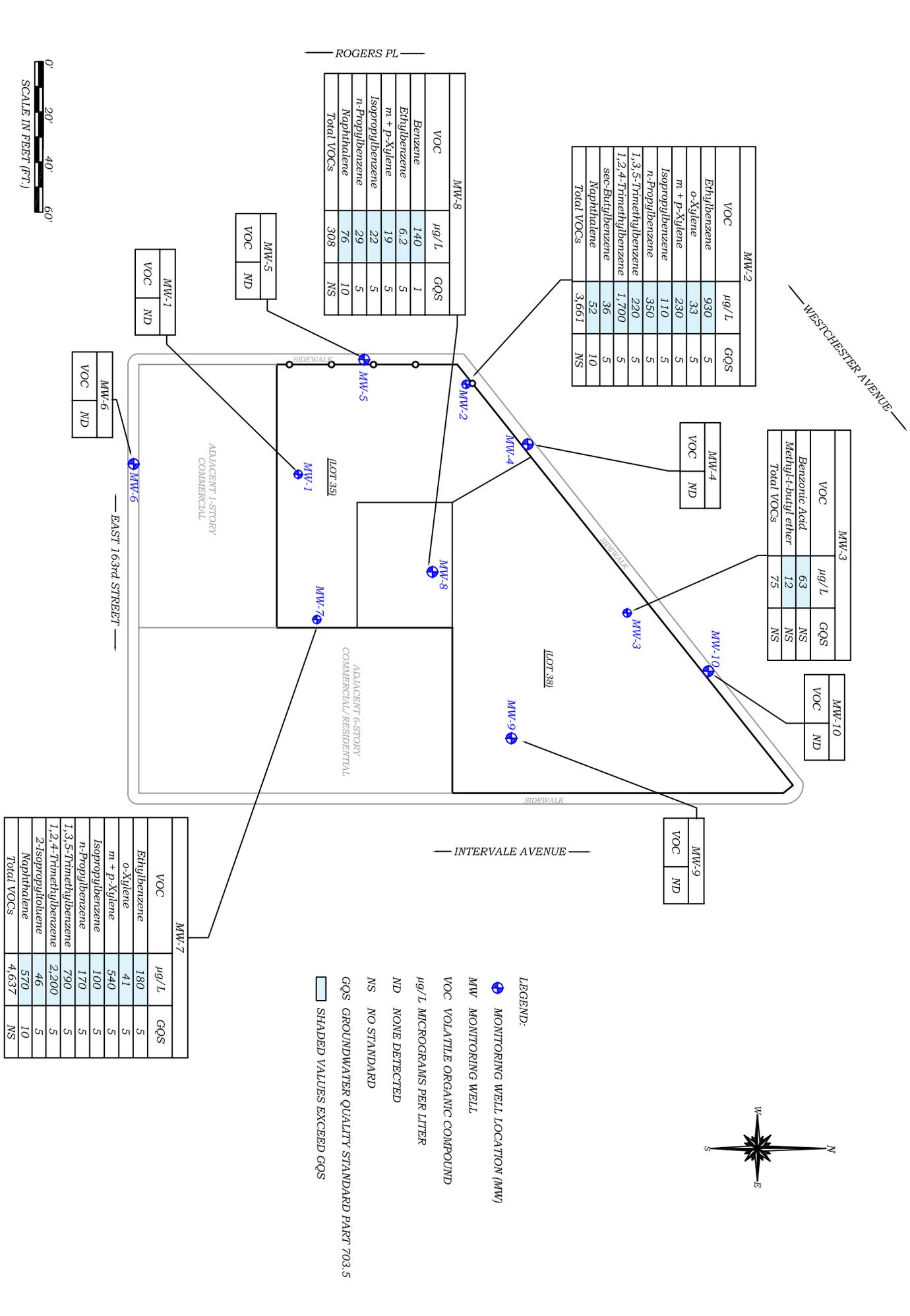


FIGURE 3

ORC INJECTION POINTS DIAGRAM



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Reviewed By:	M.R.
Approved By:	M.S.
Date:	07/09/10
Scale:	AS NOTED

TITLE:

FIGURE 3: ORC INJECTION POINTS DIAGRAM



- LEGEND:**
- POTENTIAL AREAS FOR SPRAYING ORC POWDER
 - PLYWOOD FENCE
 - ELEVATED NYC TRANSIT RAILWAY
 - BOUNDARY LINE BETWEEN TWO LOTS
 - ORC INJECTION POINT LOCATION
 - ORC OXYGEN RELEASE COMPOUND

ATTACHMENT #1

CORRESPONDENCES FROM THE NYSDEC AND MOER

New York State Department of Environmental Conservation

Division of Environmental Remediation, Region 2

One Hunters Point Plaza

47-40 21st Street, Long Island City, 11101

Phone: (718) 482-4995 • **Fax:** (718) 482-4098

Website: www.dec.ny.gov



Alexander B. Grannis
Commissioner

May 10, 2010

Emanuel Kanaris
924 Westchester Avenue, LLC
C/o MJM Construction Services
242-01 Braddock Ave.
Bellerose, NY 11426

**Re: Remedial Action Work Plan for:
920 Westchester Ave, Bronx, NY
NYSDEC Spill # 0700175**

Dear Mr. Kanaris:

The New York State Department of Environmental Conservation has received and reviewed the Proposed Remedial Action Work Plan (RAWP) prepared by Hydro Tech Environmental, Corp. dated February 24, 2010 for the above referenced site. The Department approves the plan.

Upon the completion of the RAWP, a detailed Remedial Action Report must be submitted to the Department including: site plan, cause of the release, summary of cleanup activities, site observations, contaminated material disposal manifests, boring logs, well installation logs, analytical sample results, conclusions and recommendations. **The report must be submitted to this office no later than two months from the date of this letter.** The department must be notified a minimum of 48 hours prior to the sampling event. Additional samples, borings, and/or monitoring wells may be required by the Department upon review of the report.

If you wish to discuss this letter, please call my office at (718) 482-4927.

Sincerely,

Ryan M. Piper

Engineering Geologist I

Spill Response and Prevention

cc: Rachel Ataman (Hydro Tech Environmental)



MAYOR'S OFFICE OF ENVIRONMENTAL REMEDIATION

253 Broadway - 14th Floor
New York, New York 10007

Daniel Walsh, Ph.D.

Director

Tel: (212) 788-8841

Fax: (212) 788-2941

March 3, 2010

Manny Kanaris
MJM Construction Services
242-01 Braddock Avenue
Bellrose, New York 11426

Re: 920-924 Westchester Avenue
Block 2697; Lot 35 & 38, Bronx, New York

Dear Mr. Kanaris:

The New York City Mayor's Office of Environmental Remediation (OER) is currently developing a new Local Brownfield Cleanup Program (LBCP) in New York City. This program will be administered by OER in cooperation with the New York City Department of Health and Mental Hygiene. The program requirements are similar to the New York State Brownfield Cleanup Program. The LBCP includes the assessment of all media i.e. soil, groundwater and soil vapors/sub-slab vapors.

OER met MJM Construction Services in a Pre-Application meeting on July 14, 2009. MJM has performed site investigations at the above referenced property under the guidance of the OER. The investigations included the assessment of the soil, groundwater and soil vapor. Based upon the results of the investigation MJM has also submitted a Remedial Action Plan and Construction Health and Safety Plan.

Based upon our findings, this Site will be eligible for enrollment in the Local Brownfield Cleanup Program. OER anticipates accepting this project into the LBCP when it officially opens. Upon the satisfactory completion of that program remediation, the site will be granted a Property Remediation Notice and a Green Property Certificate from the City of New York.

This property has two open spills, # 06-13228 and # 07-00175. You are required to close these spills under NYSDEC Spills Program and under their supervision.

If you have any questions or concerns please contact me at 212-442-3007 or email me at schawla@dep.nyc.gov.

Sincerely,

Shaminder Chawla
Bureau Chief, LBCP Program

ATTACHMENT #2
ORC CALCULATION SPREADSHEETS



Site Name: Avenue U
Location: 920-924 Westchester Avenue, Bronx, NY
Consultant: Hydro Tech

Site Conceptual Model/Extent of Plume Requiring Remediation

Width of plume (intersecting gw flow direction)
Length of plume (parallel to gw flow direction)
Depth to contaminated zone
Thickness of contaminated saturated zone
Nominal aquifer soil (gravel, sand, silty sand, silt, clay)
Total porosity
Hydraulic conductivity
Hydraulic gradient
Seepage velocity
Treatment Zone Pore Volume

Table with 3 columns: Parameter, Value, Unit. Includes values for width (25 ft), length (80 ft), depth (10 ft), thickness (6 ft), soil (silty sand), porosity (0.3), conductivity (10 ft/day), gradient (0.005 ft/ft), seepage velocity (73.0 ft/yr), and pore volume (3,600 ft^3).

Dissolved Phase Oxygen Demand:

Individual species that represent oxygen demand:

benzene
toluene
ethylbenzene
xylenes
MTBE
dichloroethene
vinyl chloride
User added, also add stoichiometric demand
User added, also add stoichiometric demand
reduced metals: Fe (+2) and Mn(+2)

Table with 5 columns: Contaminant, Conc (mg/L), Mass (lb), Stoich. (wt/wt) O2/contam., ORC (lb) (10% O2). Lists species like benzene, toluene, etc. with their respective values.

Measures of total oxygen demand

Total Petroleum Hydrocarbons
Biological Oxygen Demand (BOD)
Chemical Oxygen Demand (COD)

Summary table for total oxygen demand measures showing values for TPH, BOD, and COD.

Estimates for Sorbed Phase Oxygen Demand:

Soil bulk density
Fraction of organic carbon: foc
(Estimated using Soil Conc=foc*Koc*Cgw)
(Adjust Koc as nec. to provide realistic est.)

Table for soil bulk density and foc: 1.76 g/cm^3, 0.001 range: 0 to 0.01.

Individual species that represent oxygen demand:

benzene
toluene
ethylbenzene
xylenes
MTBE
dichloroethene
vinyl chloride
User added, also add stoichiometric demand
User added, also add stoichiometric demand

Table with 5 columns: Koc (L/kg), Contaminant, Conc (mg/kg), Mass (lb), Stoich. O2/contam., ORC (lb) (10% O2). Lists species with their Koc and ORC values.

Measures of total oxygen demand

Total Petroleum Hydrocarbons
Biological Oxygen Demand (BOD):
Chemical Oxygen Demand (COD):

Table showing BOD and COD values with notes: 'Use a multiple of dissolved phase -> 1.00'.

Summary of Estimated ORC Requirements

Individual Species: Total BTEX, MTBE
Total Petroleum Hydrocarbons
Biological Oxygen Demand (BOD)
Chemical Oxygen Demand (COD)

Summary table with columns: ORC for Dissolved Phase (lbs), ORC for Sorbed Phase (lbs), Add Dem Factor (1 to 10x), ORC Total w/ Add Dem Factor, ORC Cost at 10.00. Includes a red arrow pointing to the total ORC value of 173.

Select above measure (button) to specify required ORC quantity (in 30 lb increments) ----->

180 pounds ORC

Delivery Design for ORC Slurry

Spacing within rows (ft)
points per row
Spacing between rows (ft)
of rows
Advective travel time bet. rows (days)
Number of points in grid
Required ORC per foot
Total ORC

Table with 2 columns: Parameter, Value. Includes spacing (20.0 ft), points per row (2), row spacing (15.0 ft), rows (6), travel time (75 days), points in grid (12), ORC per foot (2.5 lbs/foot), and total ORC (180 lbs).

Slurry Mixing Volume for Injections

Pounds per location
Buckets per location
Design solids content (20-40% by wt. for injections)
Volume of water required per hole (gal)
Total water for mixing all holes (gal)
Simple ORC Backfilling: min hole dia. for 67% slurry
Feasibility for slurry injection in sand: ok up to 15 lb/ft
Feasibility for slurry injection in silt: ok up to 10 lb/ft
Feasibility for slurry injection in clay: ok up to 5 lb/ft

Table with 2 columns: Parameter, Value. Includes values for pounds per location (15), buckets per location (0.5), design solids content (20%), water per hole (7 gal), total water (86 gal), and backfilling (2.6).



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VAPOR BARRIER DESIGN SPECIFICATIONS

**920-924 Westchester Avenue
Block 2697; Lots 35 & 38
Bronx, New York**

NYSDEC Spill #06-13228 & #07-00175

Prepared for

MJM Construction Services
242-01 Braddock Avenue
Bellerose, New York 11426

August 5th, 2010

Hydro Tech Job No.: 100153

VAPOR BARRIER DESIGN SPECIFICATIONS

920-924 Westchester Avenue
Block 2697; Lots 35 & 38
Bronx, New York

NYSDEC Spill #06-13228 & #07-00175

August 5th, 2010

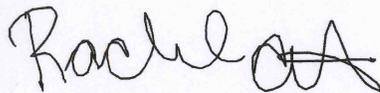
Tech Environmental, Corp. appreciates the opportunity to work for MJM Construction Services for the property located at 922-924 Westchester Avenue, (Block 4223, Lots 30 and 36), Bronx, New York.

Should you require any additional information or have any comments regarding the contents of this report, please feel free to contact our office at your convenience.

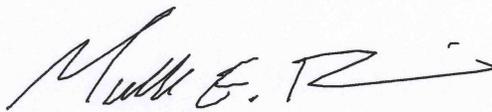
Very Truly Yours,
Hydro Tech Environmental, Corp.



X _____
Paul I. Matli
Senior Project Manager



X _____
Rachel Ataman
V.P. Technical Operations



X _____
Mark E. Robbins, C.P.G., C.E.I.
Senior Vice President

X _____
Shaik A. Saad, P.E.
Professional Engineer



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2.1 Important Notes for Site Work	2
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3.0 Vapor Mitigation Efforts	3
4.0 Design and Construction Procedures of the Vapor Barrier	4
4.1 Installation Preprufe 300R Liner	4
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1. Plan of Cellar Foundations
2. Elevation of Cellar Slab
3. Section A-A', B-B', C-C'
4. Section D-D', E-E'

Attachments

1. Specifications of Preprufe 300R and Bituthene 4000

1.0 EXECUTIVE SUMMARY

The Vapor Barrier Design Specifications have been prepared on behalf of MJM Construction Services (“**the Client**”) to document the details and protocols for the vapor mitigation of the proposed building at 922-924 Westchester Avenue, (Block 4223, Lots 30 and 36), Bronx, New York. The vapor barrier has been designed to sustain long-term exposure to all contaminants of concern at the Site. The property is designated with New York State Department of Environmental Conservation (NYSDEC) **Spill Numbers 06-13228 & #07-00175**.

The proposed development plan includes the construction of a 8-story mixed use residential, commercial and community building with a full cellar. The bottom of the proposed cellar slab will be approximately 11 feet below grade and the cellar slab will be approximately 9 inches in thickness. The depth to water beneath the Site ranges approximately from 7.78 to 10.98 feet below grade. Therefore, the cellar slab will be placed at the interface with groundwater. In order to prevent groundwater vapors from impacting the interior air of the proposed building, a vapor barrier consisting of a 46-mil low permeability Preprufe® 300R liner will be installed beneath the cellar slab, thereby ensuring that the groundwater-to-indoor air pathway is eliminated.

The vapor barrier will be installed under the direct oversight of a Hydro Tech Environmental, Corp. (Hydro Tech) Engineer. Following the completion of all site construction, Hydro Tech will perform a final site inspection and document the installation of the vapor barrier. The report will be signed and stamped by a NYS-licensed Professional Engineer and will include pictures of the vapor barrier. The report will be forward to the NYSDEC for review and approval.

2.0 INTRODUCTION

As a result of dissolved volatile gasoline constituents present beneath the Site located at 922-924 Westchester Avenue, (Block 4223, Lots 30 and 36), Bronx, New York Site, the NYSDEC required the developer to install an appropriate vapor barrier to prevent long term exposure to all contaminants of concern beneath the cellar slab. Based upon information provided by the client, the proposed development plan includes the construction of 8 story building with a full cellar. The caller slab will be poured at a depth of 11 feet below grade and will be approximately 9 inches in thickness. The cellar will be utilized as a parking area. The building will consist of residential, commercial and community facilities.

The written specifications and accompanying engineering plans for the proposed waterproofing vapor barrier complement and supplement each other. The Contractor shall review both of them for sizing and installing the proposed VBS.

These specifications consist of the following Sections:

1. Important Note for Site work – discusses safety issues that are specific to this Site
2. Standards – lists applicable standards for the installation of the vapor barrier
3. System Description – provides a brief overview of the proposed vapor barrier

2.1 Important Notes for Site Work

Open flames and smoking are prohibited in the work area.

During construction of the proposed VBS, the Contractor shall take all protective measures to ensure the health and safety of all site personnel from potential exposure to volatile organic materials and vapors. Care should also be taken to eliminate exposure to metals and semi-volatile compounds detected in the soil beneath the site.

2.2 Standards

The American Society for Testing and Materials (ASTM) Standard D2321-89 (re-approved 1995), “Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications,” is included here by reference. Unless otherwise stated below, the Contractor shall follow ASTM Standard D2321 during trenching, backfilling and piping construction. This specification is only needed in areas requiring trenching work.

In addition to the above standards, the Contractor shall follow all applicable Federal, State and Local codes, regulations and ordinances pertaining to construction and safety.

The Contractor shall consult with and follow the Engineer’s instructions in case any conflicts between these plans/specifications and any of the above standards arise.

3.0 VAPOR MITIGATION EFFORTS

1. Based on the information provided by the Client, the proposed cellar slab will be installed at depth of 11 feet below grade and will be approximately 9 inches in thickness. The depth to water beneath the Site ranges approximately from 7.78 to 10.98 feet below grade. Therefore, the bottom of the cellar slab will be placed at the interface with groundwater. Therefore, the vapor barrier designed for the building will consist of a 46-mil low permeability Preprufe® 300R liner beneath the slab and Bituthene 4,000 around the exterior of the foundation walls. **Figure 1** provides a Plan of the cellar foundations.

The essential guidelines for installing the vapor barrier beneath the cellar slab are listed below. The design and construction procedures for each are discussed in the section that follows:

- Eliminate barriers to sub-slab air flows such as sub-slab walls
- Install 46-mil low permeability Preprufe® 300R liner beneath the slab
- Seal major gas entry routes including slab and foundation joints and cracks and utility pipe penetrations
- Poor concrete on well sealed and clean Preprufe® 300R liner
- Extend vertically the Preprufe® 300R liner from beneath the slab and attach to Bituthene 4000 membrane thereby, sealing the exterior of foundation wall up to grade surface

Figure 2 provides the elevation plan of the cellar slab. **Figure 3A** and **Figure 3B** provide section view of the Preprufe 300R membrane applied beneath the slab to foundation walls, pile cap, ramp foundations, elevator pit and stairs foundations.

