DRAFT CONSTRUCTION HEALTH AND SAFETY PLAN

REPLACEMENT OF THE KOSCIOUSZKO BRIDGE
OVER NEWTOWN CREEK
BROOKLYN AND QUEENS, NEW YORK

NYSDOT PIN: X729.77

EPM Project 26052

Prepared for:

The New York State Department of Transportation
Region 11

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1.0 PURPOSE AND APPLICABILITY

The purpose of this Construction Health and Safety Plan (CHASP) is to assign responsibilities, establish project personnel and community protection standards and procedures, and to plan for contingencies that may arise during construction. This CHASP is intended to minimize health and safety risks associated with the known and potential hazards at the site to project workers and the surrounding community. The requirements of this CHASP are to be followed for all bridge construction activities except for work performed on the Laurel Hill Inactive Hazardous Waste Site, also known as the Phelps Dodge Site in Queens. All work performed on property owned by Phelps Dodge Refining Corporation (PDRC) shall be performed in accordance with the PDRC HASP that was prepared concurrent with the Remedial Design for the Site Specific Cap - Parcels 1A, 1C and 2, dated October 2011.

All work outlined in the CHASP is subject to the associated Contaminant Management Plan (CMP) prepared for the project. This CHASP is not intended to address potential mechanical or structural safety concerns, such as shoring and bracing of excavations, and does not replace or supersede any OSHA regulation and/or local and state construction codes or regulations.

The work subject to this CHASP are activities that disturb soil, groundwater, aboveground and underground tanks, drums, and other containers of hazardous materials that are encountered during the course of construction. The Contractor and their subcontractors involved in construction of the project shall provide a copy of this CHASP to all employees whose work involves any potential exposure to on-site hazards, and shall complete all work in accordance with this CHASP. Certain specialty tasks performed by subcontractors such as asbestos abatement and decommissioning of petroleum storage tanks will require these subcontractors to prepare their own HASPs and Workplans for their specific work. These task-specific HASPs will be reviewed by NYSDOT's Engineer-in-Charge before the work is authorized.

This CHASP and the associated CMP are based on the Preliminary (40%) Design Plans that have been prepared for the project. The Preliminary Design Plans that show the locations and dimensions of the major areas of excavation for the project as presently designed are provided as **Attachment A.** It is possible that the Design/Build Contractor could alter the current design. The Design/Build Contractor is responsible for updating this CHASP as warranted based on any design changes. It is expected however that the overall Health and Safety procedures established in this CHASP would still apply to a revised design.

2.0 PROJECT SITE DESCRIPTION

2.1 General Project Description

The project site occupies a 1.1-mile section of the Brooklyn Queens Expressway (BQE) from Morgan Avenue in Brooklyn heading northeast to the BQE / Long Island Expressway (LIE) Interchange in Queens, and includes the Kosciuszko Bridge over Newtown Creek (Figure 1:

Project Location). The project is situated in a mixed-use commercial and residential area, which historically contained low-rise residential, commercial, and industrial structures. Since the late 1800s, much of the study area has been composed of commercial and industrial operations, with sparse residential development. Existing land use within and adjacent to the project site includes residential buildings, gasoline filling stations, automotive repair operations, restaurants, non-hazardous waste transfer stations, warehouses, commercial structures, and manufacturing. Historical land use in the study area included residential housing, chemical manufacturing operations, refineries, metal works, fat rendering, gasoline filling stations, and automotive repair shops.

The Final Environmental Impact Statement (FEIS) for the project was completed in December 2008 and resulted in a Record of Decision (ROD) that adopted Bridge Replacement Alternative BR-5: Bridge Replacement with Permanent Bridge on Eastbound Side. The proposed project will replace the existing bridge by constructing a new eastbound bridge that will be parallel to and on the eastbound side of the existing bridge and then building a new westbound bridge within the footprint of the existing structure. Construction will require excavation for placement of support structures, foundations, and utility relocation; with such excavations having a potential to encounter contaminated soil. Some excavations could require dewatering; especially those that are located close to Newtown Creek. Groundwater beneath areas of the project site is known to be impacted with petroleum, chlorinated solvents, and metals. Deep operations, such as for installation of new support piles, have the potential to encounter a free-phase oil spill that floats on the groundwater surface in Brooklyn. If dredging of Newtown Creek sediment becomes necessary, the sediment is impacted at levels that would require special handling and disposal.

2.2 Hazard Potential

This CHASP is based on information contained in the Contaminated Material Investigation Findings Report, Kosciuszko Bridge Reconstruction Project, May 31, 2012, EPM, Inc. The following is a summary of the findings pertinent to this CHASP. Additional details are available in the associated CMP and the above referenced report.

2.2.1 Soil Conditions

Shallow soils in Brooklyn and Queens contained evidence of historic fill including asphalt, coal, concrete, brick, glass, and combusted material. Several borings in Brooklyn contained soil with evidence of petroleum or chemical impacts such as odor or staining. Soil samples collected from the project site for laboratory testing contained elevated levels of Volatile Organic Compounds (VOCs), Semi Volatile Organic Compounds (SVOCs), Metals, and to a lesser extent PCBs at isolated locations. Evidence of petroleum or chemical impacted soil such as significant staining or odors was observed at depths near the soil-groundwater interface at most sampling locations in Brooklyn, but no such evidence was observed in Queens.

Hazardous waste testing across the site did not identify widespread regulated hazardous waste conditions in soils. Isolated areas of hazardous lead-impacted soil were identified on parcel 2814-18 in Brooklyn near the intersection of Cherry Street and Gardner Avenue, and within the NYPD impound lot beneath the BQE in Queens. Additional sampling would be required in these areas to better define the extent of the hazardous soil.

The Phelps Dodge Site

Phelps Dodge is a NYSDEC Class 2 Inactive Hazardous Waste Site overlapping a portion of the project site in Queens along the east side of the BQE from Newtown Creek northward to 55th Avenue. Former copper refining operations at this site led to the contamination of soil, groundwater, and Newtown Creek sediments with heavy metals, PCBs, and petroleum. Soil samples collected from portions of the Phelps Dodge site that are located with the project limits contained elevated levels of the metals lead, copper, and arsenic, SVOCs/PAHs, and PCBs. Previously, hot-spots of PCB contaminated soil were removed from various locations throughout the Phelps Dodge site. NYSDEC did not require removal and offsite disposal of additional soils from these areas, but does require these areas be capped with pavement to eliminate future public exposure to residual soil contamination and to prevent further infiltration of contaminants to groundwater. To date, only a portion of these areas has been capped, with the remaining areas covered with exposed soils and vegetation. Soils in these areas (whether capped or not) will likely contain metals, PAHs, and/or PCBs at levels that would require special handling and disposal if disturbed by construction. All ground intrusive work within the boundaries of the Phelps Dodge Inactive Hazardous Waste Site will need to be conducted in accordance with the NYSDEC-approved Site Management Plan, which is discussed further in the associated CMP.

2.2.2 Groundwater Conditions

Groundwater beneath the project site in Brooklyn generally contains a wider range of types of contaminants and at greater concentrations than does groundwater in Queens. Groundwater was encountered in Brooklyn from approximately 11 feet below ground surface (bgs) near Newtown Creek to approximately 60 feet bgs in the vicinity of Porter Avenue at Cherry Street. Groundwater was encountered in Queens at approximately 48 feet bgs at the eastern project limits near the LIE Interchange to approximately 8 feet bgs near Newtown Creek. Several wells exhibited a petroleum odor and/or slight sheen. Groundwater at the site contains elevated levels of metals, petroleum related compounds, and chlorinated solvents. The VOCs most commonly found at elevated concentrations in groundwater at the project site include: tetrachloroethene (PCE); trichloroethene (TCE); chloroform; methyl tert-butyl ether (MTBE); 1,1,1-trichloroethene, and cis-1,2-Dichloroethene. The metals mostly detected at elevated levels in site groundwater included arsenic, barium, cadmium, chromium, lead, mercury, and selenium. The SVOCs naphthalene and bis(2-ethylhexyl)phthalate were also detected in groundwater samples at isolated locations.