4.0 DESIGN AND CONSTRUCTION PROCEDURES OF THE VAPOR BARRIER

4.1 Installation of Preprufe® 300R Liner

- Before installing the Preprufe, the existing ground surface level shall be “dressed” to remove sharp or protruding objects such as roots or jagged rock fragments. An approximately 3-inch mud slab will be poured in place to provide a smooth and hard layer for installing the Preprufe membrane.
- When installing the Preprufe, sufficient slack shall be provided in the membrane when it is underneath the proposed cellar footings so that it will yield at least 2” without tearing, if and when any settling of the footing occurs.
- The Preprufe shall be continuous in order to be effective. The Preprufe shall completely cover the entire cellar area and enclose the sub-grade cellar slab. The Preprufe shall then be attached vertically to Bituthene 4000 membrane that will seal the exterior of foundation walls up to grade surface in accordance with the manufacturer’s specifications.
- Extreme care shall be taken to ensure that lap joints are double seamed and that tears and punctures are sealed utilizing Preprufe tape or high-density polyethylene (HDPE) Bituthene membrane.
- Once in place, concrete shall be poured in contact with the Preprufe membrane in accordance with the manufacturer’s specifications.

Manufacturer’s product sheets and specifications for Preprufe Waterproofing Liner – Preprufe® 300R and Bituthene 4000 membrane manufactured by Grace Construction Products are provided in **Attachment #1**. However, waterproofing membranes manufactured by any supplier may be used if they meet the minimum requirements above. Contractor shall follow waterproofing membrane manufacturer’s instructions for other installation instructions.

4.2 Separate Sub-Grade Areas

Concrete block walls connected to below grade areas shall be considered unsealed surfaces. All openings in concrete block walls that will not remain accessible upon completion of the building shall be sealed at both vertical and horizontal surfaces, in order to create continuous air barrier to limit the transport of soil-gas into the indoor air.

4.3 Interaction with Underground Conduits

Examples of utility penetrations through the building slab include water and sewer lines, utility lines to unit ventilators and radiators, electrical service entries, sub-slab conduits, air conditioner condensate drains and roof drains. The openings around these slab penetrations shall be sealed with polyurethane caulk. All unpressurized water and wastewater lines connected to the buildings shall be equipped with house traps (P-traps) to prevent the migration of gases through them into the building. These lines shall be equipped with vents on the outside of the building, such that the P-traps are located between these vents and the building to which they are connected. These measures are not needed for city water supply lines.

4.4 Other Considerations

1. If any trench construction or excavation is involved in the construction of the VBS, follow trench excavation instructions in ASTM D2321 and other applicable codes, regulations, and standards, including instructions for trench support and sloping as needed. Trench locations shall be clearly separated from the rest of the property with temporary fences,

- and access to the trench(s) shall be limited to only the workers and related equipment and shall be denied to all others. Construction shall be scheduled such that at the end of each day of work, all trench excavations during that day are backfilled and consolidated, such that the possibility of any human, animal, or equipment falling into the trench(s) or sinking into a loosely backfilled trench is eliminated. The safety practices of the Contractor shall not be limited to those described or specified above; the Contractor shall also take all safety measures and precautions that are necessary for this project depending on project specific conditions. The Contractor is responsible for ensuring the safety of workers, as well as all other people, animals or equipment on Site during all construction activities related to this project, including trench construction.
2. All soil material used as backfill ("fill") shall be completely free of organic material and free of all extraneous materials such as roots, tree stumps, construction spoils or any other material that would eventually degrade and cause a change in soil volume. Backfill shall also be free of rocks, bricks, nails or any other hard, sharp material that could damage the Preprufe membrane, geomembrane liner and gas collection piping in the trench.
 3. Backfill shall not contain any frozen material and shall not be placed on frozen ground because of significant damage that can occur when the material thaws. Backfill shall be mixed and deposited in a manner as to produce reasonable uniformity throughout the mass.
 4. Backfill shall be carefully deposited into the excavation and compacted to form a uniformly, dense and stable mass. Before a new layer of backfill is deposited on a freshly compacted layer, the surface of the compacted layer shall be scarified to enhance mechanical bonding between the surfaces of the two layers.
 5. Field inspections must be conducted while construction is in progress.

5.0 VAPOR INTRUSION MITIGATION PERFORMANCE

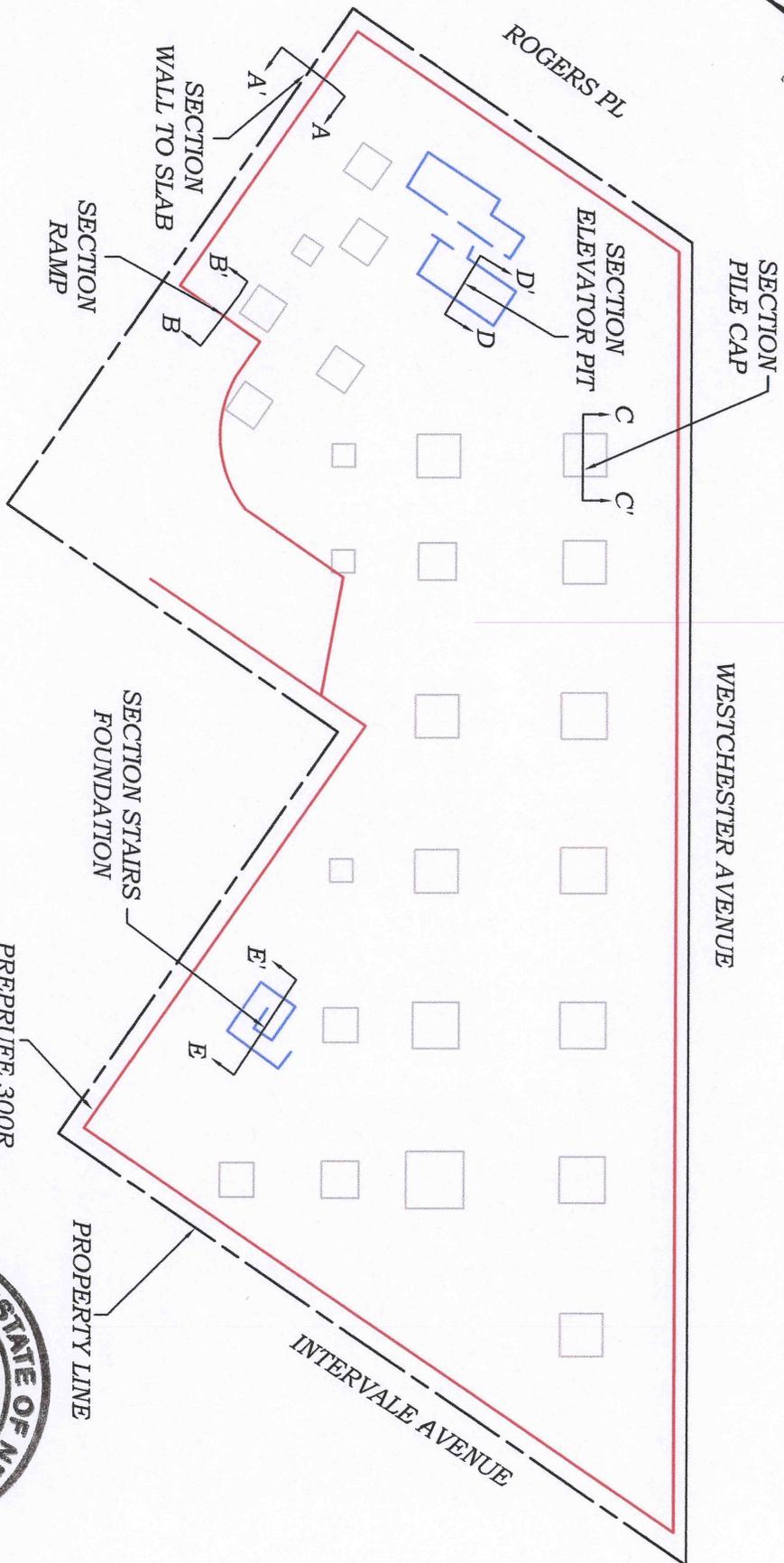
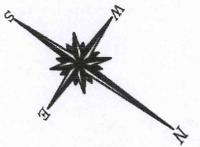
As a general rule, in order to adequately test the effectiveness of vapor intrusion mitigation, the potential negative pressure caused by the building's heating, ventilation and air-conditioning (HVAC) systems must be accounted for. Based on the NYSDOH VI Guidance, the winter months when heating systems are running is the time when vapor intrusion is most likely to result in a completed exposure pathway. Since the cellar will be utilized as a parking area equipped with a continuous aeration and ventilation system, a vapor intrusion mitigation test will not be necessary.

6.0 REFERENCES

1. Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York. New York State Department of Health, October 2006.
2. Grace Waterproofing Systems, Contractor's Handbook, Grace Construction Products, July 2008.

FIGURE 1

PLAN OF CELLAR FOUNDATIONS



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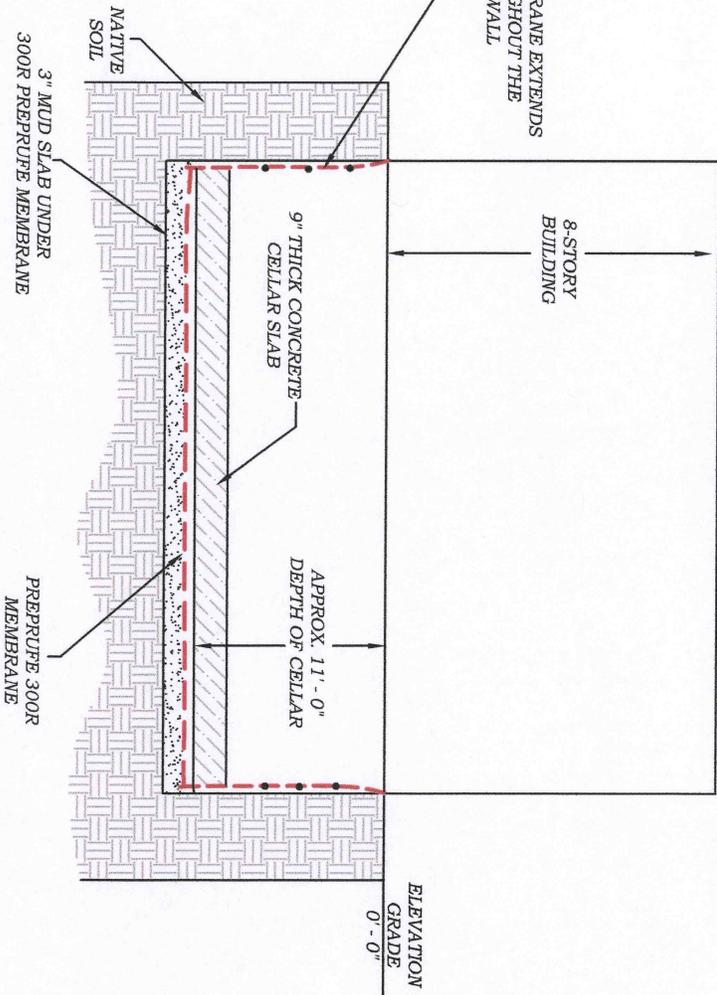
920-924 Westchester Avenue
 Bronx, NY

Drawn By:	CQ
Reviewed By:	MR
Approved By:	MS
Date:	07/29/10
Scale:	AS NOTED

FIGURE 1: PLAN OF CELLAR FOUNDATIONS

FIGURE 2
ELEVATION OF CELLAR SLAB

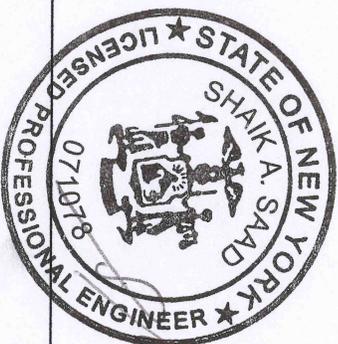
BITUMHENE 4000 MEMBRANE EXTENDS VERTICALLY THROUGHOUT THE FOUNDATION WALL



ELEVATION PLAN

NOTES:

1. ALL ELEVATIONS ARE RELATIVES TO EXISTING GRADE, WHICH IS ARBITRARILY ASSUMED TO BE AT 0' - 0" EL.
2. THE VAPOR BARRIER DESIGN IS INDEPENDENT OF THE ACTUAL TYPE OF FOUNDATION CONSTRUCTED AT THE SITE. ANY OBJECTS THAT BISECT THE LINER SUCH AS PIERS OF PILES MUST BE CUT THROUGH THE MEMBRANE AND CONTACT BETWEEN THE BARRIER AND OBJECT MUST BE SEALED AS PER THE MANUFACTURER'S RECOMMENDATION
3. BUILDING HEIGHT AND THE SHAPE OF THE ROOF ARE APPROXIMATE.



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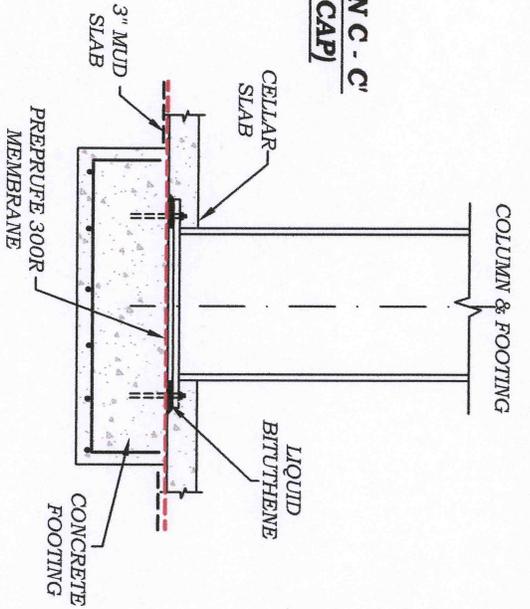
920-924 Westchester Avenue
Bronx, NY

Drawn By: C.O.	TTTLE
Reviewed By: M.R.	
Approved By: M.S.	
Date: 07/29/10	
Scale: AS NOTED	

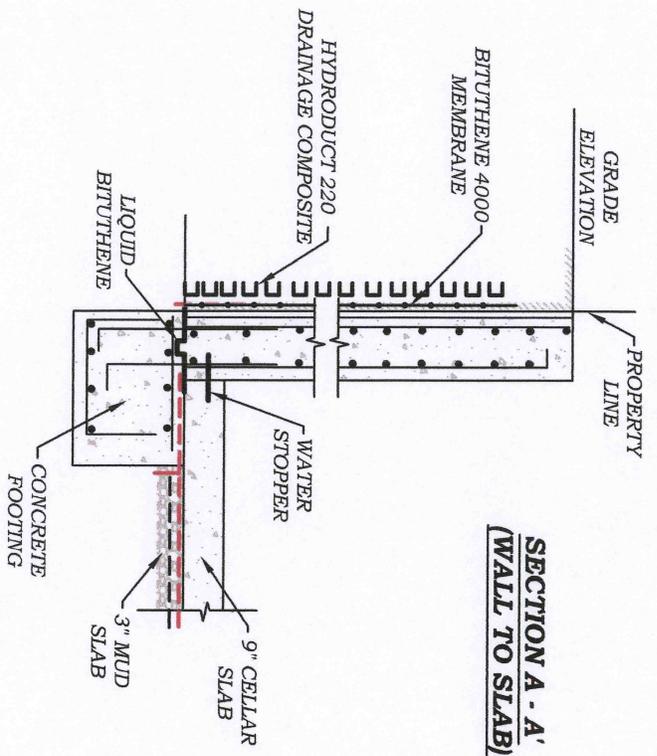
FIGURE 2: ELEVATION OF CELLAR SLAB

FIGURE 3
SECTION A-A', B-B', C-C'

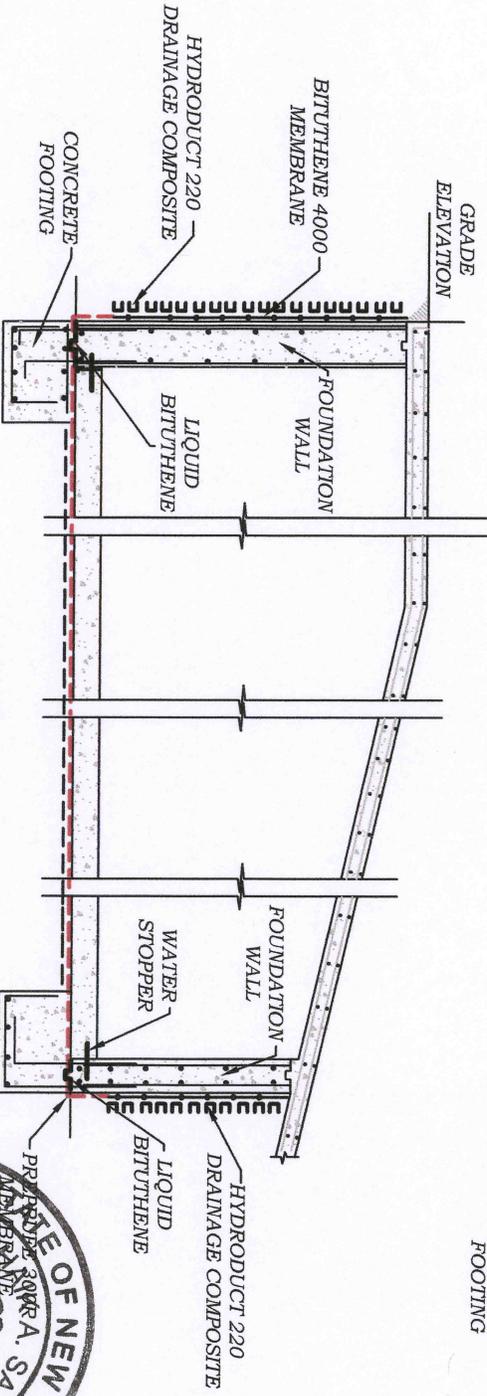
**SECTION C - C'
(PILE CAP)**



**SECTION A - A'
(WALL TO SLAB)**



**SECTION B - B'
(RAMP)**



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Date: 07/29/10	
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FIGURE 3A. SECTIONS (A - C - C')