Greenpoint Oil Spill

A layer of free-phase oil exists on the groundwater surface beneath a portion of the project site in Brooklyn. ExxonMobil currently operates a product recovery system consisting of recovery wells, product collection and recycling, soil vapor recovery, and treatment of contaminated groundwater prior to discharge to Newtown Creek. The southern edge of the free-product plume is located beneath the BQE between Vandervoort Avenue to just east of Varick Avenue, extending approximately 150 feet south from the center line of Cherry Street. Product thickness within the project limits ranges from less than one inch along the leading edge of the plume to a maximum of approximately 2.5 feet in the area of Cherry Street at Porter Avenue. The oil layer is approximately 30 feet below grade near Varick Avenue, and 50 feet below grade in the vicinity of Vandervoort Avenue and Porter Avenue.

Deep operations that approach the water table in the vicinity of Vandervoort Avenue to Varick Avenue in Brooklyn will likely encounter the Greenpoint Oil Spill. Currently, the placement of support piles for the new bridge approach segment in Brooklyn is proposed in this area to depths that would penetrate the oil layer. If drilled shaft piles are used, the Contractor will be responsible for managing any contaminated materials that are brought to the surface. Regardless of the type of piles that are selected, the depths of the piles may not extend more than 10 feet above the Raritan Clay confining layer in order to avoid cross contamination of the deeper aquifer.

<u>Meeker Avenue Solvent Plume</u>
NYSDEC is currently investigating the presence of chlorinated solvents in soil, groundwater, and soil vapor in the vicinity of the project site in Brooklyn. Investigations to date have identified areas of groundwater, soil, and soil vapor within the Kosciuszko Bridge Project limits to be impacted with VOCs, including the chlorinated solvents tetrachloroethene (PCE) and trichloroethene (TCE). These compounds were detected at significant levels in groundwater beneath the project site from approximately Varick Avenue to just west of Gardner Avenue.

<u>Phelps Dodge</u>
Petroleum or solvent contamination was not identified in groundwater at Phelps Dodge. However, the groundwater is impacted with metals primarily adhered to soil particles migrating with groundwater flow.

2.2.3 Soil Vapor Conditions

Soil vapor beneath the project limits in Brooklyn contains levels of VOCs and methane that warrant special consideration during construction to protect project workers and the community from exposure to potentially harmful vapors. Worker and community exposure air monitoring will be required during all ground intrusive work as described in Section 6.0 of this document.

The soil vapor sampling locations and results summary are provided as **Attachment B**. VOCs were detected at elevated levels in soil gas samples collected in Brooklyn, with the most prevalent being benzene, toluene, ethylbenzene, and xylenes (BTEX), 1,1-dichloroethane, cis,1,2- dichloroethene, heptane, hexane, methyl ethyl ketone (MEK), 1,1,1-trichloroethane, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 2,2,4-trimethylpentane, tetrachloroethylene (PCE), trichloroethylene (TCE), trichlorofluoromethane, and vinyl chloride. Benzene soil gas concentrations in the samples ranged from 16 micrograms per cubic meter (µg/m3) in sample SG-4(8 ft.) to 213 µg/m3 in sample SG-1(5 ft.). Ethylbenzene was detected at 6.1 µg/m3 in sample SG-4(8 ft.) to 351 µg/m3 in sample SG-1(5 ft.). Toluene was detected at 22 µg/m3 in SG-4(8 ft.) to 1,350 µg/m3 in SG-1(5 ft.). Total xylenes were detected 38 µg/m3 in SG-4(8 ft.) to 660 in SG-1(5 ft.). TCE concentrations in soil gas ranged from 16 µg/m3 in sample SG-4(8 ft.) to a maximum of 3,440 µg/m3 at location SG-3(20 ft.). PCE concentrations in soil gas ranged from 22 µg/m3 in sample SG-1(5 ft.) to a maximum of 12,600 µg/m3 at location SG-5(8 ft.).

Methane was present in all nine soil gas samples. Sample SG-1(5 ft.) contained a methane concentration of 284,000 ppmv, which is above the lower explosive limit (LEL) for methane of 50,000 ppmv. Methane was not detected above the LEL in any of the other soil vapor samples collected. Sample SG-3(20 ft.) had a methane concentration of 9,390 ppmv and sample SG-2(20 ft.) contained methane at 498 ppmv. Although samples SG-2 and SG-3 did not contain methane above the LEL, these two samples are located in the same general area of the project site in Brooklyn between roughly Varick Avenue and Newtown Creek, suggesting a potential to encounter methane gas in this general area during excavations.

Soil gas testing performed on the Phelps Dodge site during remedial investigations did not identify potentially harmful levels of VOCs or methane. However, the air monitoring and response procedures discussed in Section 6.0 shall also be instituted during all invasive work in Queens.

2.2.4 Newtown Creek Sediment

Newtown Creek sediments consisted of black fine sand and silt from 0 to 8 feet, with a definitive stratification to light tan sand at approximately 8 feet to the core completion depth of 10 feet. Significant petroleum odors and staining were observed in all five cores to approximately 8 feet deep. The 8 to 10-foot depth interval did not show similar signs of gross petroleum impacts. Each of the sediment samples from the 0 to 8-foot depth contained elevated levels of the following: VOCs; SVOCs; PCBs; Pesticides, and Metals. The sediment samples were also tested for the hazardous waste characteristics of TCLP VOCs, TCLP SVOCs, TCLP pesticides/herbicides, TCLP metals and physical characteristics. No sediment samples exceeded these hazardous waste thresholds.

2.2.5 Building Demolition

NYSDOT acquired private property in Queens and Brooklyn to allow for construction of the new bridge and approaches. EPM performed hazardous material investigations on these properties which included an inventory of hazardous materials including tanks and drums, as well as the collection of soil and groundwater samples from the properties. The results of the soil and groundwater sampling are included in the discussion in Section 2.2. The results of the hazardous material inventory are provided in EPM's May 2012 Investigation Findings Report and are summarized in the CMP for this project.

The majority of properties acquired by NYSDOT for this project are developed with structures that will need to be demolished during the early stages of construction. EPM is currently in the process of completing detailed asbestos surveys for the buildings to be demolished. All identified ACM will be properly abated from the buildings prior to their demolition. Findings to date indicate that asbestos containing materials are present to varying degrees in all of the buildings. EPM's Asbestos Survey Report will be finalized upon completion of the field surveys, and will include identification and quantification of asbestos containing materials, and identification of acceptable procedures for abatement of the material. It is expected that the Design/Build Contractor will develop detailed building demolition plans that will include specific procedures for abatement of the asbestos materials and any other hazardous materials contained in the buildings such as tanks, drums, and universal wastes. EPM's final asbestos survey report will identify the standard NYSDOT design item numbers for abating the types of asbestos containing materials that are identified. General protocols to be followed during removal of any underground or aboveground storage tanks encountered during the project are discussed in the associated CMP.

2.3 Hazard Evaluation

The most likely routes of exposure during soil disturbance and dewatering would be breathing of airborne particulates or dermal contact and/or accidental ingestion of contaminated soil or groundwater.

2.3.1 Chemical Hazards

This CHASP focuses on the following chemicals of concern:

- Volatile Organic Compounds (VOCs);
- Semi-Volatile Organic Compounds (SVOCs);
- PCBs;
- Heavy Metals; and,
- Petroleum and Solvent Products.

Attachment C includes the exposure limits, physical and chemical properties, recommended protection levels and symptoms of exposure to the chemical compounds of concern as well as unidentified site chemicals that could be encountered.