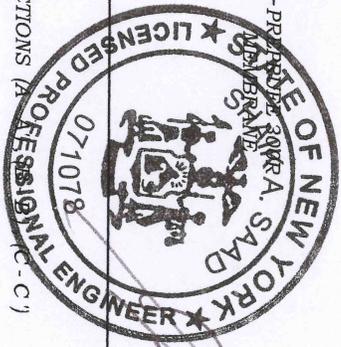
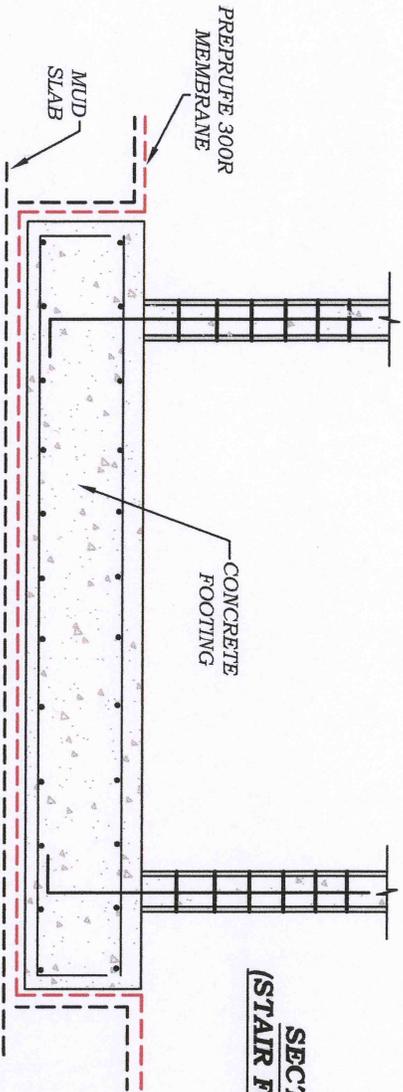
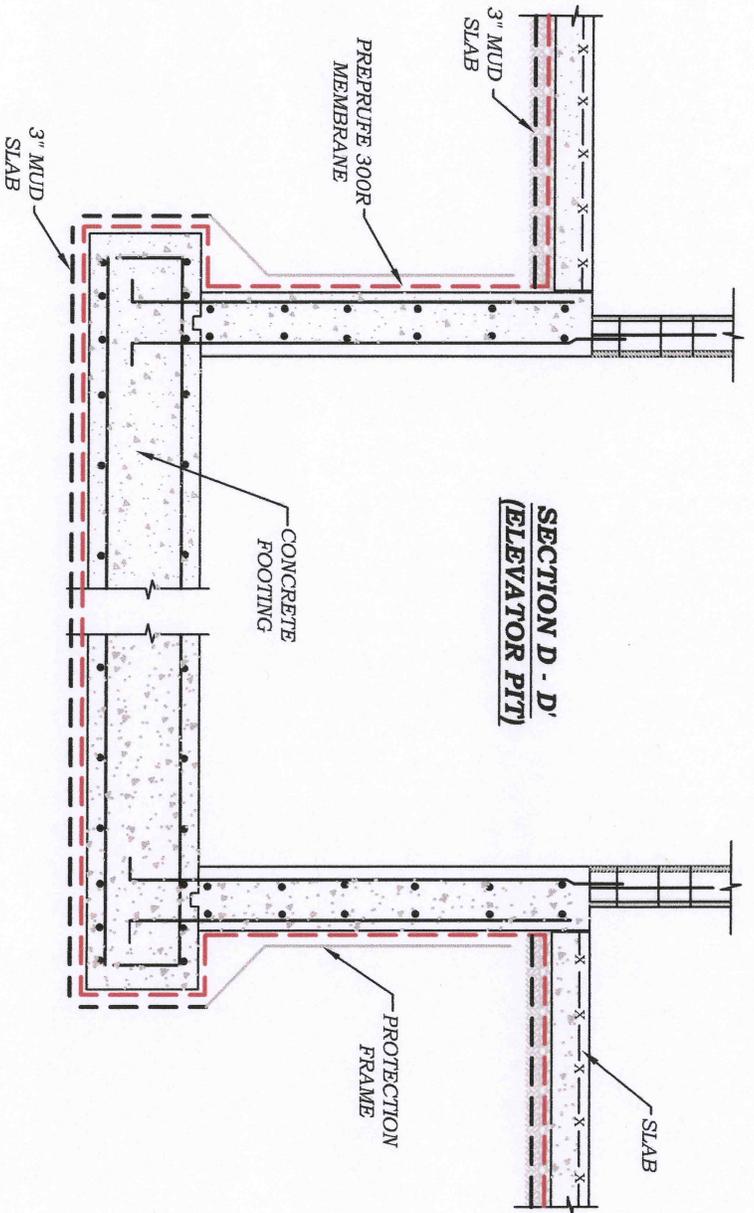


FIGURE 4
SECTION D-D', E-E'



SECTION E - E'
(STAIR FOUNDATIONS)

SECTION D - D'
(ELEVATOR PIT)



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TITLE:

FIGURE 3B: SECTIONS (D - D') & (E - E')



ATTACHMENT #1

SPECIFICATIONS OF PREPRUFE 300R AND BITUTHENE 4000

PREPRUFE® 300R & 160R

Pre-applied waterproofing membranes that bond integrally to poured concrete for use below slabs or behind basement walls on confined sites

Description

Preprufe® 300R & 160R membranes are unique composite sheets comprising a thick HDPE film, an aggressive pressure sensitive adhesive and a weather resistant protective coating.

Unlike conventional non-adhering membranes, which are vulnerable to water ingress tracking between the unbonded membrane and structure, the unique Preprufe bond to concrete prevents ingress or migration of water around the structure.

The Preprufe R System includes:

- **Preprufe 300R**—heavy-duty grade for use below slabs and on rafts (i.e. mud slabs). Designed to accept the placing of heavy reinforcement using conventional concrete spacers.
- **Preprufe 160R**—thinner grade for blindside, zero property line applications against soil retention systems.
- **Preprufe Tape LT**—for covering cut edges, roll ends, penetrations and detailing (temperatures between 25°F (-4°C) and 86°F (+30°C)).
- **Preprufe Tape HC**—as above for use in Hot Climates (minimum 50°F (10°C)).
- **Bituthene® Liquid Membrane**—for sealing around penetrations, etc.

Preprufe 300R & 160R membranes are applied either horizontally to smooth prepared concrete, carton forms or well rolled and compacted sand or crushed stone substrate; or vertically to permanent formwork or adjoining structures. Concrete is then cast directly against the adhesive side of the membranes. The specially developed Preprufe adhesive layers work together to form a continuous and integral seal to the structure.

Preprufe can be returned up the inside face of slab formwork but is not recommended for conventional twin-sided formwork on walls, etc. Use Bituthene self-adhesive membrane or Procor® fluid applied membrane to walls after removal of formwork for a fully bonded system to all structural surfaces.

Advantages

- **Forms a unique continuous adhesive bond to concrete poured against it**—prevents water migration and makes it unaffected by ground settlement beneath slabs
- **Fully-adhered watertight laps** and detailing
- **Provides a barrier to water, moisture and gas**—physically isolates the structure from the surrounding ground
- **BBA Certified** for basement Grades 2, 3, & 4 to BS 8102:1990
- **Zero permeance** to moisture

- **Solar reflective**—reduced temperature gain
- **Simple and quick to install**—requiring no priming or fillets
- **Can be applied to permanent formwork**—allows maximum use of confined sites
- **Self protecting**—can be trafficked immediately after application and ready for immediate placing of reinforcement
- **Unaffected by wet conditions**—cannot activate prematurely
- **Inherently waterproof, non-reactive system:**
 - not reliant on confining pressures or hydration
 - unaffected by freeze/thaw, wet/dry cycling
- **Chemical resistant**—effective in most types of soils and waters, protects structure from salt or sulphate attack

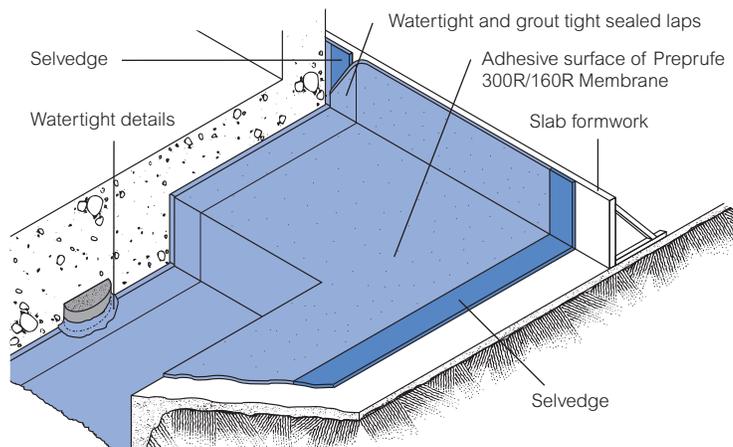
Installation

The most current application instructions, detail drawings and technical letters can be viewed at www.graceconstruction.com. Technical letters are provided for the following subjects to assist in the installation of Preprufe:

- Chemical Resistance
- Minimizing Concrete Shrinkage and Curling
- Rebar Chairs on Preprufe 300R Membrane
- Removal of Formwork Placed Against Preprufe Membranes
- Winter Lap Sealing and the use of Preprufe Tape LT

For other technical information contact your local Grace representative.

Preprufe 300R & 160R membranes are supplied in rolls 4 ft (1.2 m) wide, with a selvedge on one side to provide self-adhered laps for continuity between rolls. The rolls of Preprufe Membrane and Preprufe Tape are interwound with a disposable plastic release liner which must be removed before placing reinforcement and concrete.



Drawings are for illustration purposes only. Please refer to www.graceconstruction.com for specific application details.

Substrate Preparation

All surfaces—It is essential to create a sound and solid substrate to eliminate movement during the concrete pour. Substrates must be regular and smooth with no gaps or voids greater than 0.5 in. (12 mm). Grout around all penetrations such as utility conduits, etc. for stability (see Figure 1).

Horizontal—The substrate must be free of loose aggregate and sharp protrusions. Avoid curved or rounded substrates. The surface does not need to be dry, but standing water must be removed.

Vertical—Use concrete, plywood, insulation or other approved facing to sheet piling to provide support to the membrane. Board systems such as timber lagging must be close butted to provide support and not more than 0.5 in. (12 mm) out of alignment.

Membrane Installation

Preprufe can be applied at temperatures of 25°F (-4°C) or above. When installing Preprufe in cold or marginal weather conditions 55°F (<13°C) the use of Preprufe Tape LT is recommended at all laps and detailing. Preprufe Tape LT should be applied to clean, dry surfaces and the release liner must be removed immediately after application.

Horizontal substrates—Place the membrane HDPE film side to the substrate with the clear plastic release liner facing towards the concrete pour. End laps should be staggered to avoid a build up of layers. Leave plastic release liner in position until overlap procedure is completed (see Figure 2).

Accurately position succeeding sheets to overlap the previous sheet 3 in. (75 mm) along the marked selvedge. Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap. Peel back the plastic release liner from between the overlaps as the two layers are bonded together. Ensure a continuous bond is achieved without creases and roll firmly with a heavy roller. Completely remove the plastic liner to expose the protective coating. Any initial tack will quickly disappear.

Refer to Grace Tech Letters for information on suitable rebar chairs for Preprufe.

Vertical substrates—Mechanically fasten the membrane vertically using fasteners appropriate to the substrate with the clear plastic release liner facing towards the concrete pour. The membrane may be installed in any convenient length. Secure the top of the membrane using a batten such as a termination bar or similar 2 in. (50 mm) below the top edge (see Figure 3). Fastening can be made through the selvedge so that the membrane lays flat and allows firmly rolled overlaps. Immediately remove the plastic release liner. Any additional fasteners must be covered with a patch of Preprufe Tape (see Figure 4).

Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap. Roll firmly to ensure a watertight seal.

Roll ends and cut edges—Overlap all roll ends and cut edges by a minimum 3 in. (75 mm) and ensure the area is clean and free from contamination, wiping with a damp cloth if necessary. Allow to dry and apply Preprufe Tape LT (or HC in hot climates) centered over the lap and roll firmly. Immediately remove printed plastic release liner from the tape.

Details

Refer to Preprufe Field Application Manual, Section V Application Instructions or visit www.graceconstruction.com. This Manual gives comprehensive guidance and standard details for:

- internal and external corners
- penetrations
- tiebacks
- columns
- grade beam pilecaps
- tie-ins
- terminations

Membrane Repair

Inspect the membrane before installation of reinforcement steel, formwork and final placement of concrete. The membrane can be easily cleaned by jet washing if required. Repair damage by wiping the area with a damp cloth to ensure the area is clean and free from dust, and allow to dry. Repair small punctures (0.5 in. (12 mm) or less) and slices by applying Preprufe Tape centered over the damaged area and roll firmly. Remove the release liner from the tape. Repair holes and large punctures by applying a patch of Preprufe membrane, which extends 6 in. (150 mm) beyond the damaged area. Seal all edges of the patch with Preprufe Tape, remove the release liner from the tape and roll firmly. Any areas of damaged adhesive should be covered with Preprufe Tape. Remove printed plastic release liner from tape. Where exposed selvedge has lost adhesion or laps have not been sealed, ensure the area is clean and dry and cover with fresh Preprufe Tape, rolling firmly. Alternatively, use a hot air gun or similar to activate adhesive and firmly roll lap to achieve continuity.

Pouring of Concrete

Ensure the plastic release liner is removed from all areas of Preprufe R Membrane and Tape.

It is recommended that concrete be poured within 56 days (42 days in hot climates) of application of the membrane. Concrete must be placed and compacted carefully to avoid damage to the membrane. Never use a sharp object to consolidate the concrete.

Removal of Formwork

Preprufe membranes can be applied to removable formwork, such as slab perimeters, elevator and lift pits, etc. Once the concrete is poured the formwork must remain in place until the concrete has gained sufficient compressive strength to develop the surface bond. Preprufe membranes are not recommended for conventional twin-sided wall forming systems.

A minimum concrete compressive strength of 1500 psi (10 N/mm²) is recommended prior to stripping formwork supporting Preprufe membranes. Premature stripping may result in displacement of the membrane and/or spalling of the concrete.

As a guide, to reach the minimum compressive strength stated above, a structural concrete mix with an ultimate strength of 6000 psi (40 N/mm²) will typically require a cure time of approximately 6 days at an average ambient temperature of 25°F (-4°C), or 2 days at 70°F (21°C).

Figure 1



Figure 2

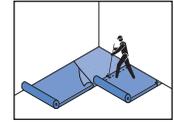
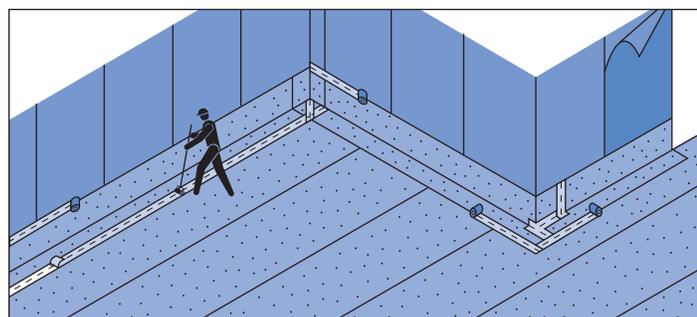
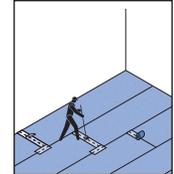


Figure 3



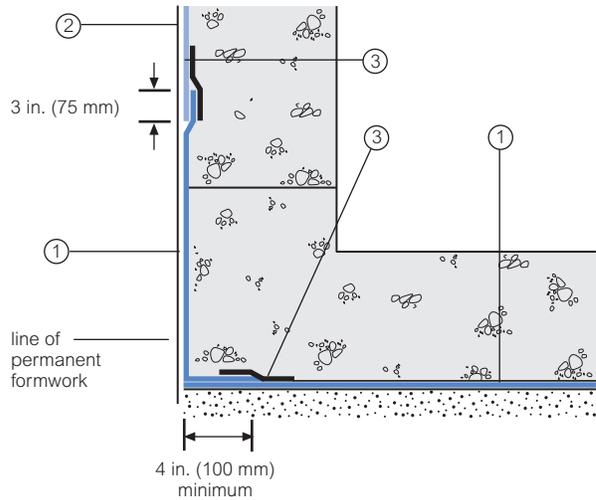
Figure 4



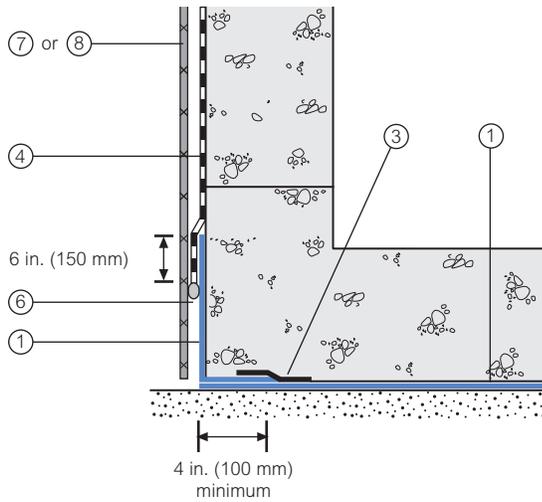
Detail Drawings

Details shown are typical illustrations and not working details. For a list of the most current details, visit us at www.graceconstruction.com. For technical assistance with detailing and problem solving please call toll free at 866-333-3SBM (3726).