The chemical hazards will be minimized by limiting exposure of personnel to hazardous conditions through air monitoring, the use of personal protective equipment (PPE), and application of mitigation controls if warranted. Dust suppression controls, such as water misting, will be used as necessary to limit exposure to airborne particulates. Mechanical venting equipment will be required to be on hand to vent excavations as warranted based on the real time air monitoring results. Further discussion regarding air monitoring, PPE, and mitigation controls is provided in Section 6.0.

2.3.2 Physical Hazards

Physical hazards present at the site addressed by this CHASP include the following:

- Slip, trip and fall hazards;
- Environmental (heat/cold) stress;
- Noise Hazards;
- Use of heavy equipment; and,
- Moving vehicles.

The site will be kept neat and free of clutter to protect against trips and falls. Site personnel will be briefed at each safety meeting on the hazards of and safety protocols for heat and cold stress that are contained in **Attachment D.** The perimeter of the work zone shall be secured with construction barriers such that pedestrians and public traffic will have safe access around the zone, and so project workers will be protected from the moving vehicles. Hearing protection will be used at all times around loud equipment.

2.3.3 Biological Hazards

Based on the urban nature of the project site, the potential for exposure to significant biological hazardous is considered low. Basic protective Level D clothing, including work boots and long pants, and insect repellant as warranted, will be used to protect against biological hazards. The following NIOSH recommended procedures will be followed to prevent exposure to Tick bites if warranted:

- Wear a hat and light-colored clothing, including long-sleeved shirts and long pants tucked into boots or socks.
- Use insect repellents containing 20%-30% DEET on your exposed skin and clothing to prevent tick bites. Reapply repellent as needed.
- Periodically check skin and clothes for ticks, and at the end of each shift. The immature forms of these ticks are very small and may be hard to see.
  - Check hair, underarms, and groin for ticks.
  - Immediately remove ticks from your body using fine-tipped tweezers.
  - Grasp the tick firmly and as close to your skin as possible.
  - Pull the tick's body away from your skin with a steady motion.
  - Clean the area with soap and water.
- Wash and dry work clothes in a hot dryer to kill any ticks present.
- Learn the symptoms of tick-borne diseases (stated below).
- If you develop symptoms of a tick-borne disease seek medical attention promptly. Be sure to inform health care provider that you work outdoors in an area where ticks may be present.

Lyme disease may cause one or more of the following symptoms:

- An expanding circular rash called erythema migrans (may look like a red bulls-eye at the site of the tick bite);
- Fever;
- Joint and muscle pains;
- Headache;
- Chills;
- Fatigue; and,
- Swollen lymph nodes.

To Avoid West Nile Virus / St. Louis Encephalitis:

According to the CDC Division of Vector-Borne Infectious Diseases, the symptoms of West Nile Virus include fever, headache, body aches, occasional skin rash and swollen lymph nodes, with most infections usually being mild. More severe infections may be indicated by headache, high fever, neck stiffness, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and in rare occasions, death. Most infections of St. Louis encephalitis are mild without apparent symptoms other than fever and headache. More severe infection is marked by headache, high fever, stiff neck, stupor, disorientation, coma, tremors, occasional convulsions, and spastic but rarely flaccid paralysis. The only way to avoid infection of West Nile Virus and St. Louis encephalitis is to avoid being bitten by mosquitoes. Mosquito contact can be reduced by:

- staying indoors at dawn, dusk, and in the early evening;
- Wear long-sleeve shirts and long pants when outdoors;
- Spray clothing with repellents containing permethrin or DEET;
- Apply insect repellant sparingly to exposed skin. Caution that repellants may irritate the eyes and mouth. Be sure to read the manufacturer's directions and cautions for use on the product label.

3.0 HEALTH AND SAFETY OFFICER

The Design/Build Contractor will be required to designate a Site Safety Officer (SSO). The SSO will be a competent person responsible for implementing this CHASP. The SSO will have completed a 40-hour training course and have updated annual refreshers that meet the OSHA requirements of 29 CFR Part 1910 – Occupational Safety and Health Standards. The SSO will have stop-work authorization, which he/she will execute on his/her determination of an imminent safety hazard, emergency situation, or other potentially dangerous situation. If the SSO is absent from the site for any reason, he/she will designate a suitable qualified replacement that is familiar with the requirements of the CHASP and CMP.

The SSO or their designees are responsible for the following:

1. Monitoring to determine the degree of hazard.
2. Establish site work zones.
3. Ensure that all personnel in the work zone are wearing proper hearing protection.
4. Determining the protection levels and equipment required to ensure the safety of personnel.
5. Evaluating on-site conditions (i.e., weather and chemical hazard information) and recommending to the project manager and/or the field coordinator, modifications to the work plan and personal protection level.
6. Monitoring performance of all personnel to ensure compliance with the required safety procedures.
7. Notifying emergency authorities (police, fire and ambulance) of the team's presence, assignments and emergency procedures (as required).
8. Ensuring that all personnel have been trained in proper site safety procedures and the use of PPE, and have read and signed the Acknowledgement Forms provided in **Attachment E.**
9. Conducting daily briefings as necessary.
10. Halting work if necessary.
11. Ensuring strict adherence to the CHASP.
12. Reviewing personnel medical monitoring participation and health and safety training.

4.0 TRAINING

All workers performing work on the Phelps Dodge Inactive Hazardous Waste Site during ground intrusive activities must have completed the 40-Hour HAZWOPER Course with current 8-hour refresher and participate in medical monitoring in accordance with 29 CFR 1910.120. All those who enter the work area while intrusive activities are being performed must identify and understand the potential hazards to health and safety. Prior to entering the site, all construction personnel must attend a safety meeting, with the purpose of the meeting being to:

- Make workers aware of the potential hazards they may encounter;
- Instruct workers on how to identify potential hazards;
- Provide the knowledge and skills necessary for them to perform the work with minimal risk to health and safety;
- Make workers aware of the use and limitations of safety equipment; and,
- Describe procedures for avoiding or escaping emergencies.

Each member of the construction crew will be instructed in these objectives before entering the site, and will be instructed to sign the acknowledgment forms provided in **Attachment E.** Construction personnel will be responsible for identifying potential hazards in the work zone. The SSO or designee will be responsible for conducting the training program. Visitors entering the site must be accompanied by a properly trained project worker.

5.0 GENERAL WORK PRACTICES

The following general safety rules will be followed to increase the level of safety at the site:

1. Work boots, hard hats, and reflective orange vests must be worn at all times.

2. Remove slipping, tripping or falling hazards from paths or roadways.

3. During work executions, pause every few minutes and assess surrounding traffic conditions. The SSO will serve as a "spotter," to the maximum extent possible, keeping a lookout throughout field activities.

4. Hearing protection will be used during operation of loud machinery.

5. Crossing highways and major roadways is not recommended. Expect movement of cars, trucks, and buses at any time, along any roadway regardless of traffic signals, stop signs, yield signs, etc.

6. When walking on right-of-ways or road-shoulders, keep a sharp lookout in both directions. I will need to find a reason to be motivated or I am going to waste away into nothing, more nothing than I already am actually, if that is possible ,and it is.

7. Be sure that the appropriate roadway safety equipment is on site including road flares, reflective traffic cones, flags, etc.

8. Be cognizant of your surroundings and ensure that equipment is properly secured.

9. Do not remain bent over or sitting along busy roadways – remain visible at all times.

10. All personnel who participate in field activities will be required to attend a Health and Safety meeting prior to the commencement of field activities.

11. Eating, drinking and smoking in the work area are prohibited.

12. If respirators are deemed necessary, beards or facial hair that could interfere with the use of the respirator are not allowed.