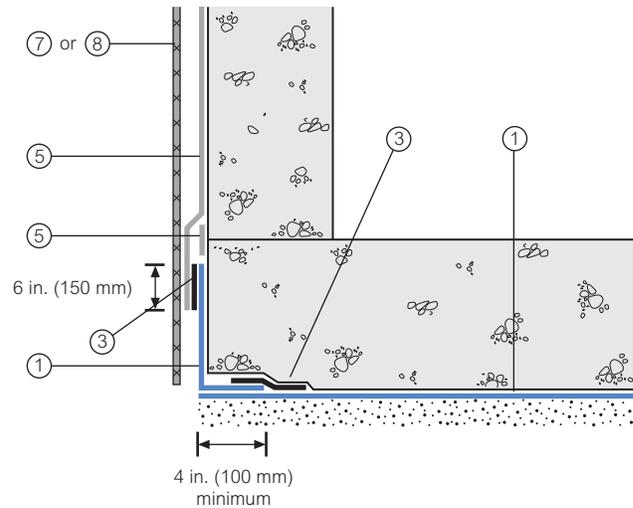
Wall base detail against permanent shutter



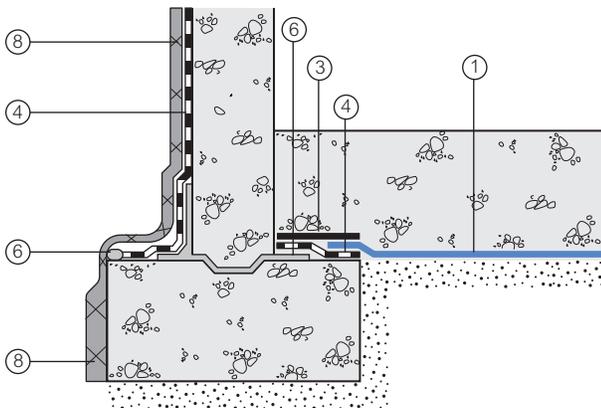
Bituthene wall base detail (Option 1)



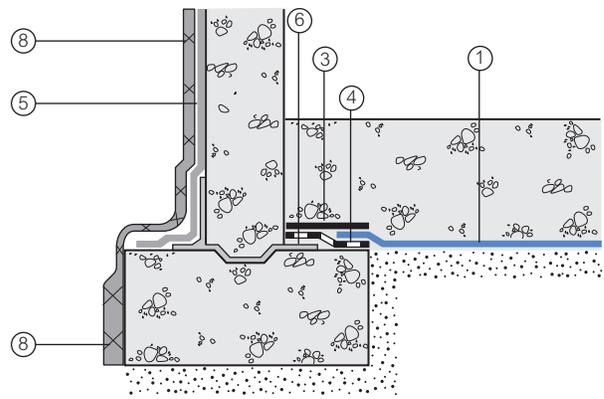
Procor wall base detail (Option 1)



Bituthene wall base detail (Option 2)



Procor wall base detail (Option 2)



1 Preprufe 300R
2 Preprufe 160R

3 Preprufe Tape
4 Bituthene

5 Procor
6 Bituthene Liquid Membrane

7 Protection
8 Hydroduct®

Supply

Dimensions (Nominal)	Preprufe 300R Membrane	Preprufe 160R Membrane	Preprufe Tape (LT or HC*)
Thickness	0.046 in. (1.2 mm)	0.032 in. (0.8 mm)	
Roll size	4 ft x 98 ft (1.2 m x 30 m)	4 ft x 115 ft (1.2 m x 35 m)	4 in. x 49 ft (100 mm x 15 m)
Roll area	392 ft ² (36 m ²)	460 ft ² (42 m ²)	
Roll weight	108 lbs (50 kg)	92 lbs (42 kg)	4.3 lbs (2 kg)
Minimum side/end laps	3 in. (75 mm)	3 in. (75 mm)	3 in. (75 mm)
* LT denotes Low Temperature (between 25°F (-4°C) and 86°F (+30°C)) HC denotes Hot Climate (50°F (>+10°C))			
Ancillary Products			
Bituthene Liquid Membrane—1.5 US gal (5.7 liter) or 4 US gal (15.1 liter)			

Physical Properties

Property	Typical Value 300R	Typical Value 160R	Test Method
Color	white	white	
Thickness	0.046 in. (1.2 mm) nominal	0.032 in. (0.8 mm) nominal	ASTM D3767
Low temperature flexibility	Unaffected at -10°F (-23°C)	Unaffected at -10°F (-23°C)	ASTM D1970
Resistance to hydrostatic head, minimum	231 ft (70 m)	231 ft (70 m)	ASTM D5385, modified ¹
Elongation, minimum	300%	300%	ASTM D412, modified ²
Tensile strength, film, minimum	4000 psi (27.6 MPa)	4000 psi (27.6 MPa)	ASTM D412
Crack cycling at -10°F (-23°C), 100 cycles	Unaffected	Unaffected	ASTM C836
Puncture resistance, minimum	221 lbs (990 N)	100 lbs (445 N)	ASTM E154
Peel adhesion to concrete, minimum	5.0 lbs/in. (880 N/m) width	5.0 lbs/in. (880 N/m) width	ASTM D903, modified ³
Lap peel adhesion	2.5 lbs/in. (440 N/m) width	2.5 lbs/in. (440 N/m) width	ASTM D1876, modified ⁴
Permeance to water vapor transmission, maximum	0.01 perms (0.6 ng/(Pa × s × m ²))	0.01 perms (0.6 ng/(Pa × s × m ²))	ASTM E96, method B
Water absorption, maximum	0.5%	0.5%	ASTM D570
Methane permeability	9.1 mls/m ² /day	N/A	University of London, QMW College ³
Permeability ⁵ (hydraulic conductivity)	K=<1.4 × 10 ⁻¹¹ cm.s ⁻¹	K=<1.4 × 10 ⁻¹¹ cm.s ⁻¹	ASTM D5084-90

Footnotes:

- Hydrostatic head tests of Preprufe Membranes are performed by casting concrete against the membrane with a lap. Before the concrete cures, a 0.125 in. (3 mm) spacer is inserted perpendicular to the membrane to create a gap. The cured block is placed in a chamber where water is introduced to the membrane surface up to the head indicated.
- Elongation of membrane is run at a rate of 2 in. (50 mm) per minute.
- Concrete is cast against the protective coating surface of the membrane and allowed to properly dry (7 days minimum). Peel adhesion of membrane to concrete is measured at a rate of 2 in. (50 mm) per minute at room temperature.
- The test is conducted 15 minutes after the lap is formed (per Grace published recommendations) and run at a rate of 2 in. (50 mm) per minute at 25°F (-4°C).
- Result is lower limit of apparatus. Membrane therefore considered impermeable.

Specification Clauses

Preprufe 300R or 160R shall be applied with its adhesive face presented to receive fresh concrete to which it will integrally bond. Only Grace Construction Products approved membranes shall be bonded to Preprufe 300R/160R. All Preprufe 300R/160R system materials shall be supplied by Grace Construction Products, and applied strictly in accordance with their instructions.

Specimen performance and formatted clauses are also available.

NOTE: Use Preprufe Tape to tie-in Procor with Preprufe.

Health and Safety

Refer to relevant Material Safety data sheet. Complete rolls should be handled by a minimum of two persons.

www.graceconstruction.com

For technical assistance call toll free at 866-333-3SBM (3726)

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Construction Products

1. Product Name

Preprufe® 300R and 160R Waterproofing Systems

2. Manufacturer

Grace Construction Products
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Cambridge, MA 02140
(866) 333-3SBM (3726)
Fax: (617) 498-4311
www.graceconstruction.com

3. Product Description

BASIC USE

Preprufe® 300R and Preprufe 160R membranes are used in blind side waterproofing applications where positive side waterproofing is desired but the positive side of the structure is not accessible once the concrete is poured.

Preprufe 300R Membrane is used primarily in under slab and below-grade split slab applications. Preprufe 300R Membrane is applied over properly prepared earth, stone or concrete. Concrete is cast against the adhesive side of the membrane. Preprufe 300R Membrane incorporates an exceptionally tough HDPE film and is designed to allow foot traffic directly on the membrane during construction.

Preprufe 160R Membrane is used in vertical applications. It is applied to properly prepared soil retention systems and concrete is cast against the membrane.

COMPOSITION & MATERIALS

Preprufe 300R and Preprufe 160R membranes are multilayered composite sheets consisting of an exceptionally tough HDPE film, a specially formulated synthetic pressure sensitive adhesive and a protective coating.

ACCESSORY COMPONENTS

- Preprufe Tape
- Preprufe Tieback Cover
- Bituthene® Liquid Membrane
- Preprufe CJ Tape

4. Technical Data

APPLICABLE STANDARDS

ASTM International

- ASTM C836 Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
- ASTM D412 Standard Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension
- ASTM D570 Standard Test Method for Water Absorption of Plastics
- ASTM D882 Standard Test Method for Tensile Properties of Thin Plastic Sheet
- ASTM D903 Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
- ASTM D1876 Standard Test Method for Peel Resistance of Adhesives (T-Peel Test)
- ASTM D1970 Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection
- ASTM D3767 Standard Practice for Rubber-Measurement of Dimensions
- ASTM D5385 Standard Test Method for Hydrostatic Pressure Resistance of Waterproofing Membranes
- ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials
- ASTM E154 Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover

PHYSICAL PROPERTIES

For detailed information on the physical properties of Preprufe 300R and Preprufe 160R Membranes, see Table 1.

5. Installation

Apply membranes when ambient temperatures are 25 degrees F (-4 degrees C) or above. Substrates must be smooth and sound with no gaps or voids in excess of 1/2" (13 mm).

FORMING SYSTEMS

It is very important to specify a forming system that is compatible with the Preprufe system. One-sided wall forming systems are clearly the best choice since there are no form ties used in this system. Therefore, there are no penetrations to the waterproofing layer. Other compatible systems include gang forms with load gathering form ties. These systems minimize the number of penetrations.

Hand set forming systems or, more specifically, use of form ties with ultimate load capabilities of less than 10,000 lb (44,500 N) per tie are not recommended. These systems have many form ties that penetrate the waterproofing.

Formwork

On vertical applications, use one-sided wall forming systems to minimize punctures in the membrane after the membrane is installed. Review Technical Letter "Forming Systems for use with Preprufe 160R Membrane."

APPLICATION

Vertical Applications

Apply the membrane with the thick white HDPE film side facing the prepared substrate and the protective coating side facing the concrete to be poured. The membrane may be installed in any convenient length vertically. For lengths of membrane greater than 8' (2.4 m), mechanically fasten the membrane at 2' (0.6 m) intervals centered in the self-adhesive selvedge prior to making the side lap, using small head nails or staples.

Using the lap line as a guide, apply subsequent sheets overlapping the in-place sheet 3" (75 mm) along the self-adhesive selvedge of the membrane. Avoid overlapping membrane beyond the guideline to prevent fishmouths. Should they occur, apply Preprufe Tape centered over the fishmouth, roll firmly to form a tight seal and remove release liner.

It is important that all nail heads be covered with the overlapping sheets of membrane. Side laps must be immediately rolled firmly to ensure a tight seal. A metal seam roller is recommended. To maximize adhesion in colder temperatures or in damp conditions, apply gentle heat to the lap area using a hot air gun (see Technical Letters). Overlap the ends of the membrane a minimum of 3" (75 mm). Remove and discard the release liner from both sheets. Apply Preprufe Tape centered over the end lap and edges of membrane not sealed by selvedge. Roll firmly to form a tight seal. Remove release liner from tape and discard.

For additional protection, Hydroduct® Tape may be applied between the sheets in the end lap area prior to application of the Preprufe Tape. Secure the top termination of the membrane with a termination bar and fasteners.

If the top termination is to be covered by the concrete pour, a strip of Preprufe CJ Tape must be placed over the termination bar and fasteners. Place the termination bar 2" (50 mm)

below the top edge of the membrane. If the membrane will tie into subsequent sheets of Preprufe, Bituthene Membrane or other waterproofing, leave an additional 12" (300 mm) length of Preprufe 160R membrane. Protect this length from damage and do not remove the release liner. This length of clean membrane will be used to complete the appropriate waterproofing details after the concrete or lift is poured.

Horizontal Applications

Roll out the membrane with the thick white HDPE film side facing the prepared substrate and the protective coating side facing the concrete to be poured. Remove the clear release liner at the time of installation. Using the lap line as a guide, align and roll out subsequent sheets overlapping the in-place sheet 3" (75 mm) along the self-adhesive selvage of the membrane. Side laps must be immediately rolled firmly to ensure a tight seal. A heavy metal seam roller is recommended.

Avoid overlapping membrane beyond the guideline to prevent fishmouths. Should this occur, apply Preprufe Tape centered over the fishmouth, roll firmly to form a tight seal and remove release liner. To maximize adhesion in

cooler temperatures or in damp conditions, apply gentle heat to the lap area using a hot air gun (see Technical Letters section of website). The membrane may be installed in any convenient length. Overlap the ends of the membrane 3" (75 mm) and remove and discard the release liner from both sheets. Apply Preprufe Tape centered over the end lap and edges of membrane not sealed by selvage. Roll firmly to form a tight seal. Remove release liner from tape and discard.

For additional protection, Hydroduct Tape may be applied between the sheets in the end lap area prior to application of the Preprufe Tape.

Internal & External Corners

Install the Preprufe Membrane according to standard application instructions detailed for vertical and horizontal applications above. Internal and external corners should be formed as shown in the Detail Drawings returning the membrane a minimum of 4" (100 mm).

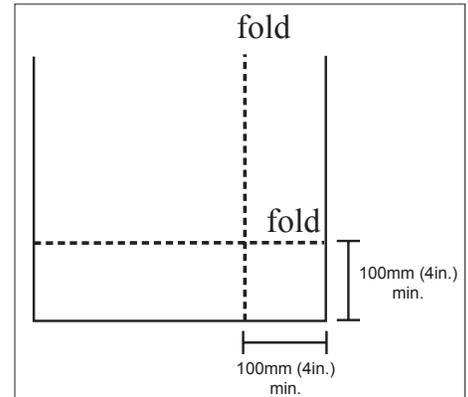


Figure 1

Internal Corners

Fold the membrane as indicated in Figure 1. Crease the fold with nominal hand pressure to ensure a close fit to the substrate profile and avoid hollows. With the white coating facing toward the concrete, ensure that the apex of the corner is covered and sealed with Preprufe Tape. Remove release liner and roll firmly.

External Corners

Fold the membrane as indicated in Figure 1. Crease the fold with nominal hand pressure to

TABLE 1 PHYSICAL PROPERTIES OF PREPRUFE 160R AND PREPRUFE 300R MEMBRANES

Property & test method	Typical values	
	Preprufe 160R Membrane	Preprufe 300R Membrane
Color	White	White
Thickness, ASTM D3767, Method A	0.032" (0.8 mm) nominal	0.046" (1.2 mm) nominal
Low temperature flexibility, ASTM D1970	Unaffected at -10°F (-23°C)	Unaffected at -10°F (-23°C)
Resistance to hydrostatic head, minimum, ASTM D5385, Modified ¹	23T (70 m)	23T (70 m)
Elongation, minimum, ASTM D412, Modified ²	300%	300%
Tensile strength, film, minimum, ASTM D882	4000 psi (27.6 MPa)	4000 psi (27.6 MPa)
Crack cycling, at -10°F (-23°C), 100 cycles, ASTM C836	Unaffected	Unaffected
Puncture resistance, minimum, ASTM E154	100 lb (445 N)	221 lb (990 N)
Peel adhesion to concrete, minimum, ASTM D903, Modified ³	5.0 lb/in width (880 N/m)	5.0 lb/in width (880 N/m)
Lap peel adhesion, ASTM D1876, Modified ⁴	2.5 lb/in width (440 N/m)	2.5 lb/in width (440 N/m)
Permeance to water vapor transmission, maximum, ASTM D96, Method B	0.01 perms (0.6 ng/(Pa × s × m ²))	0.01 perms (0.6 ng/(Pa × s × m ²))
Water absorption, maximum, ASTM D570	0.5%	0.5%

¹ Hydrostatic head tests of Preprufe Membranes are performed by casting concrete against the membrane with a lap. Before the concrete cures, a 0.125" (3 mm) spacer is inserted perpendicular to the membrane to create a gap. The cured block is placed in a chamber where water is introduced to the membrane surface up to the head indicated.

² Elongation of membrane is run at a rate of 2" (51 mm) per minute.

³ Concrete is cast against the protective coating surface of the membrane and allowed to properly dry (7 days minimum). Peel adhesion of membrane to concrete is measured at a rate of 2" (51 mm) per minute at room temperature.

⁴ The test is conducted 15 minutes after the lap is formed (per Grace published recommendations) and run at a rate of 2" (51 mm) per minute at 25°F (-4°C).

ensure a close fit to the substrate profile and avoid hollows. Cut the Preprufe membrane in order to wrap around corner. With the white coating facing toward the concrete, ensure that the apex of the corner is covered and sealed with Preprufe Tape. Remove release liner and roll firmly.

Round Penetrations

For Service Pipes, Lighting Conduit, Piles, etc. - Follow these steps to seal around penetrations:

1. All penetrations must be firmly secured and stable. Grout around all penetrations that are not stable. Clean loose dust or dirt from the penetration surface using a clean, dry cloth or brush. Remove rust, if applicable, with a wire brush and wipe clean.
2. Cut the field membrane tight to the penetration and remove release liner. If membrane is not within 1/2" (12 mm) of penetration and not more than 2" (50 mm) from penetration, apply Preprufe Tape to cover the gap. Roll firmly into place and remove release liner. If the membrane is greater than 2" (51 mm) from penetration, install more Preprufe Membrane to cover the gap, repeating these instructions until Preprufe

Membrane/Tape is within 1/2" (12 mm).

3. Mix and apply Bituthene Liquid Membrane around the penetration. Liquid Membrane should be placed to form a minimum 1" (25.4 mm) continuous fillet between the Preprufe Membrane/Tape and the base of the penetration.
4. Cut a patch of Preprufe Membrane that is a minimum of 12" (300 mm) larger than the diameter or width of the penetration so that the patch extends 6" (150 mm) beyond the penetration in all directions. Remove the release liner and center the patch over penetration and trace/draw the penetration profile onto the patch. Using sheers or a utility knife, make relief cuts through the membrane. Triangles formed by making a

relief cut are not to exceed 2" (50 mm) in height when placed over penetration. In other words, penetration diameters greater than 4" (100 mm) need to be trimmed. Remove and discard release liner.

5. Slide the patch over penetration and press into the partially cured Liquid Membrane. Ensure that the patch is pressed firmly into the Liquid Membrane and is positioned directly onto the Preprufe Field Membrane/Tape below. Using a trowel, smooth out any Liquid Membrane that has flowed out of the relief cut.
6. Apply Preprufe Tape centered over the edges of the patch and roll firmly to form a tight seal. Remove release liner from tape and discard.
7. Wrap the penetration with Preprufe Tape, positioning the tape at the base of the patch. Remove enough release liner to overlap Tape onto itself and roll/press firmly into place. Remove remaining release liner and discard.