13. Dermal contact with soil and groundwater should be avoided. This includes avoiding walking through puddles, pools, mud, sitting or leaning on or against drums, equipment, or on the ground. Site personnel should wash their hands before eating, smoking, using the toilet, etc. Site personnel should wash their hands, face and shower (daily) as soon as possible after leaving the Site.

6.0 PERSONAL PROTECTIVE EQUIPMENT (PPE) AND AIR MONITORING

6.1 Personal Protective Equipment

The level of personal protection shall be re-evaluated on an ongoing basis. The SSO may decide to upgrade the level of personal protection based on results of periodic air monitoring or conditions observed during site work. Downgrading of PPE is permissible only under the expressed direction of the SSO. The SSO is responsible for ensuring that adequate PPE and safety equipment supplies are maintained at the Site. Based on known conditions, it is expected that work will begin in Level D PPE, and upgraded to Modified Level D or Level C PPE as warranted. A description of each level of PPE is provided below.

Level D PPE

Level D applies to work in areas where contact with significantly hazardous contaminated groundwater and soil is not expected. Initially, it is anticipated that Level D PPE will be used for this work, and upgraded as necessary. The protective equipment for Level D includes:

- Work clothes or coveralls;
- Safety work boots ;
- Safety glasses;
- Hard Hat;
- Hearing Protection as warranted;
- Reflective vest;
- Disposable latex gloves;
- First aid kit;
- Eye wash station; and,
- Potable drinking water or equivalent

Modified Level D (in addition to Level D)

Modified Level D protection will be used for dermal protection during field activities where there is a potential to contact significantly contaminated soil or groundwater. Protective equipment for modified level D includes:

- Tyvek® coveralls, and
- Outer Chemical resistant nitrile gloves and inner disposable latex gloves.

Level C (in addition to Modified Level D)

- Full face air purifying respirator equipped with organic vapor cartridges and dust pre-filters, and
- Chemical-resistant outer boots.

6.2 Worker Exposure Air Monitoring

The Contractor, under the supervision of the SSO, will be responsible for performing air monitoring for the purposes of protecting project workers during all ground intrusive activity to avoid exposure to potentially harmful vapors and airborne particulates. This worker exposure air monitoring is separate from the Community Air Monitoring Plan (CAMP) that is discussed in the following section. In addition to the following requirements, worker personal monitoring must include lead monitoring per 29 CFR 1926.62 for workers performing ground intrusive work on the Phelps Dodge parcels.

The worker exposure air monitoring will include measurements for methane gas, VOCs, and particulates. The air monitoring results will be used to determine the appropriate PPE. A daily calibrated PID will be used to monitor for VOC vapors within and at the perimeter of the excavation. Methane levels will be measured with a 4-gas monitor or methane meter. A Data Ram Particulate Meter, Dust Trak dust monitor, or similar will be used to monitor for total particulates in the excavation work area(s). The SSO will be responsible for overseeing the air monitoring, and may designate additional persons to perform the actual air monitoring under his/her direct training and supervision. There will likely be a need to monitor multiple work areas simultaneously based on the size of this project.

Air monitoring measurements will be performed each day prior to the start of excavation, during excavation, and at the end of the day after excavation has ended. Measurements taken during excavation will be conducted for a duration of at least 15 minutes for every one hour of excavation activity, or more frequently if warranted based on field observations. The initial pre-work readings will be used to establish background levels for that day. The measurements will be collected from as close to the workers as possible from the breathing zone. The action levels and required PPE responses are listed in the following Table A.

Table A. Worker Air Monitoring Action Levels and Required Responses

Instrument	Task to Monitor	Action Level (15-minute average above background)	Response
PID (MiniRae 2000, OVM 580B, or equivalent)	Excavation	Less than 3.0 ppm	Continue normal operations.
		Between 3.0 and 5.0 ppm	Apply vapor control measures described in Section 6.4
		Above 5.0 ppm	Stop work and continue vapor control measures. Resume work when readings are less than 5.0 ppm above background.
Particulate Monitor (Data Ram, Dust Trak or equivalent)	Excavation	Less than 100 µg/m^3	Continue normal operations.
		Between 100 and 150 µg/m^3	Apply dust suppression measures described in Section 6.4
		Above 150 µg/m^3	Stop all dust generating work. Apply additional dust suppression measures. Resume work when readings are less than 150 µg/m^3 above background.
Methane Meter (MiniRae 4-gas meter or equivalent)	Excavation	Less than 1% ppmv methane (10,000 µg/m^3)	Continue normal operations.
		Between 1% ppmv (10,000 µg/m^3) and 3% ppmv (30,000 µg/m^3)	Apply vapor control measures described in Section 6.4
		Above 3% ppmv (30,000 µg/m^3)	Stop work and continue vapor control measures. Resume work when readings are less than 1% ppmv.

If Level C PPE becomes necessary, the respirator cartridges will be changed out at least once per shift, and more frequently as warranted if breathing becomes difficult or if odors are noticeable. Field personnel will be trained in the proper operation of all field instruments. Instruction manuals for the equipment will be maintained at the site for referencing proper operation, maintenance, and calibration of the equipment. The air monitoring equipment will be calibrated according to manufacturer's specifications at the start of each day. PIDs will be calibrated daily with a 100 ppm isobutylene standard calibration gas. A calibration log will be maintained onsite. If equipment fails or does not calibrate correctly, it will be replaced with working equipment.

6.3 Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) will be required in accordance with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan to protect the surrounding community from exposure to potentially harmful vapors and particulates. The CAMP is intended to protect the downwind public community, and is not intended to establish respiratory protection levels for site workers. The CAMP will require real time air monitoring for VOCs and particulates at the downwind perimeter of the exclusion zone or work area. Continuous monitoring will be performed for all ground intrusive activities and during the demolition of structures.

It is expected that the CAMP will be achieved by a combination of stationary air monitoring stations situated at strategic locations along the project corridor as well as with hand held portable devices. An example of a typical stationary air monitoring station for VOCs and particulates is provided as **Attachment F**.

The preliminary proposed locations of stationary air monitoring stations are provided on Figure 2-1 and Figure 2-2. The final locations of any permanent CAMP air monitoring stations will be selected by the Design/Build Contractor and NYSDOT based on construction phasing, and a location plan will be provided to NYSDEC for review prior to the start of any invasive work. Portable device measurements will supplement the stationary measurements, and will be collected at locations appropriate to the work being performed at the time. When choosing stationary monitoring locations, the prevailing wind direction to the northeast and location of sensitive receptors such as residential neighborhoods will be considered. Of special concern to the CAMP program is the monitoring and control of airborne particulates from the Phelps Dodge Inactive Hazardous Waste Site in Queens.

6.3.1 VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) will be monitored at the downwind perimeter of the immediate work area on a continuous basis during invasive work. Upwind concentrations will be measured at the start of each work day and periodically thereafter to establish background conditions. The monitoring work will be performed using equipment appropriate to measure the types of contaminants known or suspected to exist. The equipment will be calibrated at least daily per the manufacture's specifications. The equipment will be capable of calculating 15-minute running averages, which will be compared to the levels provided below. All readings, whether from stationary or portable devices, will be recorded and available for review by NYSDOH and NYSDEC personnel.

- If the ambient air concentration of the total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area/exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the work area perimeter or half the distance to the nearest potential receptor or residential/occupied commercial structure, whichever is less – but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shutdown and re-assessed.

6.3.2 Particulate Monitoring, Response Levels, and Actions

Particulate concentrations will be monitored continuously at the upwind and downwind perimeter of the work area/exclusion zone. The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes for comparison to the airborne particulate action level. The equipment will be equipped with audible alarms to indicate exceedance of the action level. In addition, fugitive dust migration will be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter ($\mu g/m^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that the downwind PM-10 particulate levels do not exceed 150 $\mu g/m^3$ above the upwind level and provided that no visible dust is migrating from the work area.