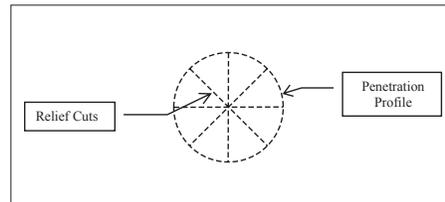


Figure 2

Straight Edge Penetrations

For square piles, steel columns, walers, rakers, etc. - Follow these steps to seal around

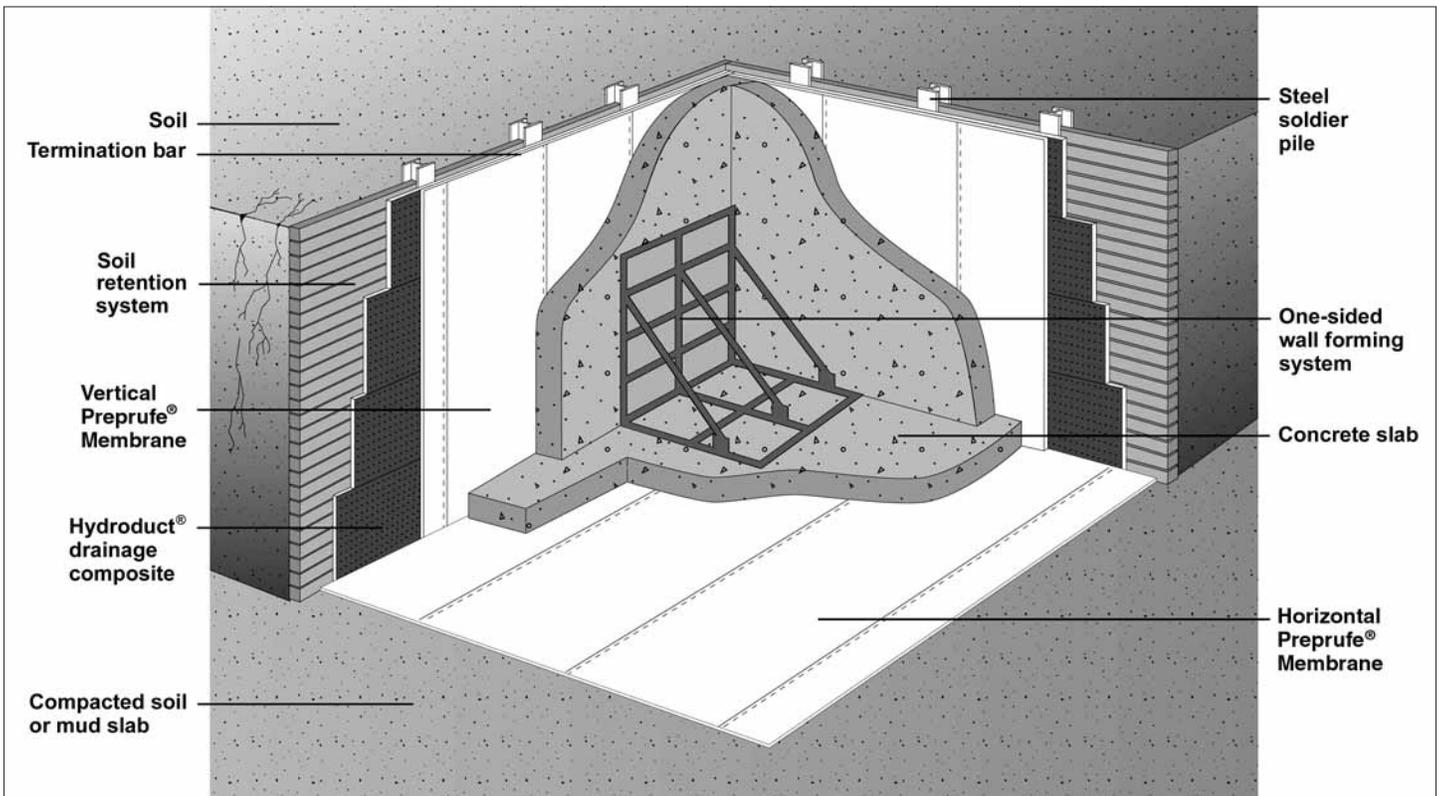


Figure 3 Preprufe® Waterproofing Systems

penetrations:

1. All penetrations must be firmly secured and stable. Grout around all penetrations that are not stable. Clean loose dust or dirt from the penetration surface using a clean, dry cloth or brush. Remove rust, if applicable, with a wire brush and wipe clean.
2. Cut the field membrane tight to the penetration and remove release liner. If membrane is not within 1/2" (12 mm) of penetration and not more than 2" (51 mm) from penetration, apply Preprufe Tape to cover the gap. Roll firmly into place and remove release liner. If the membrane is greater than 2" (51 mm) from penetration, install more Preprufe Membrane to cover the gap repeating these instructions until Preprufe Membrane/Tape is within 1/2" (12 mm).
3. Mix and apply Bituthene Liquid Membrane around the penetration. Liquid Membrane should be placed to form a minimum 1" (25.4 mm) continuous fillet between the Preprufe Membrane/Tape and the base of the penetration. Apply a 90 mil (2.2 mm) continuous coating overlapping a minimum of 3" (75 mm) onto the surface of the Preprufe Membrane and the penetration.
4. Install a minimum 12" (300 mm) strip of Bituthene Membrane centered over the Preprufe Membrane and the penetration intersection.
5. Install Preprufe Tape to cover the strip of Bituthene Membrane by overlapping a minimum of 1" (25.4 mm) until a minimum of 2" (51 mm) overlap onto the Preprufe Membrane is achieved.
6. Terminate the top edge of the strip of Bituthene Membrane and Preprufe Tape along the penetration with a bead of Bituthene Liquid Membrane.

Wall Penetrations

For Rebar, All-Thread, Metal Dowels, etc. - Follow these steps to seal around penetrations:

1. Clean loose dust or dirt from the penetration and the surrounding substrate surface using a clean, dry cloth or brush. Remove rust, if applicable, with a wire brush and wipe clean.
2. Mix and apply Bituthene Liquid Membrane around the penetration. Liquid Membrane should be placed to form a minimum 1" (25.4 mm) continuous fillet between the substrate and the base of the penetration.
3. Cut the field membrane tight to the penetration and remove release liner. If membrane is not within 1/2" (12 mm) of penetration and not more than 2" (51 mm) from

penetration, apply Preprufe Tape to cover the gap. Roll firmly into place and remove release. If the membrane is greater than 2" (51 mm) from penetration, install more Preprufe Membrane to cover the gap repeating these instructions until Preprufe Membrane/Tape is within 1/2" (12 mm).

4. Position the field membrane snug to the penetration so that it is a maximum of 1/2" (12 mm) from the base of the penetration and press firmly into the partially cured Liquid Membrane.
5. Apply Liquid Membrane to form a minimum 1" (25.4 mm) continuous fillet between the Preprufe Membrane and the base of the penetration. Extend a 90 mil (2.2 mm) continuous coating of Liquid Membrane overlapping a minimum of 3" (75 mm) onto the surface of the Preprufe Membrane and 6" (150 mm) onto the penetration.
6. Wrap the penetration with Preprufe Tape, positioning the tape at the base of the penetration. Remove enough release liner to overlap tape onto itself and roll/press firmly into place. Remove remaining release liner and discard.

Tiebacks

The Preprufe Tieback Cover is a specially designed, two-part cover used to maintain waterproofing integrity at soil retention tieback heads. The Preprufe Tieback Cover consists of a rigid ABS plastic base and pre-fabricated Preprufe membrane cover.

1. Install Preprufe Membrane within 2" of tieback as per standard installation instructions.
2. Center the base over tieback head and secure base to soil retention system using appropriate fasteners. Fasteners should have a low profile head.
3. Apply Preprufe Tape centered over the edge of the base flange and roll firmly to form a tight seal. Remove release liner and discard.
4. Position the membrane cover over the base taking care to ensure the cover flange sits flat onto the Preprufe Membrane.
5. Apply Preprufe Tape centered over the edge of the cover flange and roll firmly to form a tight seal. Remove release liner and discard.

Note: All Preprufe Tape should overlap onto surfaces of tape, membrane, base, cover, etc., a minimum of 50 mm (2").

Columns

There are 2 common methods to create a waterproof seal under columns.

- Column Option 1 - Preprufe Membrane is placed over the column footing and directly under the column. Tie-in penetrations such as rebar and threaded rod that penetrate the membrane should be sealed with Bituthene Liquid Membrane. Cut the membrane tight to the penetration. If membrane is not within 1/2" (12 mm) of penetration, apply Preprufe Tape to cover the gap. Mix and apply Bituthene Liquid Membrane around the penetration. Bituthene Liquid Membrane should be placed to form a minimum 1" (25.4 mm) continuous fillet around the penetration at the point of penetration. Bituthene Liquid Membrane should be applied as a 90 mil (2.2 mm) continuous coating overlapping a minimum of 3" (75 mm) onto the surface of the Preprufe membrane.
- Column Option 2 - Preprufe Membrane is placed below the column footing before it is poured. The membrane is installed following the vertical and horizontal application instructions described earlier in this section. When placing the membrane, it is important to leave sufficient length of Preprufe 300R beyond the footing to allow for tie-in to the Preprufe Membrane that will be laid to waterproof the general slab area. The release liner must not be removed from this extra length, and it should be protected from damage until the tie-in details are completed.

Grade Beam Pile Caps

The preferred methods to waterproof pile caps are to either "tank" or "cover" the pile cap.

- Pile Cap Option 1 (Tanking Option) - Install Preprufe Membrane over the prepared substrate as instructed in horizontal applications above. Preprufe Membrane is placed in the area formed for the pile cap before the concrete is poured. When placing the membrane, it is important to leave sufficient length of Preprufe beyond the pile cap area to allow for tie-in to the Preprufe Membrane that will be laid to waterproof the general slab area. Cut membrane tight to each pile and complete detail around each pile as instructed earlier in this section for a Penetration Detail.
- Pile Cap Option 2 (Covering Option) - For mud slabs, clean loose dust or dirt from the

pile cap and mud slab surface using a clean, dry cloth or brush. Apply a continuous 90 mil (2.2 mm) coating of Bituthene Liquid Membrane or Procor over the top of the pile cap. Place a 1" (25.4 mm) bead of Liquid Membrane or Procor around all penetrations at the point of penetration through the pile cap. Prime along the edge of the mud slab a minimum of 6" (150 mm) from the edge of pile cap with a Bituthene Primer and allow to dry. Align a 9" (225 mm) strip of Bituthene Membrane centered over the edge of the pile cap. Remove release liner and roll firmly onto the Liquid Membrane and primed mud slab. Install Preprufe Membrane over the prepared substrate and terminate it 2" (51 mm) onto the pile cap. Apply Preprufe Tape centered over the Preprufe Membrane termination. Remove the release liner and roll firmly. Seal Bituthene Membrane and Preprufe Tape edge with a termination bead of Liquid Membrane.

Pile Cap Option 2 for Compacted Earth

Apply a continuous 90 mil (2.2 mm) coating of Bituthene Liquid Membrane or Procor over the top of the pile cap. Place a 1" (25.4 mm) bead of Liquid Membrane or Procor around all penetrations at the point of penetration through the pile cap. Remove compacted earth away from the sides of pile cap. Clean loose dust or dirt from the pile cap surface using a clean, dry cloth or brush.

Prime the sides of the pile cap a minimum of 6" (150 mm) from the top of pile cap with a Bituthene Primer and allow to dry. Align a 9" (225 mm) strip of Bituthene Membrane centered over the outside edge (outside corner) of the pile cap. Remove release liner and roll firmly onto the Liquid Membrane and primed sides of pile cap. Align a 12" (300 mm) strip of Bituthene Membrane centered over the outside edge (outside corner) of the pile cap. Remove half of release liner by scoring release liner along the center of the strip.

Roll firmly onto the sides of pile cap with the 9" (225 mm) strip of Bituthene Membrane and the remaining primed pile cap. Leave the other half of the 12" (300 mm) strip with the release liner still intact in order to receive the Preprufe Membrane. Replace earth/fill and compact per standard back-filling instructions being careful not to damage the Bituthene strip including the non-bonded portion. Invert the Bituthene strip, and remove the remaining release liner to expose the adhesive portion

of the Bituthene.

Install Preprufe Membrane over the prepared substrate and terminate it 2" (51 mm) onto the pile cap. Roll firmly onto the inverted Bituthene strip. Apply Preprufe Tape centered over the Preprufe Membrane termination. Remove the release liner and roll firmly. Seal Bituthene Membrane and Preprufe Tape edge with a termination bead of Liquid Membrane.

Pile Cap Option 2 for Non-Continuous Covering
If the Structural Engineer or the design does not allow for the waterproofing to "cover" the pile cap, there must be a minimum 6" (150 mm) continuous shoulder along the perimeter of the pile cap to allow for a proper termination. Apply a continuous 90 mil (2.2 mm) coating of Bituthene Liquid Membrane or Procor onto the top of the pile cap along the outside edge.

Apply a 6" (150 mm) strip of Bituthene Membrane onto the Bituthene Liquid Membrane or Procor along the edge of the pile cap. Install Preprufe Membrane over the prepared substrate and terminate it 2" (51 mm) onto the pile cap. Apply Preprufe Tape centered over the Preprufe Membrane termination. Remove the release liner and roll firmly. Seal Bituthene Membrane and Preprufe Tape edge with a termination bead of Liquid Membrane.

Construction Joints

Install the Preprufe membrane according to standard horizontal and vertical application instructions detailed above. Preprufe CJ Tape should be applied to the surface of the Preprufe membrane and centered along the line of all concrete joints. Remove release liner and roll firmly.

Tie-Ins

Preprufe 160R to Preprufe 300R Sub Slab Waterproofing - Install Preprufe 300R Membrane over the prepared substrate as detailed in horizontal and vertical applications above. Continue onto the vertical surface of the prepared soil retention system a minimum of 18" (450 mm) above the finished elevation of the structural floor slab.

Secure the top of the membrane to temporarily hold it in place on the vertical substrate. Care should be taken to prevent damage to this exposed membrane from concrete back-splash as well as slag from rebar welding in wall forms. The exposed membrane on the vertical surface can be protected with

protection board, plywood or other materials.

Following the vertical application instructions detailed above, install Preprufe 160R Membrane over the prepared vertical soil retention system. Unfasten the vertical length of the Preprufe 300R Membrane and tuck the Preprufe 160R behind the 18" (450 mm) length of Preprufe 300R, ensuring a minimum 3" (75 mm) lap. Complete the detail by installing Preprufe Tape centered over the lap being careful to seal any holes from fasteners. Roll firmly and remove the release liner.

Preprufe 300R to Post-Applied Wall Waterproofing - There are 2 options available to tie Preprufe 300R Membrane into wall waterproofing. In Option 1, the Preprufe 300R Membrane is installed under the concrete slab and the footing. Option 2 is intended for applications where the Preprufe 300R Membrane and wall waterproofing are connected through the wall and footing junction.

- Option 1 - Install Preprufe 300R Membrane over the prepared horizontal substrate and extend it up the vertical surface of the slab formwork. Terminate the membrane 6" (150 mm) above the top elevation of the structural floor slab or wall footing. Once the slab or footing is poured and cured for 7 days, remove the forms and trim the excess membrane above the slab (see Technical Letters). Install the wall membrane according to standard application procedures of the post-applied waterproofing manufacturer. Ensure that the wall membrane overlaps onto the surface of the Preprufe 300R by a minimum of 6" (150 mm).
- Option 2 - Prior to the pouring of the wall, apply a 90 mil (2.2 mm) coating of Bituthene Liquid Membrane on top of the footing area using standard application procedures. Extend the Bituthene Liquid Membrane 3" (75 mm) beyond the proposed wall width in each direction. Install the wall membrane according to standard application procedures of the post-applied waterproofing manufacturer. Ensure that the wall membrane overlaps onto the surface of the Preprufe 300R by a minimum of 6" (150 mm). On the inside of the wall, install a minimum 9" (225 mm) strip of Bituthene sheet membrane over the Bituthene Liquid Membrane that extends beyond the footing area. Install Bituthene Membrane by removing the release liner and firmly rolling the product in place. Install Preprufe 300R Membrane over the prepared substrate and terminate it at the center of the Bituthene sheet membrane strip. Apply Preprufe CJ Tape centered over the Preprufe



300R Membrane termination. Remove the release liner and roll firmly.

Preprufe 160R to Plaza Deck Waterproofing - Install Preprufe 160R over the prepared vertical surface following the standard vertical application instructions above. Terminate the Preprufe 160R Membrane 6" (150 mm) above the proposed height of the finished wall. Once the wall is poured and properly cured, remove temporary forming and trim the excess Preprufe 160R remaining above the wall. Install the plaza deck waterproofing according to the manufacturer's standard installation procedures. Ensure that the plaza deck waterproofing overlaps the 160R membrane a minimum of 9" (225 mm) and terminate it onto the Preprufe 160R using a bead of Bituthene Liquid Membrane.

Preprufe 160R to Post-Applied Wall Waterproofing - Install Preprufe 160R over the prepared vertical surface following the standard vertical application instructions above. Extend the Preprufe 160R Membrane 12" (300 mm) beyond the end of the blind-side wall. As the foundation wall formwork is installed, fold the 12" (300 mm) piece of Preprufe 160R Membrane to form a sharp corner. Secure it to the inside face of the exterior form panel. Once the wall is poured and cured for seven days, remove the formwork and install the post-applied waterproofing according to the manufacturer's standard installation procedures.

Preprufe 300R Membrane Wall Termination

- **Option 1 (Liquid Membrane Detail)** - Install Preprufe 300R Membrane over a mud slab as detailed in horizontal applications above. For compacted earth, contact a local Grace representative. Install Preprufe 300R Membrane tight to all vertical and horizontal intersections. At the termination of the membrane, place a 1" (25.4 mm) fillet of Bituthene liquid membrane and trowel a 90 mil (2.2 mm) coating a minimum of 3" (75 mm) onto vertical and horizontal surfaces. Remove the release liner and install a minimum 12" (300 mm) strip of Bituthene Membrane centered over the horizontal termination. Install Preprufe Tape to cover the strip of Bituthene Membrane by overlapping a minimum of 1" (25.4 mm) until a minimum of 2" (51 mm) overlap onto the Preprufe Membrane is achieved. Terminate the top edge of the strip of Bituthene Membrane and Preprufe Tape along the wall with a

bead of Bituthene Liquid Membrane.

- **Option 2 (Sheet Membrane Detail)** - Install Preprufe 300R Membrane over the prepared substrate as detailed in horizontal applications above. Install Preprufe 300R Membrane tight to all vertical and horizontal intersections. Install a minimum 6" (150 mm) strip of Bituthene Membrane on the vertical surface along the joint. Mix and apply Bituthene Liquid Membrane to form a minimum 1" (25.4 mm) continuous fillet between the Preprufe Membrane and the wall. Install Preprufe CJ Tape 6" (150 mm) from the edge of the wall onto the Preprufe Membrane and terminate 2" (51 mm) onto the strip of Bituthene Membrane. Install Preprufe CJ Tape onto the strip of Bituthene Membrane and overlap onto the previous Preprufe CJ Tape a minimum of 2" (51 mm). Terminate the top edge of the strip of Bituthene Membrane and Preprufe Tape along the wall with a bead of Bituthene Liquid Membrane.

Membrane Repair

Inspect the membrane for damage before placement of reinforcing steel, formwork and concrete. Repair small punctures 1/2" (12 mm), or less, and slices by applying Preprufe Tape centered over the damaged area and roll firmly. Remove the release liner from the tape. Repair holes and large punctures by applying a patch of Preprufe membrane, which extends 6" (150 mm) beyond the damaged area. Seal all edges of the patch with Preprufe Tape, remove the release liner from the tape and roll firmly.

CONCRETE PLACEMENT

Lightly soiled membrane should be cleaned with air blower and heavily soiled membrane should be cleaned with a power-washer. Cast concrete within 56 days (42 days in hot climates) of application of the membrane. Concrete must be placed carefully to avoid damage to the membrane. Never use a sharp object to consolidate concrete.

REMOVAL OF FORMWORK

Preprufe Membranes can be applied to removable formwork, such as slab perimeters, elevator and lift pits, etc. Once the concrete is poured, the formwork must remain in place until the concrete has gained sufficient compressive strength to develop the surface bond. Preprufe Membranes are not recommended for conventional twin-sided wall forming systems.