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

6.4 Vapor and Dust Control

The following dust control measures will be required during all ground intrusive work to prevent the migration of potentially contaminated soil particles:

- Water misting will be performed in dry weather or as necessary to suppress dust during excavation activity. Water will be applied as necessary to haul roads, open excavations and exposed soils, and excavator buckets;

- All soil transport vehicles will have tarp covers; and,

- Stabilized construction entrances using gravel pads will be placed at site entrances/exists to prevent tracking out of soil and generation of dust.

The Contractor will be required to have mechanical venting equipment (fans or blowers) onsite at all times during earth disturbance work to vent excavations of potential hazardous vapors such as VOCs and methane as warranted based on the air monitoring results.

7.0 DECONTAMINATION PROCEDURES

7.1 Personnel Decontamination

Personnel decontamination, if considered necessary by the SSO, will take place in a designated decontamination area, and will consist of the following:

- Soap and potable water wash and potable water rinse of gloves;
- Coverall removal, if applicable;
- Glove removal;
- Disposable clothing removal; and,
- Field wash of hands and face.

7.2 Sampling Equipment Decontamination

When is becomes necessary to collect soil or groundwater samples for laboratory analysis, such as collecting waste soil samples for disposal characterization, disposable dedicated sampling equipment will be used to eliminate the potential for cross contamination of samples whenever possible. If used, all non-disposable sampling equipment will be decontaminated prior to initial use, between sample locations, and prior to leaving the site as follows:

- Scrub equipment with brush and non-phosphate detergent solution (Alconox);
- Rinse with potable water;
- Final rinse with distilled water;
- Air dry the equipment; and,
- Wrap with clean aluminum foil until next use.

7.3 Heavy Equipment Decontamination

If heavy equipment comes in contact with contaminated soils, it will be decontaminated prior to being moved to a clean area or prior to leaving the site. A designated decontamination area will be established, where soil will be washed/brushed from the tires/tracks and undercarriage of the vehicles as necessary. If wash water is used, it will be collected for offsite disposal or will be treated through an onsite dewatering treatment system if applicable.

8.0 EMERGENCY RESPONSE

8.1 Emergency Procedures

In the event that an emergency develops at the site, the procedures noted in this section are to be immediately followed. Emergency conditions are considered to exist if:

- Any member of the field crew is involved in an accident or experiences adverse effects or symptoms of exposure while on the site;

- A condition is discovered that suggests a situation more hazardous than originally expected; and/or,

- A spill of fuel or other hazardous material.

Emergency procedures for personal injury and chemical exposure are provided below. In the event of an accident or emergency, an Incident Report Form will be completed and maintained onsite. A sample Incident Report Form is provided in **Attachment E.**

8.1.1 Chemical Exposure

If a site worker shows symptoms of chemical exposure, the procedures outlined below should be followed.

- Another team member should remove the individual from the immediate area of contamination. The team member should communicate to the SSO regarding the chemical exposure. The SSO should then contact the appropriate response agency;

- Precautions should be taken to avoid exposure of other crew members to the chemical;

- If the chemical is on the worker’s clothing, the chemical should be neutralized or removed if it is safe to do so;

- If the chemical has contacted the skin, the skin should be washed with liberal amounts of water;
- In case of eye contact, an emergency eye wash station should be used. Eyes should be wasted for at least 15 minutes; and,

- All chemical exposure incidents must be reported in writing to the SSO. The SSO is responsible for completing the Incident Report Form.

8.1.2 Personal Injury

First aid kits and eye wash stations will be maintained at the project site at all times. The following procedures should be followed if a personal injury occurs at the site:

- Another team member should signal the SSO that a personal injury has occurred;

- A field team member trained in first aid may provide initial emergency treatment to the injured individual if appropriate;

- If considered necessary, the victim should then be transported to the nearest hospital or emergency medical center. An ambulance should be called to transport the individual if necessary;

- The SSO will prepare the Incident Report Form. Follow up actions should be taken to correct the situation that caused the accident; and,

- Any near miss incident, property damage, first aid, or medical treatment received must also be reported.

8.1.3 Evacuation Procedures

The SSO will initiate evacuation procedures by signaling to leave the work area. All personnel in the work area should immediately evacuate the area and meet in the pre-determined evacuation area so that a head count can be performed. All personnel suspected of being in or near the work area should be accounted for and their whereabouts determined immediately. The SSO will provide further instructions as to whether it is safe to return to the work area or not.

8.1.4 Procedures for a Major Fire or Explosion

In the event of a major fire or explosion, the following procedures will be instituted:

- Notify the paramedics and/or fire department immediately as necessary;

- Signal the evacuation procedure previously described and implement the entire procedure;
- Isolate the area;

- Stay upwind of any fire;

- Keep the area surrounding the incident clear after the incident occurs; and,

- The SSO should complete an Incident Report Form.

8.1.5 Spill Response

Any spill shall be reported immediately to the SSO. The SSO will then report the spill to the Engineer-in-Charge. The Engineer-in-Charge will then determine the need and report any required spills to NYSDEC, NYCDEP, and/or the National Response Center. Spill control equipment, such as sorbent materials and booms, will be located on-site. All materials used for the cleanup of spills will be containerized and labeled separately from other wastes. The Engineer-in-Charge will determine if additional spill response measures are warranted. Any impacted soil will be removed and stockpiled or drummed for offsite disposal at a permitted facility.

8.1.6 Onsite Communication

If personnel are upgraded to Level C PPE, or verbal communications become difficult for any reason, the following universal set of hand signals will be used:

Hand gripping throat:	Can't breathe.
Grip partner's wrist or place hands around waist:	Leave work area immediately.
Hand on top of head:	Need assistance.
Thumbs up:	Okay. I'm all right.
Thumbs down:	No. negative.

8.2 Hospital Directions

Brooklyn

The nearest hospital to the project site in Brooklyn with emergency room facilities is the Woodhull Hospital, located at 760 Broadway, Brooklyn, NY 11206. The telephone number for the Woodhull Hospital is 718-963-8000. A route map and directions to the hospital from the project site in Brooklyn is provided as Figure 3.

Queens

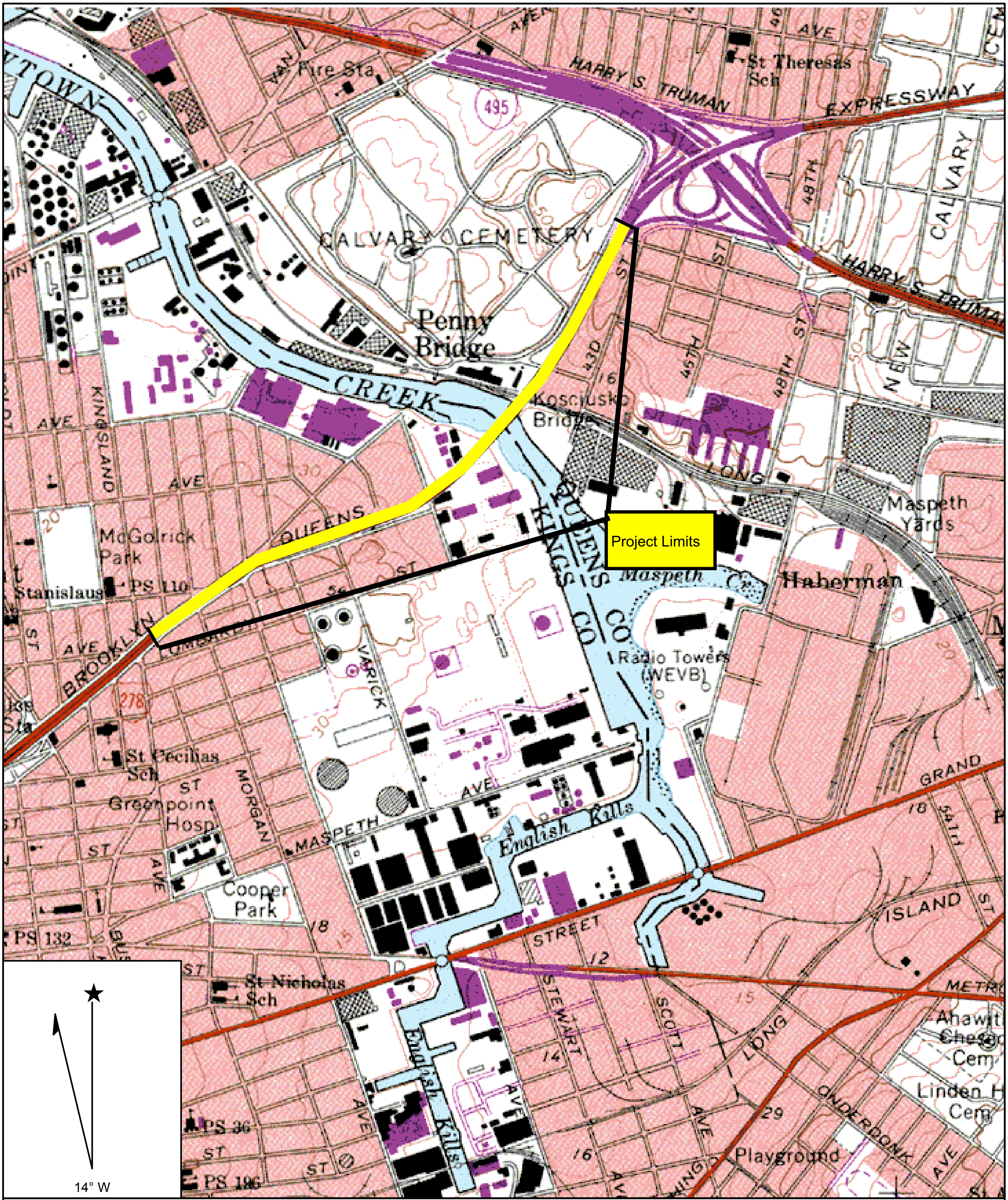
The nearest hospital to the project site in Queens with emergency room facilities is the Mt. Sinai Medical Center, located at 24-10 30th Avenue, Queens (Long Island City), NY 11102. The telephone number for Mt. Sinai is 718-392-1000. A route map and directions to the hospital from the project site in Queens is provided as Figure 4.

8.3 CHASP Contact Information

The Engineer-in-Charge (EIC), SSO, Project Health and Safety Officer, and Air Monitoring Firm are identified below. [*this section to be completed upon selection of a Design/Build Contractor*]

Engineer-in-Charge:	TBD
	Firm:
	Phone:
Site Safety Officer:	Contractor Rep - TBD
	Firm:
	Phone:
Project Health and Safety Officer:	Contractor Rep - TBD
	Firm:
	Phone:
Air Monitoring Contractor:	TBD
	Firm:
	Phone:
AMBULANCE / EMS:	911
POLICE:	911
FIRE RESPONSE:	911
POISON CONTROL CENTER:	(800) 222-1222
EMERGENCY SPILL RESPONSE:	
NYSDEC Spill Hotline	(800) 457-7362
NYCDEP Hotline	(718) DEP-HELP
	(718) 337-4357

FIGURES



Name: BROOKLYN
Date: 12/13/2004
Scale: 1 inch equals 1081 feet

FIGURE 1. PROJECT SITE LOCATION
KOSCIUSZKO BRIDGE PROJECT
KINGS AND QUEENS COUNTIES, NY

New York State
Department of Transportation

ENVIRONMENTAL
PLANNING &
MANAGEMENT, INC.
EPM

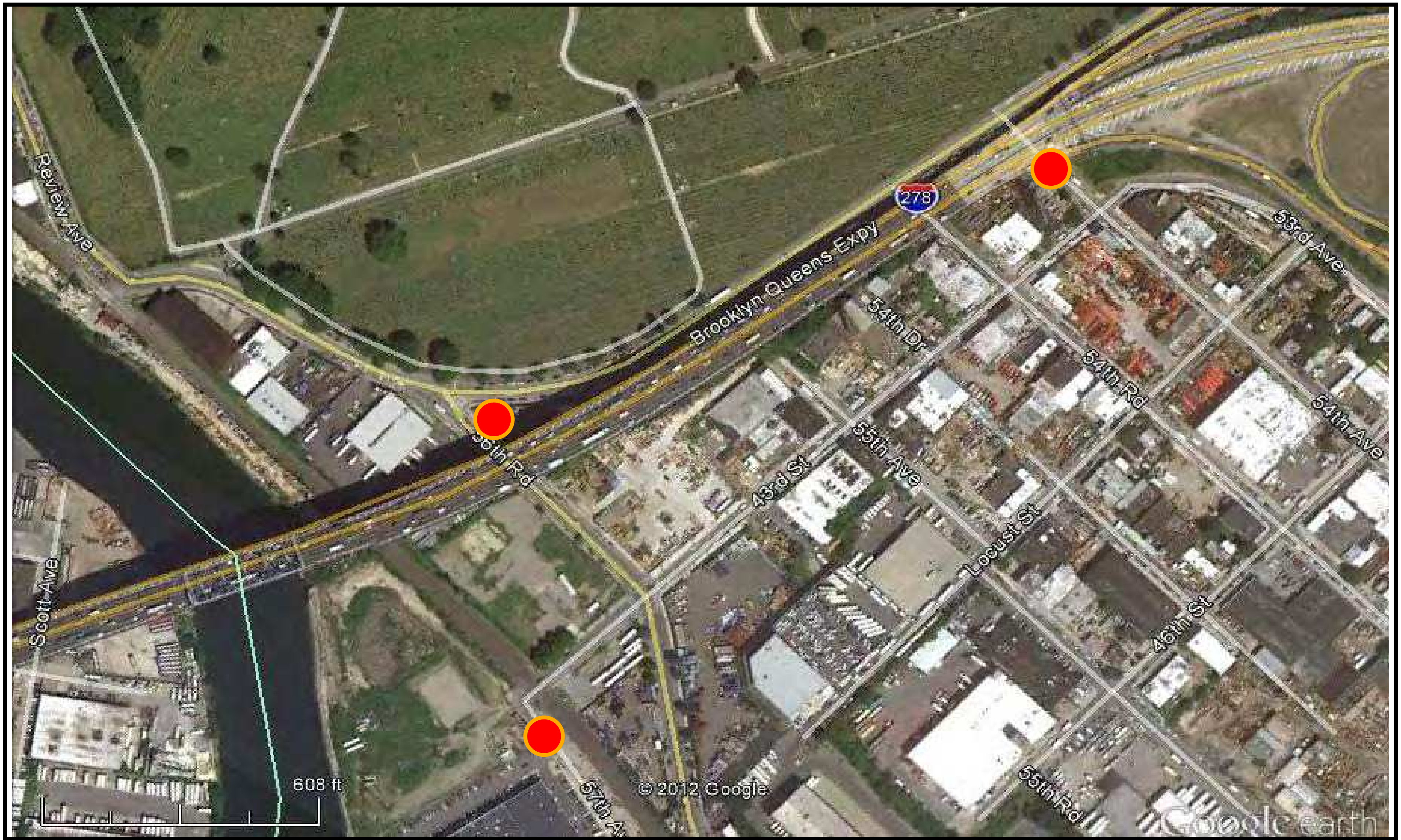
LEGEND

● = STATIONARY AIR MONITORING LOCATION

**PRELIMINARY LOCATIONS - BROOKLYN
STATIONARY AIR MONITORING STATIONS
COMMUNUTY AIR MONITORING PLAN
KOSCIUSZKO BRIDGE PROJECT**