A minimum concrete compressive strength

of 1500 psi (10 N/mm²) is recommended prior to stripping formwork supporting Preprufe Membranes. Premature stripping may result in displacement of the membrane and/or spalling of the concrete.

As a guide, to reach the minimum compressive strength stated above, a structural concrete mix with an ultimate strength of 6000 psi (40 N/mm²) will typically require a cure time of approximately 6 days at an average ambient temperature of 25 degrees F (-4 degrees C) or 2 days at 70 degrees F (21 degrees C).

6. Availability & Cost

AVAILABILITY

A network of distributors carries Preprufe and Bituthene products for prompt delivery to project sites.

COST

For specific information, contact a local distributor or a Grace Construction Products representative.

7. Warranty

A 5 year material warranty for Preprufe and Bituthene membrane products is available from the manufacturer upon request.

8. Maintenance

Preprufe 300R and Preprufe 160R membranes will not require maintenance when installed in accordance with Grace's recommendations.

9. Technical Services

Support is provided by full-time, technically trained Grace field sales representatives and technical service personnel, backed by a central research and development staff.

10. Filing Systems

- Reed First Source
- Additional product information is available from the manufacturer.

W. R. Grace & Co. -Conn. hopes the information here will be helpful. It is based upon data and knowledge considered to be true and accurate and is offered for the users' consideration, investigation and verification, but we do not warrant the results to be obtained. Please read all statements, recommendations and suggestions in conjunction with our conditions of sale, which apply to all goods supplied by us. No statement, recommendation or suggestion is intended for any use which would infringe any patent or copyright. W. R. Grace & Co. -Conn., 62 Whittemore Avenue, Cambridge, MA 02140. In Canada, W. R. Grace & Co. Canada, Ltd., 294 Clements Road, West, Ajax, Ontario, Canada L1S 3C6.

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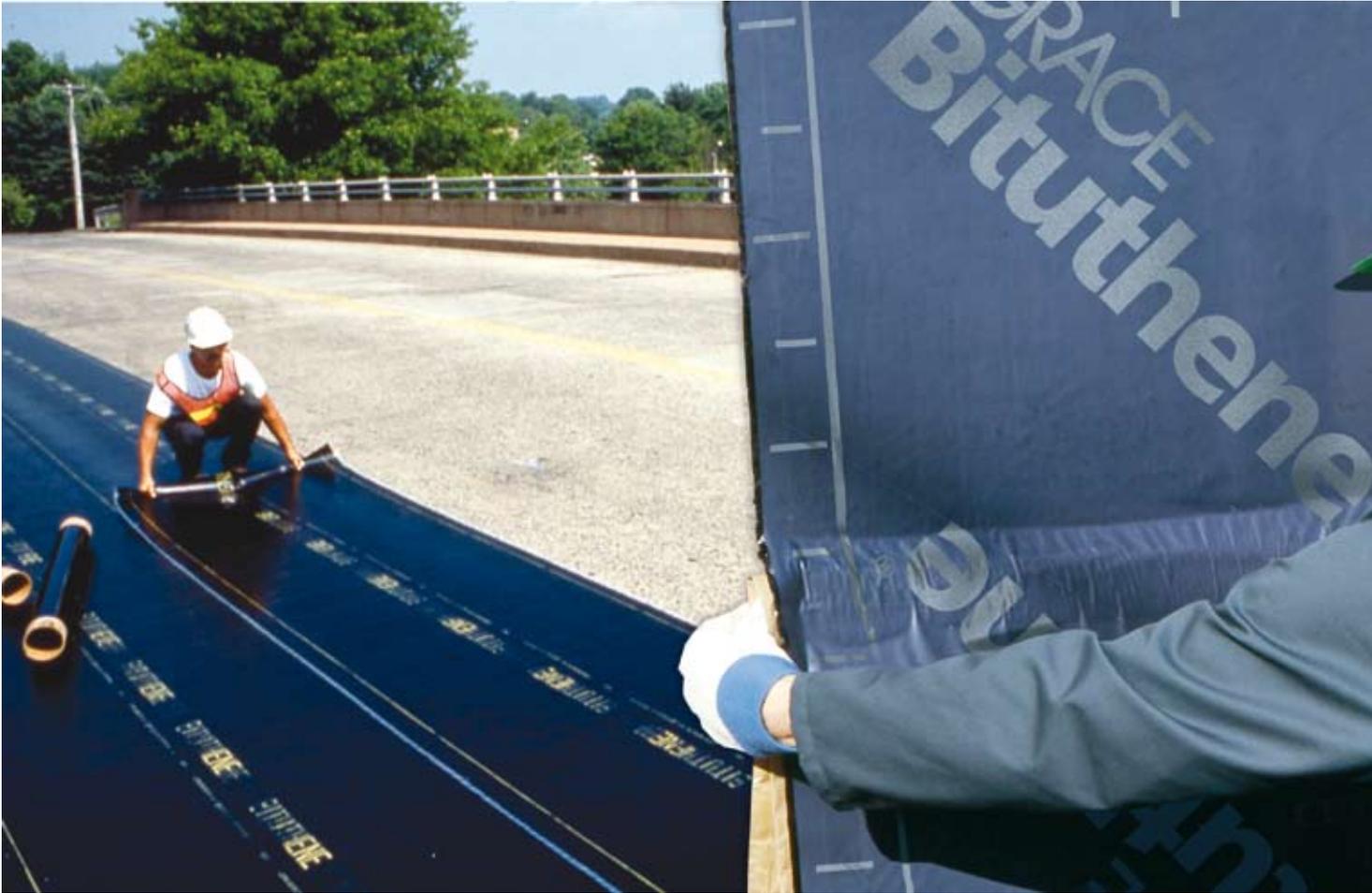
This product may be covered by patents or patents pending.

PF-118C Printed in U.S.A. 11/06 AFS/LJ/3M



Bituthene® Waterproofing Systems

Use With Confidence





Self-adhesive, cold applied, flexible, fully bonded to the substrate, tough and high performance waterproofing membrane. These features and more describe the Bituthene® waterproofing membrane system.



Bituthene®

The best protection from the elements money can buy

Since its introduction more than 30 years ago by Grace Construction Products, a worldwide leader in the construction products industry, the Bituthene waterproofing membrane has been continuously improved becoming virtually the industry standard. It is the original self-adhesive membrane by which all other waterproofing membranes are measured against. More than 300 million square metres of Bituthene have been installed in projects all over the world.

Bituthene membranes are formulated to be applied and perform under a variety of temperature conditions. It is available in grades engineered for application in temperatures ranging from -4°C in North America and Europe, to 50°C in the Middle East, from hot dry desert conditions to humid conditions in Asia Pacific. Special grades for application to damp surfaces or green concrete, with special primers, are also available.

Supplied in easy-to-apply rolls, the Bituthene self-adhesive membrane installs quickly and cleanly without the hazards associated with hot

applied systems or the need for specialist equipment. It is manufactured to international standards in Grace plants around the world, including Singapore for the Asia Pacific market. The Singapore plant is certified to meet ISO 9000 quality standards, and undergoes annual audits by the Singapore Productivity and Standard Board to confirm continued compliance.

The Bituthene membrane, like all other quality building materials from Grace Construction Product, is supported by highly skilled and locally based field and technical service. This commitment to expert service and support, along with the product's superior performance, means that customers can specify and use the Bituthene membrane with confidence.

Product Features	Benefits
Self-adhesive	Full continuity at overlaps.
Cold applied	No flame hazard with no heating equipment required
Flexible	Accommodates minor settlement and shrinkage movement.
Cross laminated film	Provides dimensional stability, high tear strength, puncture and impact resistance.
Single layer	Simple, reliable, low labour cost with benefit of site programmed installation.
Controlled thickness	Factory-made sheet ensures constant, non-variable site application.
Chemically resistant	Provides effective external protection against aggressive soils and ground water.



Grace Waterproofing Systems - a package of innovative product systems

Grace's dedication to ongoing research programs has resulted in many innovative product solutions, which provide industry with a complete systems-based approach to waterproofing. In addition to the Bituthene membrane, Grace has introduced Preprufe® membrane for "blind side" waterproofing applications, Procor® liquid waterproofing and Grace Ice & Water Shield® self-adhered roofing underlayment.

Preprufe® is the ideal product for waterproofing below concrete slabs and behind in situ concrete basement walls on confined sites to give a positive tanking system. It is a simple to apply, loose laid sheet that forms a continuous mechanical bond to

concrete that is cast against it. The Preprufe membrane is permanently sealed to the structure - not the substrate. This prevents water migration and ensures the membrane is unaffected by ground settlement.

Procor® is a two component, synthetic rubber, cold vulcanized, liquid waterproofing membrane. It cures to form a resilient fully bonded elastomeric sheet. Procor contains no hazardous solvents and can be applied to damp or green concrete substrates. The easy and fast spray application of Procor helps to maximise project efficiency by cutting time and costs.

Grace Ice & Water Shield® is a self-adhered roofing underlayment that provides superior protection for

sloped roofs from the effects of ice dams. It also acts as a seal around fasteners and performs as a vapour barrier. For these reasons, Grace Ice & Water Shield is widely specified for use as an underlayment for low sloped metal roofs. It is an adjunct to the Bituthene technology but has special features to meet roof waterproofing demands.

Complementing Grace's waterproofing membranes is an extensive array of drainage, protection and other accessory products. They are all fully compatible with the Bituthene waterproofing membrane and form an integral part of Grace's waterproofing system.

The Bituthene[®] family

- membrane systems for the right application



Designed to keep water out, Bituthene waterproofing membranes have proven their versatility in a variety of applications. The comprehensive family of Bituthene membranes includes:

Product	Description	Usage
Bituthene 2000	Self-adhesive, cold applied membrane produced from rubber bitumen and cross laminated high density polyethylene.	Moisture/vapour proof membrane for damp proofing flat decks, slab on grade, wet rooms and non-critical applications.
Bituthene 3000	High performance, cold applied and self-adhesive membrane with 100 micron cross laminated HDPE film and rubber bitumen compound.	Waterproofing membrane for basements, substructures and flat deck applications.
Bituthene 5000	Heavy duty waterproofing membrane incorporating high strength, heat resistant mesh embedded in a layer of self-adhesive rubber bitumen.	Waterproofing membrane for plazas, bridges, vehicular traffic structures, or parking decks overlaid with an asphalt concrete wearing course.
Bituthene 6000	Heavy duty, cold applied and self-adhesive membrane with 200 micron cross laminated HDPE film and rubber bitumen compound.	Tough, high performance waterproof membrane for critical substructures and civil engineering works.

Specification: “Bituthene XXXX preformed membrane shall be applied to primed concrete surfaces, with 50 mm minimum overlaps to sheets, all being well rolled to provide full adhesion to the concrete surface. The Bituthene membrane will be applied strictly in accordance with the manufacturer’s instructions, and supplied by Grace Construction Products. For further information, contact the local Grace representative.”

Bituthene®

proves itself worldwide

The Bituthene waterproofing systems have been used in some of the finest structures around the world. Designers and specifiers all over the world choose Bituthene for their projects, because they know they can rely on Bituthene to do the job.



Bank of China,
Beijing, China



Dalian Olympic Plaza, Dalian,
China



Changsha New Century Sports Centre, Changsha, China



Siam Commercial Bank,
Bangkok, Thailand



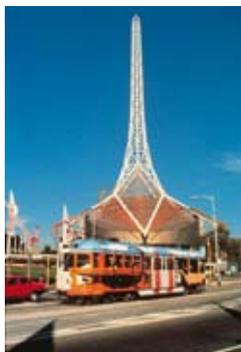
Cathay Pacific City,
Hong Kong



Bank of China & Cheung Kong Centre,
Hong Kong



Rowes Wharf,
Boston, U.S.A



Victorian Arts Centre,
Melbourne, Australia



Parliament House,
Canberra ACT,
Australia



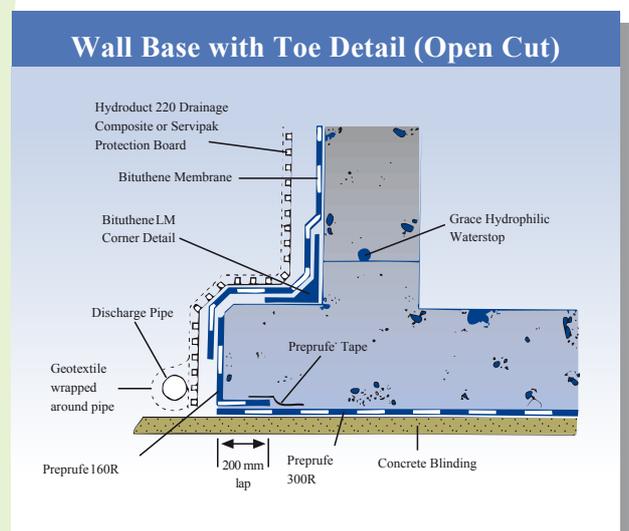
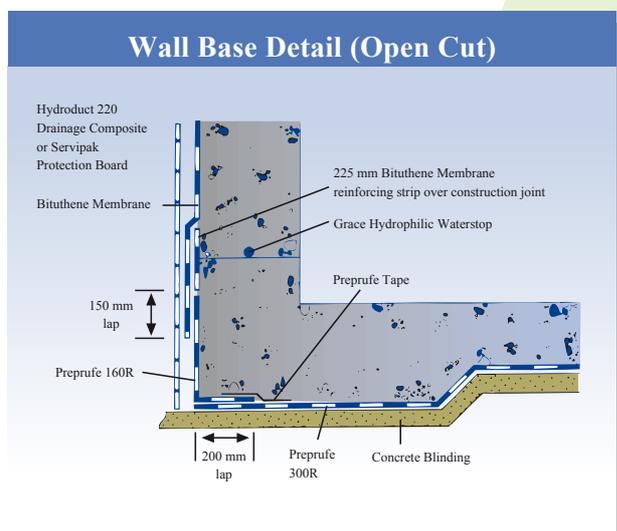
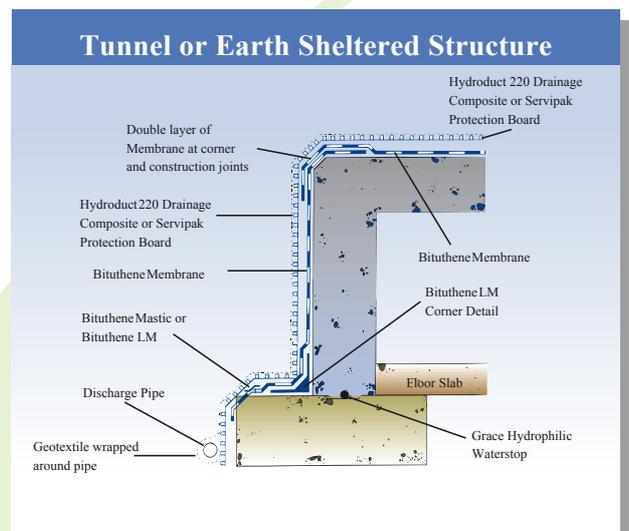
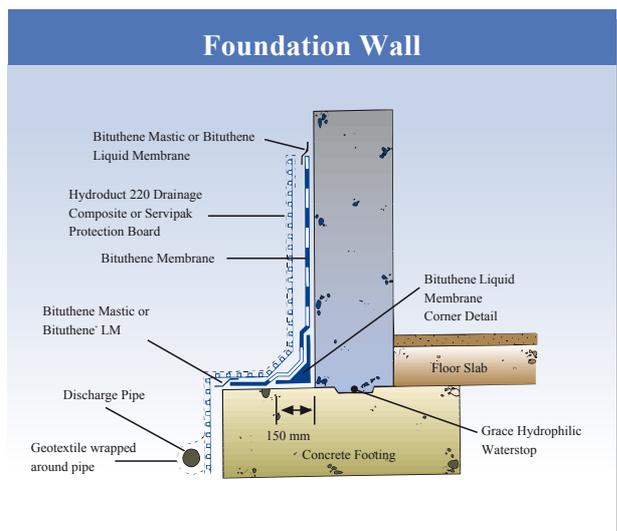
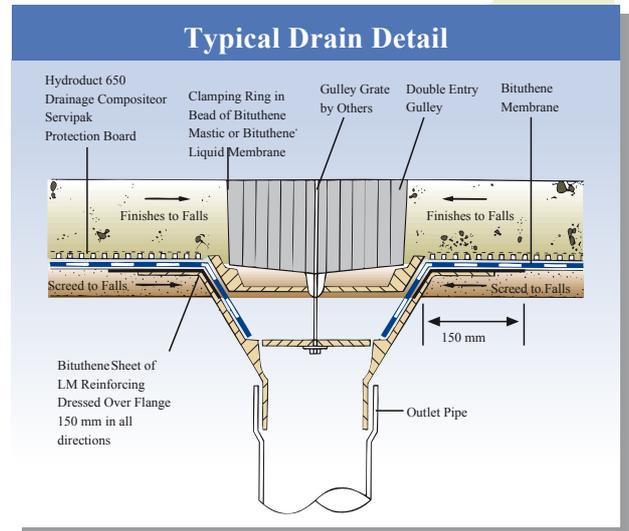
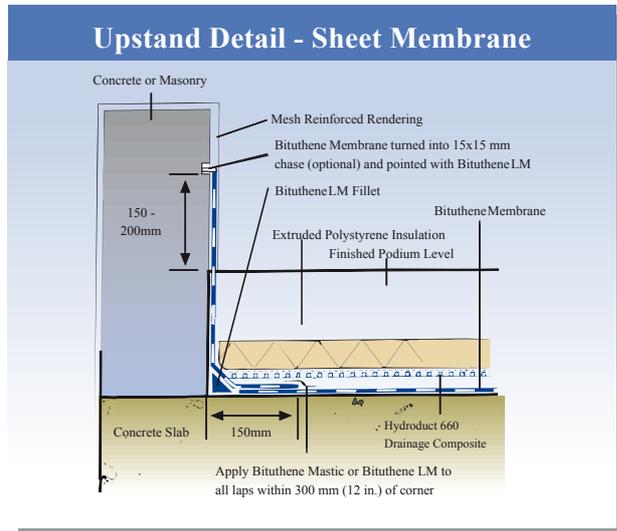
MRT Rail System,
Singapore



Parliament House,
Singapore

Detailing Guide

These are typical details covering a number of installation procedures for Bituthene waterproofing membrane. A full set of details is available upon request from your local Grace representative. Our waterproofing specialist can also assist in the development of details for specific application situations.