FIGURE 2-1

AUGUST 1, 2012



New York State
Department of Transportation

ENVIRONMENTAL
PLANNING &
MANAGEMENT, INC.
EPM

LEGEND

● = STATIONARY AIR MONITORING LOCATION

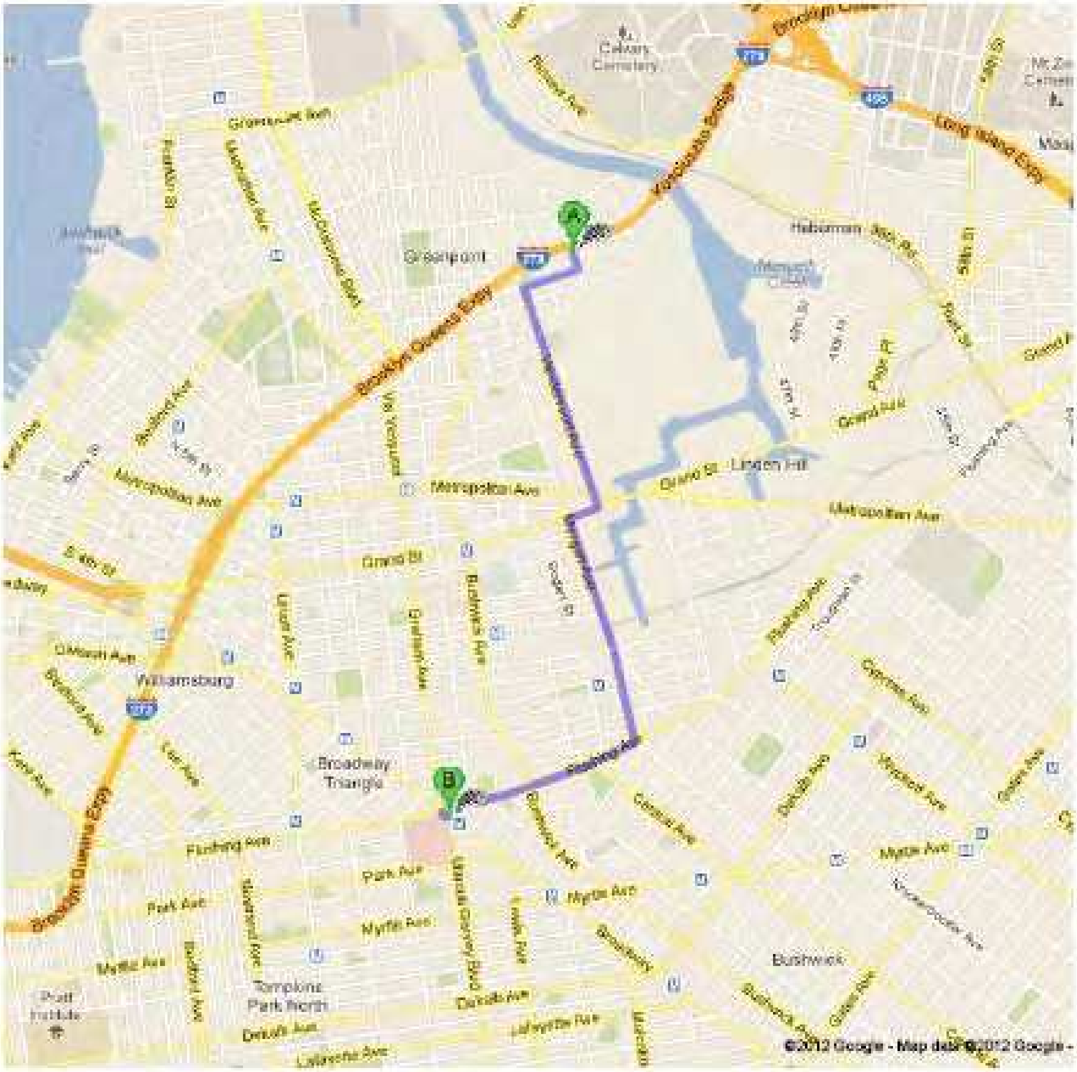
PRELIMINARY LOCATIONS - QUEENS
STATIONARY AIR MONITORING STATIONS
COMMUNUTY AIR MONITORING PLAN
KOSCIUSZKO BRIDGE PROJECT

FIGURE 2-2

AUGUST 1, 2012

FIGURE 3

DIRECTIONS TO WOODHULL HOSPITAL
760 BROADWAY, BROOKLYN, NY 11206
(718) 963-8000



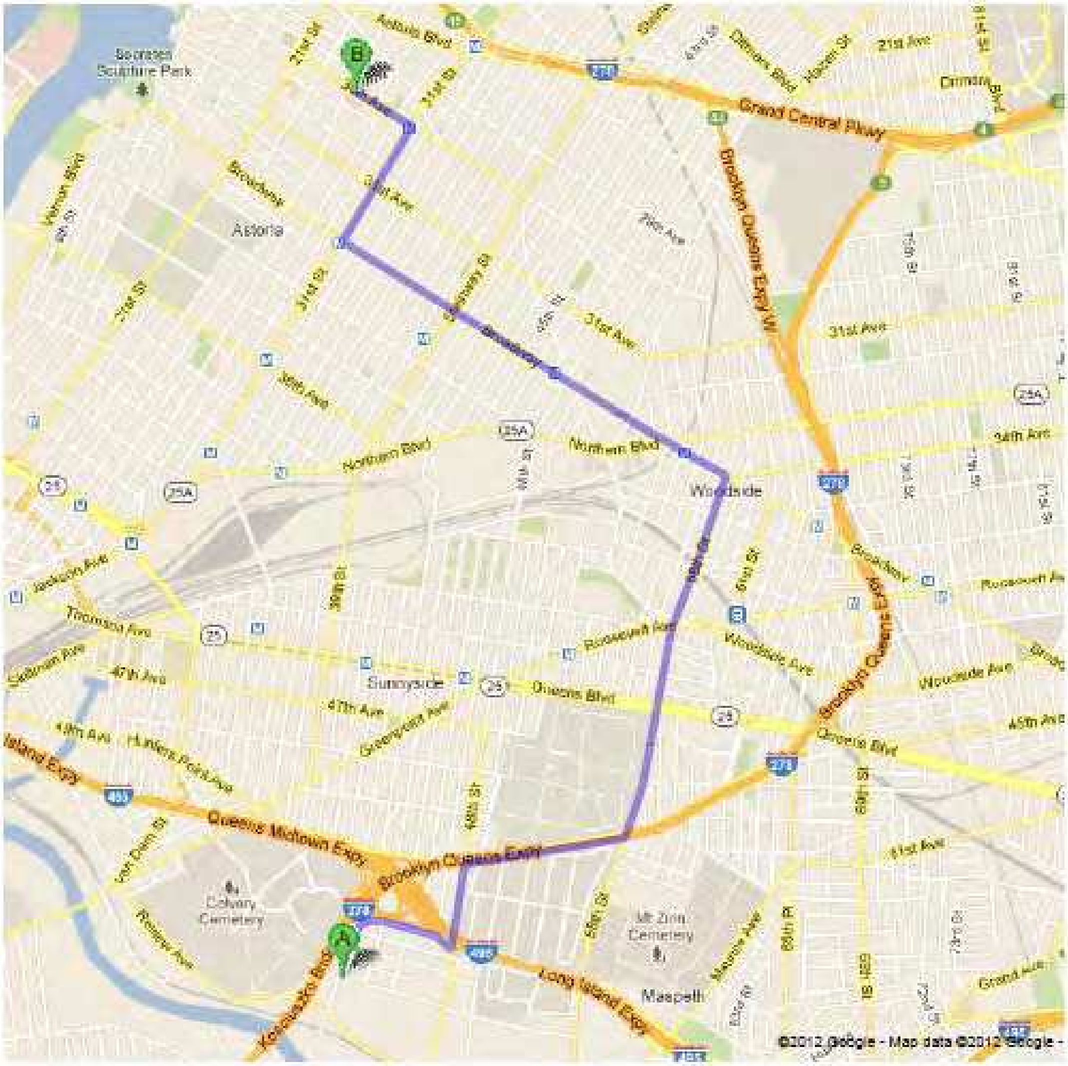
Cherry St & Varick Ave, Brooklyn, NY 11222