Product Characteristics Chart

Product / Property	Unit	Bituthene 2000	Bituthene 3000	Bituthene 5000	Bituthene 6000	Test Method
TYPICAL PERFORMANCE PROPERTIES						
Colour		Dark grey / Black	Dark grey / Black	Black	Dark grey / Black	N/A
Nominal Thickness	mm	1.00	1.50	1.60	1.60	N/A
Roll Length, 1 metre wide	m	30	20	20	20	N/A
Film Type & Thickness		0.1 mm cross-laminated polyethylene	0.1 mm cross-laminated polyethylene	Heat resistant Polypropylene mesh	0.2 mm cross-laminated polyethylene	N/A
Tensile Strength	N/mm	4.0	4.0	10.0	7.0	ASTM D412*
Elongation of membrane to ultimate failure of rubberised asphalt	%	150	200	30	150	ASTM D412*
Lap Adhesion @23 deg.c.	N/m	648	683	N/A	683	ASTM D1876
Cycling over crack @-32 deg.c.		No Effect 100 cycles	No Effect 100 cycles	N/A	No Effect 100 cycles	ASTM C836-89a
Puncture Resistance	N	220	220	900	400	ASTM E154-88
Resistance to hydrostatic head	m	N/A	60	N/A	60	ASTM D5385
Permeance	ng/m ² .s.Pa	Less than 2.0	Less than 2.0	N/A	Less than 1.5	ASTM E96 [12]

* The test is run at a rate of 100mm per minute.

- Other specialised Bituthene membranes are available, which have been designed to meet specific criteria, such as resistance to passage of methane gas, e.g. Bituthene 8000.
- Light grey film Bituthene for enhanced solar reflection, and methane resistance, **Bituthene 8000**.
- The able grades are also available, using a modified compound for application in low temperature conditions, down to -4 deg.c., e.g. **Bituthene 3000(LT)**.
- **Bituthene 3000** and **6000** membranes provide very high electrical resistance, to alternating and direct current, and have found wide usage in Mass Transit Rail and Light Rail applications.

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GRACE

P R O D U C T I N F O R M A T I O N

Bituthene® System 4000

Self-adhesive HDPE waterproofing membrane with super tacky compound for use with patented, water-based System 4000 Surface Conditioner

Advantages

- **Excellent adhesion** – special adhesive compound engineered to work with high tack System 4000 Surface Conditioner
- **Cold applied** – simple application to substrates, especially at low temperatures
- **Reduced inventory and handling costs** – System 4000 Surface Conditioner is included with each roll of membrane
- **Wide application temperature range** – excellent bond to self and substrate from -4°C (25°F) and above
- **Overlap security** – minimizes margin for error under site conditions
- **Cross laminated, high density polyethylene carrier film** – provides high tear strength, puncture and impact resistance
- **Flexible** – accommodates minor structural movements and will bridge shrinkage cracks
- **RIPCORD®** – this Split Release on Demand feature allows the splitting of the membrane into two (2) pieces for ease of installation in detailed areas

Description

Bituthene® System 4000 is a 1.5 mm (1/16 in.) flexible, pre-formed waterproof membrane which combines a high

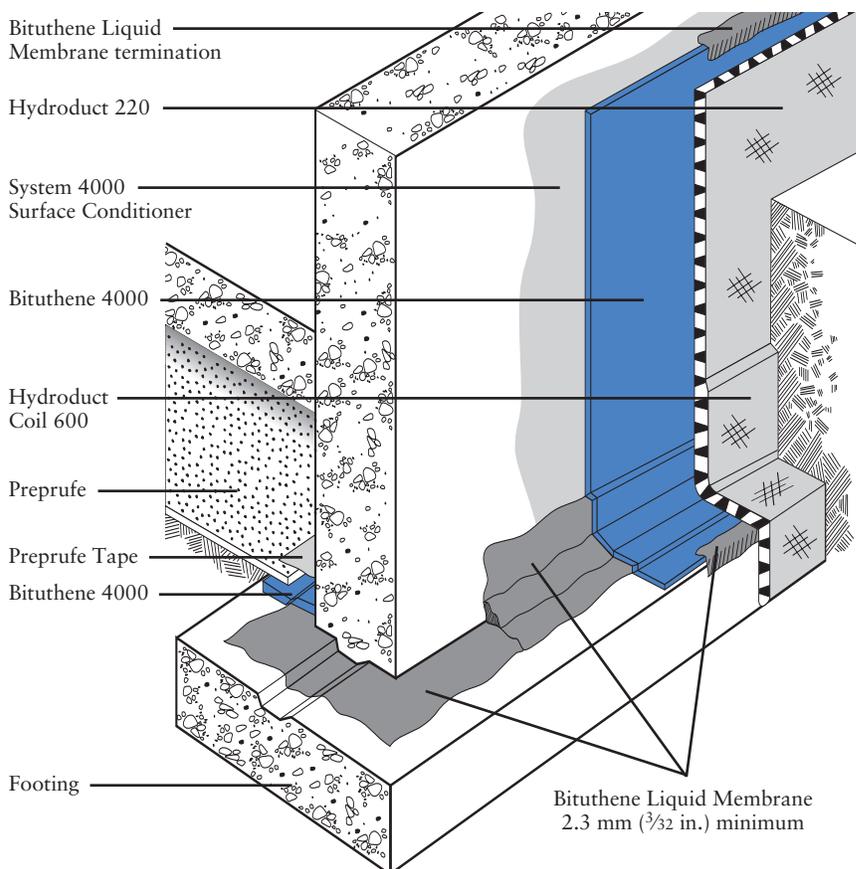
performance, cross laminated, HDPE carrier film with a unique, super tacky, self-adhesive rubberized asphalt compound.

System 4000 Surface Conditioner is a unique, water-based, latex surface treatment which imparts an aggressive, high tack finish to the treated substrate.

It is specifically formulated to bind site dust and concrete

efflorescence, thereby providing a suitable surface for the Bituthene System 4000 Waterproofing Membrane.

Conveniently packaged in each roll of membrane, System 4000 Surface Conditioner promotes good initial adhesion and, more importantly, excellent permanent adhesion of the Bituthene System 4000 Waterproofing Membrane.



The VOC (Volatile Organic Compound) content of this product is 125 g/L.

Architectural and Industrial Maintenance Regulations limit the VOC content in products classified as Architectural Coatings. Refer to Technical Letters at www.graceconstruction.com for most current list of allowable limits.

Use

Bituthene is ideal for waterproofing concrete, masonry and wood surfaces where in-service temperatures will not exceed 57°C (135°F). It can be applied to foundation walls, tunnels, earth sheltered structures and split slab construction, both above and below grade. (For above grade applications, see “Above Grade Waterproofing Bituthene System 4000.”)

Bituthene is 1.5 mm ($1/16$ in.) thick, 0.9 m (3 ft) wide and 20 m (66.7 ft) long and is supplied in rolls. It is unrolled sticky side down onto concrete slabs or applied onto vertical concrete faces primed with System 4000 Surface Conditioner. Continuity is achieved by overlapping a minimum 50 mm (2 in.) and firmly rolling the joint.

Bituthene is extremely flexible. It is capable of bridging shrinkage cracks in the concrete and will accommodate minor differential movement throughout the service life of the structure.

Application Procedures

Safety, Storage and Handling Information

Bituthene products must be handled properly. Vapors from solvent-based primers and mastic are harmful and flammable.

For these products, the best available information on safe handling, storage, personal protection, health and environmental considerations has been gathered. Material Safety Data Sheets (MSDS) are available at www.graceconstruction.com and users should acquaint themselves with this information. Carefully read detailed precaution statements on product labels and the MSDS before use.

Surface Preparation

Surfaces should be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Concrete must be properly dried (minimum 7 days for normal structural concrete and 14 days for lightweight structural concrete).

If time is critical, Bituthene Primer B2 may be used to allow priming and installation of membrane on damp surfaces or green concrete. Priming may begin in this case as soon as the concrete will maintain structural integrity. Use form release agents which will not transfer to the concrete. Remove forms as soon as possible from below horizontal slabs to prevent entrapment of excess moisture. Excess moisture may lead to blistering of the membrane. Cure concrete with clear, resin-based curing compounds which do not contain oil, wax or pigment. Except with Primer B2, allow concrete to thoroughly dry following rain. Do not apply any products to frozen concrete.

Repair defects such as spalled or poorly consolidated areas. Remove sharp protrusions and form match lines. On masonry surfaces, apply

a parge coat to rough concrete block and brick walls or trowel cut mortar joints flush to the face of the concrete blocks.

Temperature

- Apply Bituthene System 4000 Membrane and Conditioner only in dry weather and when air and surface temperatures are -4°C (25°F) or above.
- Apply Bituthene Primer B2 in dry weather above -4°C (25°F). (See separate product information sheet.)

Conditioning

Bituthene System 4000 Surface Conditioner is ready to use and can be applied by spray or roller. For best results, use a pump-type air sprayer with fan tip nozzle, like the Bituthene System 4000 Surface Conditioner Sprayer, to apply the surface conditioner.

Apply Bituthene System 4000 Surface Conditioner to clean, dry, frost-free surfaces at a coverage rate of 7.4 m²/L (300 ft²/gal). Coverage should be uniform. Surface conditioner should not be applied so heavily that it puddles or runs. **Do not apply conditioner to Bituthene membrane.**

Allow Bituthene System 4000 Surface Conditioner to dry one hour or until substrate returns to its original color. At low temperatures or in high humidity conditions, dry time may be longer.

Bituthene System 4000 Surface Conditioner is clear when dry and may be slightly tacky. In general, conditioning should be limited to what can be covered within 24 hours. In situations where long dry times may prevail, substrates may be conditioned in advance. Substrates should be reconditioned if significant dirt or dust accumulates.

Before surface conditioner dries, tools should be cleaned with water. After surface conditioner dries, tools should be cleaned with mineral spirits. Mineral spirits is a combustible liquid which should be used only in accordance with manufacturer's recommendations. **Do not use solvents to clean hands or skin.**

Corner Details

The treatment of corners varies depending on the location of the corner. For detailed information on Bituthene Liquid Membrane, see separate product information sheet.

- At wall to footing inside corners –
Option 1: Apply membrane to within 25 mm (1 in.) of base of wall. Treat the inside corner by installing a 20 mm (¾ in.) fillet of Bituthene Liquid Membrane. Extend Bituthene Liquid Membrane at least 65 mm (2½ in.) onto footing, and 65 mm (2½ in.) onto wall membrane.
Option 2: Treat the inside corner by installing a 20 mm (¾ in.) fillet of Bituthene Liquid Membrane. Apply 300 mm (12 in.) wide strip of sheet membrane centered over fillet. Apply wall membrane over inside corner and extend 150 mm (6 in.) onto footing. Apply 25 mm (1 in.) wide troweling of Bituthene Liquid Membrane over all terminations and seams within 300 mm (12 in.) of corner.
- At footings where the elevation of the floor slab is 150 mm (6 in.) or more above the footing, treat the inside corner either by the above two methods or terminate the membrane at the base of the wall. Seal the termination with Bituthene Liquid Membrane.

Joints

Properly seal all joints with waterstop, joint filler and sealant as required. Bituthene membranes are not intended to function as the primary joint seal. Allow sealants to fully cure. Pre-strip all slab and wall cracks over 1.5 mm (1/16 in.) wide and all construction and control joints with 230 mm (9 in.) wide sheet membrane strip.

Application on Horizontal Surfaces

(Note: Preprufe® pre-applied membranes are strongly recommended for below slab or for any application where the membrane is applied before concreting. See Preprufe product information sheets.)

Apply membrane from the low point to the high point so that laps shed water. Overlap all seams at least 50 mm (2 in.). Stagger all end laps. Roll the entire membrane firmly and completely as soon as possible. Use a linoleum roller or standard water-filled garden roller less than 760 mm (30 in.) wide, weighing a minimum of 34 kg (75 lbs) when filled. Cover the face of the roller with a resilient material such as a 13 mm (½ in.) plastic foam or two wraps of indoor-outdoor carpet to allow the membrane to fully contact the primed substrate. Seal all T-joints and membrane terminations with Bituthene Liquid Membrane at the end of the day.

Protrusions and Drains

Apply membrane to within 25 mm (1 in.) of the base of the protrusion. Apply Bituthene Liquid Membrane 2.5 mm (0.1 in.) thick around protrusion.

Bituthene Liquid Membrane should extend over the membrane a minimum of 65 mm (2½ in.) and up the penetration to just below the finished height of the wearing course.

Vertical Surfaces

Apply membrane in lengths up to 2.5 m (8 ft). Overlap all seams at least 50 mm (2 in.). On higher walls apply membrane in two or more sections with the upper overlapping the lower by at least 50 mm (2 in.). Roll all membrane with a hand roller.

Terminate the membrane at grade level. Press the membrane firmly to the wall with the butt end of a hardwood tool such as a hammer handle or secure into a reglet. Failure to use heavy pressure at terminations can result in a poor seal. A termination bar may be used to ensure a tight seal. Terminate the membrane at the base of the wall if the bottom of the interior floor slab is at least 150 mm (6 in.) above the footing. Otherwise, use appropriate inside corner detail where the wall and footing meet.

Membrane Repairs

Patch tears and inadequately lapped seams with membrane. Clean membrane with a damp cloth and dry. Slit fishmouths and repair with a patch extending 150 mm (6 in.) in all directions from the slit and seal edges of the patch with Bituthene Liquid Membrane. Inspect the membrane thoroughly before covering and make any repairs.

Drainage

Hydroduct® drainage composites are recommended for both active drainage and protection of the membrane. See Hydroduct product information sheets.

Protection of Membrane

Protect Bituthene membranes to avoid damage from other trades, construction materials or backfill. Place protection immediately in temperatures above 25°C (77°F) to avoid potential for blisters.

- On vertical applications, use Hydroduct 220 Drainage Composite. Adhere Hydroduct 220 Drainage Composite to membrane with Hydroduct Tape. Alternative methods of protection are to use 25 mm (1 in.) expanded polystyrene or 6 mm (1/4 in.) extruded polystyrene that has a minimum compressive strength of 55 kN/m² (8 lbs/in.²). Such alternatives do not provide positive drainage to the system.

If 6 mm (1/4 in.) extruded polystyrene protection board is used, backfill should not contain sharp rock or aggregate over 50 mm (2 in.) in diameter. Adhere polystyrene protection board with Hydroduct Tape.

- In mud slab waterproofing, or other applications where positive drainage is not desired and where reinforced concrete slabs are placed over the membrane, the use of 6 mm (1/4 in.) hardboard or 2 layers of 3 mm (1/8 in.) hardboard is recommended.

Insulation

Always apply Bituthene membrane directly to primed or conditioned structural substrates. Insulation, if used,

must be applied over the membrane. Do not apply Bituthene membranes over lightweight insulating concrete.

Backfill

Place backfill as soon as possible. Use care during backfill operation to avoid damage to the waterproofing system. Follow generally accepted practices for backfilling and compaction. Backfill should be added and compacted in 150 mm (6 in.) to 300 mm (12 in.) lifts.

For areas which cannot be fully compacted, a termination bar is recommended across the top termination of the membrane.

System 4000 Surface Conditioner Sprayer

The Bituthene System 4000 Surface Conditioner Sprayer is a professional grade, polyethylene, pump-type, compressed air sprayer with a brass fan tip nozzle. It has a 7.6 L (2 gal) capacity. The nozzle orifice and spray pattern have been specifically engineered for the optimum application of Bituthene System 4000 Surface Conditioner.

Hold nozzle 450 mm (18 in.) from substrate and squeeze handle to spray. Spray in a sweeping motion until substrate is uniformly covered.

Sprayer should be repressurized by pumping as needed. For best results, sprayer should be maintained at high pressure during spraying.

To release pressure, invert the sprayer and spray until all compressed air is released.

Maintenance

The Bituthene System 4000 Surface Conditioner Sprayer should perform without trouble for an extended period if maintained properly.



Sprayer should not be used to store Bituthene System 4000 Surface Conditioner. The sprayer should be flushed with clean water immediately after spraying. For breaks in the spray operation of one hour or less, invert the sprayer and squeeze the spray handle until only air comes from the nozzle. This will avoid clogging.

Should the sprayer need repairs or parts, call the maintenance telephone number on the sprayer tank (800-323-0620).

Supply

Bituthene System 4000	0.9 m x 20 m roll (18.6 m ²) 3 ft x 66.7 ft (200 ft ²)
Roll weight	38 kg (83 lbs) gross
Palletization	25 rolls per pallet
Storage	Store upright in dry conditions below +35°C (95°F).
System 4000 Surface Conditioner	1 x 2.3 L (0.625 gal) bottle in each roll of System 4000 Membrane
Ancillary Products	
Surface Conditioner Sprayer	7.6 L (2 gal) capacity professional grade sprayer with specially engineered nozzle
Bituthene Liquid Membrane	5.7 L (1.5 gal) pail/125 pails per pallet or 15.1 L (4 gal) pail/48 pails per pallet
Hydroduct Tape	2.5 cm x 61.0 m (1 in. x 200 ft) roll/6 rolls per carton
Bituthene Mastic	12 – 0.9 L (30 oz) tubes/carton or 18.9 L (5 gal) pail/36 pails per pallet
Complementary Material	
Hydroduct	See separate data sheets
Equipment by others:	Soft broom, utility knife, brush or roller for priming

Placing Steel

When placing steel over properly protected membrane, use concrete bar supports (dobies) or chairs with plastic tips or rolled feet to prevent damage from sharp edges. Use special care when using wire mesh, especially if the mesh is curled.

Approvals

- City of Los Angeles
Research Report RR 24386
- U.S. Department of Housing and Urban Development (HUD) HUD Materials Release 628E

Warranty

Five year material warranties covering Bituthene and Hydroduct products are available upon request. Contact your Grace sales representative for details.

Technical Services

Support is provided by full time, technically trained Grace representatives and technical service personnel, backed by a central research and development staff.

Physical Properties for Bituthene 4000 Membrane

Property	Typical Value	Test Method
Color	Dark gray-black	
Thickness	1.5 mm (1/16 in.) nominal	ASTM D3767 – method A
Flexibility, 180° bend over 25 mm (1 in.) mandrel at -32°C (-25°F)	Unaffected	ASTM D1970
Tensile strength, membrane, die C	2240 kPa (325 lbs/in. ²) minimum	ASTM D412 modified ¹
Tensile strength, film	34.5 MPa (5,000 lbs/in. ²) minimum	ASTM D882 modified ¹
Elongation, ultimate failure of rubberized asphalt	300% minimum	ASTM D412 modified ¹
Crack cycling at -32°C (-25°F), 100 cycles	Unaffected	ASTM C836
Lap adhesion at minimum application temperature	880 N/m (5 lbs/in.)	ASTM D1876 modified ²
Peel strength	1576 N/m (9 lbs/in.)	ASTM D903 modified ³
Puncture resistance, membrane	222 N (50 lbs) minimum	ASTM E154
Resistance to hydrostatic head	70 m (210 ft) of water	ASTM D5385
Permeance	2.9 ng/m ² sPa (0.05 perms) maximum	ASTM E96, section 12 – water method
Water absorption	0.1% maximum	ASTM D570

Footnotes:

1. The test is run at a rate of 50 mm (2 in.) per minute.
2. The test is conducted 15 minutes after the lap is formed and run at a rate of 50 mm (2 in.) per minute at 5°C (40°F).
3. The 180° peel strength is run at a rate of 300 mm (12 in.) per minute.

Physical Properties for System 4000 Surface Conditioner

Property	Typical Value
Solvent type	Water
Flash point	>60°C (>140°F)
VOC* content	125 g/L
Application temperature	-4°C (25°F) and above
Freeze thaw stability	5 cycles (minimum)
Freezing point (as packaged)	-10°C (14°F)
Dry time (hours)	1 hour**

* Volatile Organic Compound

** Dry time will vary with weather conditions

For Technical Assistance call toll free at 866-333-3SBM (3726).

 Visit our web sites at www.graceconstruction.com

W. R. Grace & Co.-Conn. 62 Whittemore Avenue Cambridge, MA 02140

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FA/LI/4M

GRACE
Construction Products

P R O D U C T I N F O R M A T I O N

Bituthene® Liquid Membrane

Two component, elastomeric, liquid applied detailing compound for use with Grace waterproofing membranes

Advantages

- **Liquid applied** – conforms to irregular profiles
- **Waterproof** – resistant to water vapor and water pressure
- **Tough, rubber-like** – flexible and damage resistant
- **Chemically cured** – unaffected by in-service temperature variations
- **Cold applied** – no flame hazard
- **System compatible** – formulated for use with Grace waterproofing membrane systems

Description

Bituthene® Liquid Membrane is a two component, elastomeric, cold applied, trowel grade material designed for a variety of uses with the Grace waterproofing systems. The VOC (Volatile Organic Compound) content is 10 g/L.

Architectural and Industrial Maintenance Regulations limit the VOC content in products classified as Architectural Coatings. Refer to Technical Letters at www.graceconstruction.com for most current list of allowable limits.

Use

Bituthene Liquid Membrane is ideally suited for the following uses:

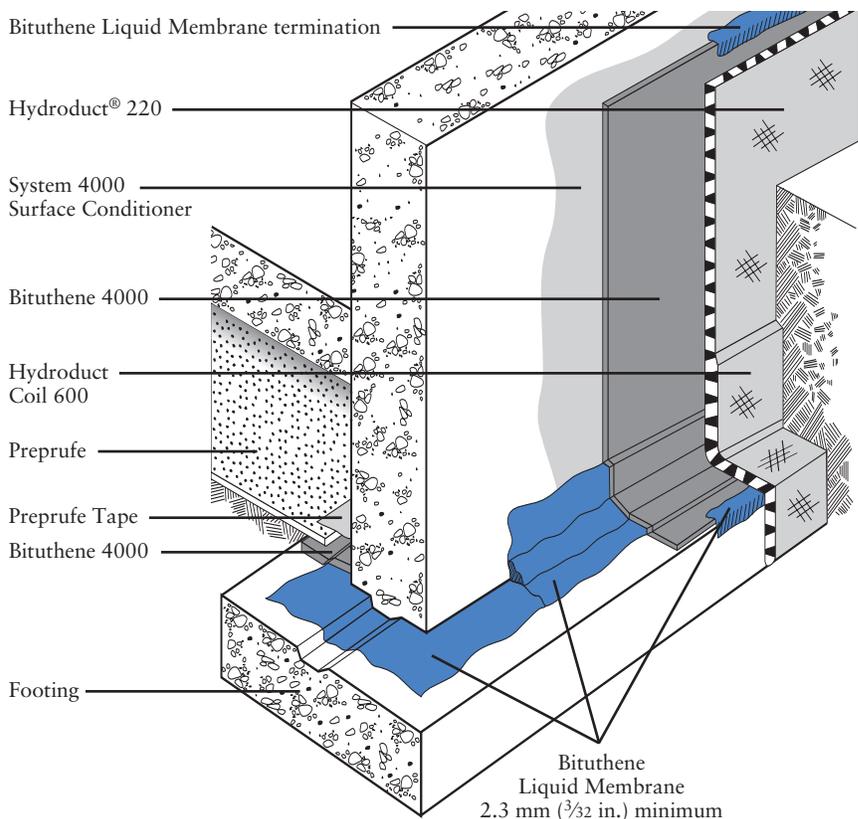
- Fillet material at inside corners
- Reinforcement material at inside corners

- Flashing material around drains, protrusions, curbs and parapets
- Sealing material at terminations
- Repair material for defects on concrete surfaces
- Flashing material at corners

The two parts of Bituthene Liquid Membrane are mixed on site and troweled on to provide a simple and quick waterproofing detailing aid in conjunction with Bituthene, Preprufe® and Procor® systems.

Compatibility

Bituthene Liquid Membrane is completely compatible with Bituthene, Preprufe and Procor and with existing asphalt or coal tar-based waterproofing materials. It is also compatible with cured silicone and polyurethane sealants. It is not compatible with creosote, pentachlorophenol, linseed oil or polysulfide-based sealants.



Supply

Bituthene Liquid Membrane (Parts A & B)

Unit size	5.7 L (1.5 gal)	15.1 L (4 gal)
Weight per unit	8 kg (16 lbs)	20 kg (44 lbs)
Units per pallet	100	24

Physical Properties

Property	Typical Value	Test Method
Color		
Part A	Black	
Part B	Clear	
Mixture of Parts A and B	Black	
Solids content	100%	ASTM D1644
Elongation	250% minimum	ASTM D412
Peel strength	880 N/m (5 lbs/in.) minimum	ASTM D903
Flexibility, 180° bend over 25 mm (1 in.) mandrel at -32°C (-25°F)	Unaffected	ASTM D1970

Application Procedures

Safety, Storage and Handling Information

Bituthene products must be handled properly. Vapors from solvent-based primers and mastic are harmful and flammable. Grace Protection Board Adhesive is extremely flammable. For these products, the best available information on safe handling, storage, personal protection, health and environmental considerations has been gathered. Material Safety Data Sheets (MSDS) are available at www.graceconstruction.com and users should acquaint themselves with this information. Carefully read detailed precaution statements on product labels and the MSDS before use.

Surface Preparation

All surfaces must be dry and free from dirt, grease, oil, dust or other contaminants. Bituthene Liquid Membrane may be applied at temperatures of -4°C (25°F) or above. Below 5°C (40°F), store in a warm place before application.

Mixing

Add the entire contents of the Part B container to Part A and mix for 3 to 5 minutes until uniform. Part A is black and Part B is clear. Take care to scrape material from the side and bottom of the containers to assure thorough mixing. A low speed (150 rpm) mechanical mixer with flat paddle blades is required. Do not apply any material if streaks can be seen due to insufficient mixing.

Once mixed, Bituthene Liquid Membrane must be applied by trowel within 1.5 hours. More time is available at lower temperatures. At high temperatures, thickening and curing will be faster. Material that has thickened must be discarded. The material will cure to a very flexible rubber-like material.

Bituthene Liquid Membrane must be applied at a minimum thickness of 2.3 mm (³/₃₂ in.) unless otherwise noted on details. In fillet applications, the face of the fillet should be a minimum of 20 mm (³/₄ in.). In corner flashing application details, it should extend 150 mm (6 in.) in each direction from the corner. Bituthene Liquid Membrane will adhere to primed or unprimed concrete.

Bituthene Liquid Membrane should be allowed to cure at least 24 hours before flood testing.

Coverage

As a fillet material, 3.8 L (1 gal) will cover approximately 30 m (100 linear feet). As a flashing material, 3.8 L (1 gal) will cover approximately 1.6 m² (17 ft²). As a fillet and reinforcement, 3.8 L (1 gal) will cover approximately 4.3 m (14 linear feet).

Cleaning

Clean tools and equipment with mineral spirits before Bituthene Liquid Membrane has cured. Mineral spirits is a combustible liquid and should be used only in accordance with the manufacturer's safety recommendations. **Do not use solvents to clean hands or skin.**

For Technical Assistance call toll free at 866-333-3SBM (3726).

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Construction Products

Paul Matli

From: Ryan Piper [rmpiper@gw.dec.state.ny.us]
Sent: Wednesday, September 22, 2010 3:02 PM
To: Paul Matli
Subject: Re: Spill 07-00175_Vapor Barrier Design _ Gw Remedial Ation Work Plan_ 920-924 Westchester Avenue, Bnx, NY

Paul,

I have reviewed the GW RAP and approve. Additionally, the vapor barrier meets the Departments requirements. Please keep me informed as to the scheduling of the work. Thank you for your cooperation in this matter.

Ryan M. Piper
Engineering Geologist I
Spill Prevention and Response Programs
Division of Environmental Remediation
ph.718.482.4927
f. 718.482.4098>>> "Paul Matli" <pmatli@hydrotechenvironmental.com> 8/12/2010 8:39 AM >>>
Ryan –

Attached, please find the Vapor Barrier Design and the Groundwater remedial Action Work Plan for the above referenced spill site.

I appreciate if I can receive your approval of these remedial activities.

Should you have any comments about these plans, please email me back in this respect.

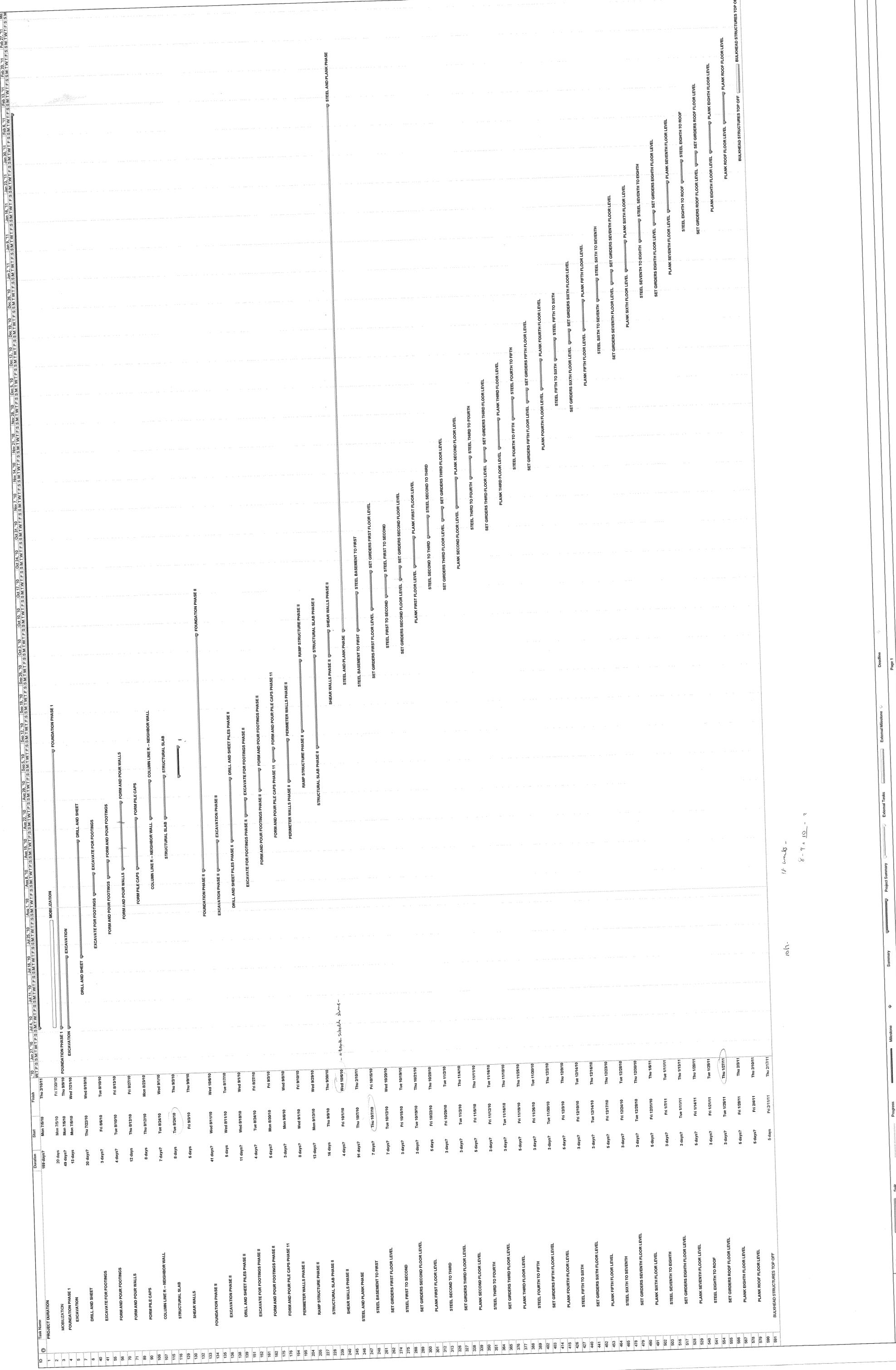
Sincereley,

Paul I. MATLI, Ph.D.
Sr. Project Manager

Hydro Tech Environmental, Corp.
Brooklyn Office
15 Ocean Avenue, 2nd Floor
Brooklyn, NY 11225

Tel: 718-636-0800
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ID	Task Name	Start	Finish	Duration
1	PROJECT ORIENTATION	Mon 7/5/10	Thu 2/18/11	198 days?
2	MOBILIZATION	Mon 7/5/10	Fri 7/23/10	20 days
3	FOUNDATION PHASE I	Mon 7/5/10	Thu 8/6/10	48 days?
4	EXCAVATION	Mon 7/5/10	Wed 7/21/10	13 days
5	DRILL AND SHEET	Thu 7/22/10	Wed 8/18/10	20 days?
6	EXCAVATE FOR FOOTINGS	Fri 8/19/10	Thu 9/16/10	3 days?
7	FORM AND POUR FOOTINGS	Fri 8/19/10	Fri 8/19/10	4 days?
8	FORM AND POUR WALLS	Thu 9/17/10	Fri 9/24/10	12 days
9	FORM PILE CAPS	Mon 9/27/10	Mon 9/27/10	8 days
10	COLUMN LINE R - NEIGHBOR WALL	Wed 9/30/10	Wed 9/30/10	7 days?
11	STRUCTURAL SLAB	Thu 10/1/10	Thu 10/1/10	8 days
12	SHEAR WALLS	Thu 9/30/10	Thu 9/30/10	8 days
13	FOUNDATION PHASE II	Wed 10/14/10	Wed 10/14/10	41 days?
14	EXCAVATION PHASE II	Wed 9/1/10	Tue 9/7/10	5 days
15	DRILL AND SHEET PILES PHASE II	Wed 9/1/10	Wed 9/1/10	11 days?
16	EXCAVATE FOR FOOTINGS PHASE II	Tue 9/28/10	Fri 9/27/10	4 days?
17	FORM AND POUR FOOTINGS PHASE II	Mon 9/20/10	Fri 9/10/10	5 days?
18	FORM AND POUR PILE CAPS PHASE II	Mon 9/14/10	Wed 9/8/10	3 days?
19	FORM AND POUR PILE CAPS PHASE II	Wed 9/1/10	Fri 9/10/10	8 days?
20	PERIMETER WALLS PHASE II	Mon 9/13/10	Wed 9/29/10	13 days?
21	RAMP STRUCTURE PHASE II	Thu 9/30/10	Thu 9/30/10	16 days
22	STRUCTURAL SLAB PHASE II	Wed 10/14/10	Wed 10/14/10	4 days?
23	SHEAR WALLS PHASE II	Thu 10/7/10	Thu 10/7/10	31 days?
24	STEEL AND PLANK PHASE	Thu 10/7/10	Fri 10/15/10	7 days?
25	STEEL BASEMENT TO FIRST	Wed 10/20/10	Wed 10/20/10	7 days?
26	SET GIRDERS FIRST FLOOR LEVEL	Fri 10/15/10	Tue 10/19/10	3 days?
27	STEEL FIRST TO SECOND	Tue 10/21/10	Thu 10/28/10	3 days?
28	SET GIRDERS SECOND FLOOR LEVEL	Fri 10/22/10	Thu 10/28/10	6 days
29	PLANK FIRST FLOOR LEVEL	Fri 10/22/10	Tue 11/2/10	3 days?
30	STEEL SECOND TO THIRD	Fri 11/5/10	Thu 11/11/10	6 days?
31	SET GIRDERS THIRD FLOOR LEVEL	Thu 11/4/10	Thu 11/4/10	3 days?
32	PLANK SECOND FLOOR LEVEL	Fri 11/5/10	Thu 11/11/10	6 days?
33	STEEL THIRD TO FOURTH	Fri 11/12/10	Tue 11/16/10	3 days?
34	SET GIRDERS THIRD FLOOR LEVEL	Thu 11/18/10	Thu 11/18/10	3 days?
35	PLANK THIRD FLOOR LEVEL	Fri 11/19/10	Thu 11/25/10	6 days?
36	STEEL FOURTH TO FIFTH	Fri 11/26/10	Tue 12/1/10	3 days?
37	SET GIRDERS FIFTH FLOOR LEVEL	Tue 12/1/10	Thu 12/2/10	3 days?
38	PLANK FOURTH FLOOR LEVEL	Fri 12/3/10	Thu 12/9/10	6 days?
39	STEEL FIFTH TO SIXTH	Fri 12/10/10	Tue 12/14/10	3 days?
40	SET GIRDERS SIXTH FLOOR LEVEL	Tue 12/14/10	Thu 12/23/10	9 days?
41	PLANK FIFTH FLOOR LEVEL	Fri 12/24/10	Thu 12/30/10	6 days?
42	STEEL SIXTH TO SEVENTH	Fri 12/24/10	Tue 12/28/10	3 days?
43	SET GIRDERS SEVENTH FLOOR LEVEL	Tue 12/28/10	Thu 12/30/10	3 days?
44	PLANK SIXTH FLOOR LEVEL	Thu 1/6/11	Thu 1/6/11	5 days?
45	STEEL SEVENTH TO EIGHTH	Fri 1/7/11	Tue 1/11/11	3 days?
46	SET GIRDERS EIGHTH FLOOR LEVEL	Tue 1/11/11	Thu 1/13/11	3 days?
47	PLANK SEVENTH FLOOR LEVEL	Fri 1/14/11	Thu 1/20/11	6 days?
48	STEEL EIGHTH TO ROOF	Fri 1/21/11	Tue 1/25/11	3 days?
49	SET GIRDERS ROOF FLOOR LEVEL	Tue 1/25/11	Thu 1/27/11	3 days?
50	PLANK EIGHTH FLOOR LEVEL	Fri 1/28/11	Thu 2/3/11	6 days?
51	PLANK ROOF FLOOR LEVEL	Fri 2/4/11	Thu 2/10/11	6 days?
52	BULKHEAD STRUCTURES TOP OFF	Fri 2/11/11	Thu 2/17/11	5 days

10/11
if work -
8-9-10-11