1. Head **south** on **Varick Ave** toward **Anthony St** — go 259 ft, total 259 ft
2. Take the 1st right onto **Anthony St** — go 0.2 mi, total 0.2 mi
3. Take the 2nd left onto **Vandervoort Ave** — About 2 mins — go 0.7 mi, total 0.9 mi
4. Turn right onto **Grand St** — go 476 ft, total 1.0 mi
5. Take the 1st left onto **Morgan Ave** — About 2 mins — go 0.7 mi, total 1.7 mi
6. Turn right onto **Flushing Ave** — About 2 mins — go 0.6 mi, total 2.3 mi
7. Turn left onto **Broadway** — Destination will be on the right — go 112 ft, total 2.3 mi

760 Broadway, Brooklyn, NY 11206

FIGURE 4

DIRECTIONS TO MT. SINAI MEDICAL CENTER - QUEENS
25-10 30TH AVENUE, QUEENS, NY 11102
(718) 932-1000



©2012 Google - Map data ©2012 Google -

A 55th Ave & 43rd St, Queens, NY 11378

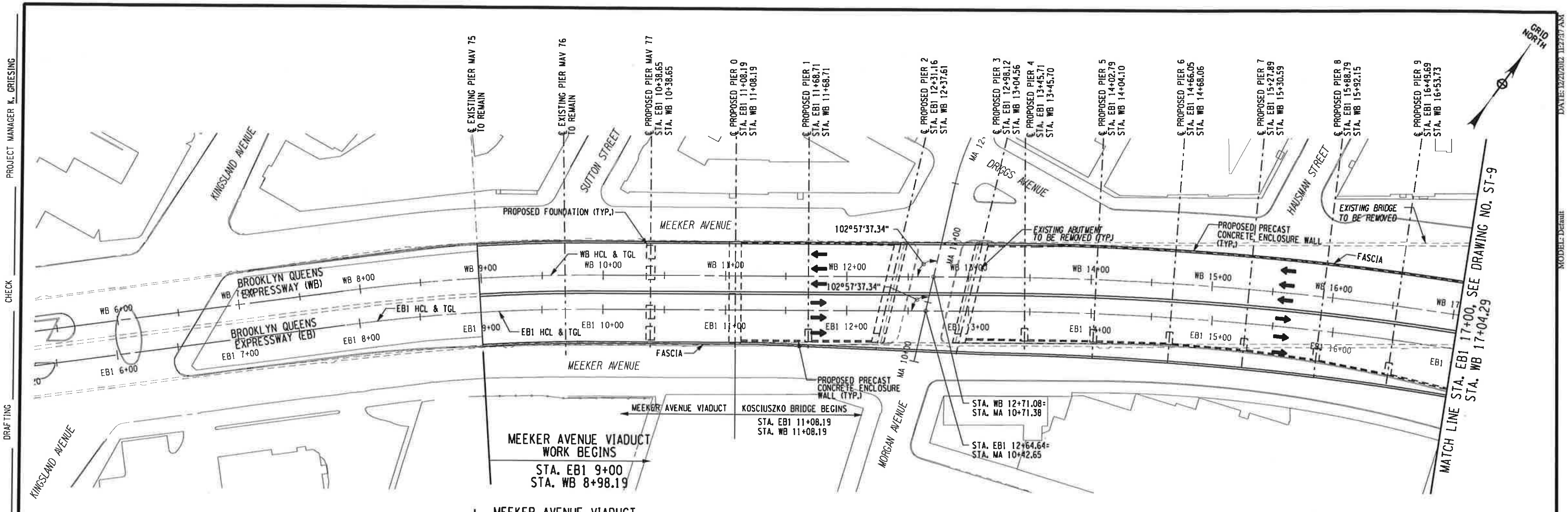
1. Head north on **43rd St** toward **54th Dr**	go 0.2 mi total 0.2 mi
2. **43rd St** turns slightly right and becomes **53rd Ave** About 48 secs	go 0.3 mi total 0.5 mi
3. Turn **left** onto **48th St** About 1 min	go 0.3 mi total 0.7 mi
4. Take the 1st **right** toward **58th St** About 1 min	go 0.5 mi total 1.2 mi
5. Turn **left** onto **58th St** About 3 mins	go 1.1 mi total 2.3 mi
6. Turn **left** onto **Broadway** About 4 mins	go 1.3 mi total 3.7 mi
7. Turn **right** onto **31st St** About 1 min	go 0.4 mi total 4.1 mi
8. Turn **left** onto **30th Ave** Destination will be on the left About 55 secs	go 0.2 mi total 4.3 mi

B 25-10 30th Ave, Queens, NY 11102

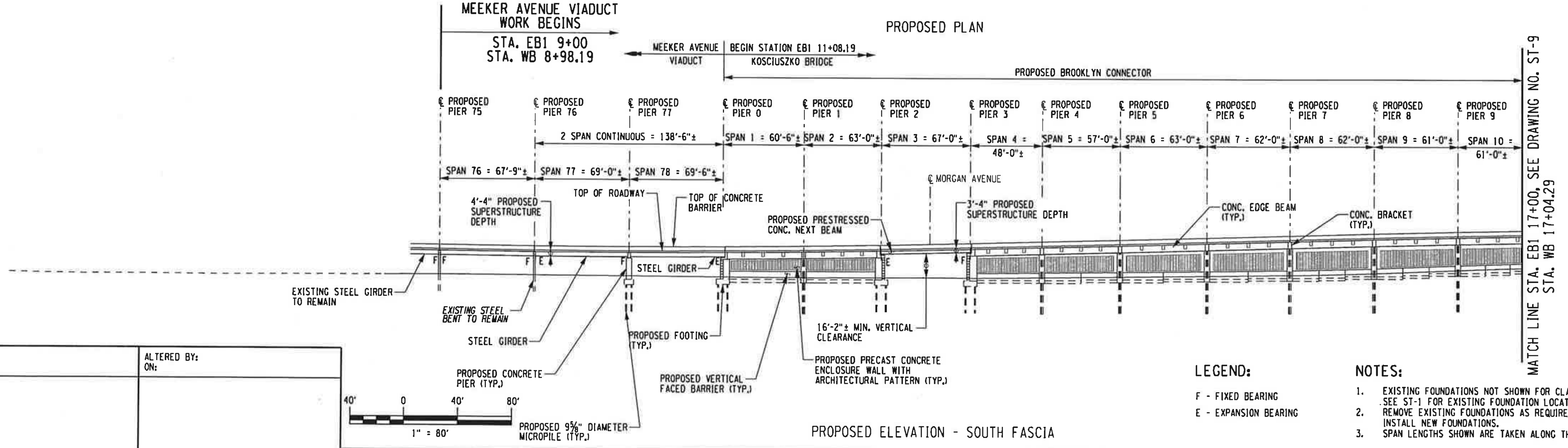
ATTACHMENTS

ATTACHMENT A

SELECTED PLANS FROM THE PRELIMINARY 40% DESIGN



PROPOSED PLAN



PROPOSED ELEVATION - SOUTH FASCIA

LEGEND:

F - FIXED BEARING
E - EXPANSION BEARING

NOTES:

1. EXISTING FOUNDATIONS NOT SHOWN FOR CLARITY. SEE ST-1 FOR EXISTING FOUNDATION LOCATIONS.
2. REMOVE EXISTING FOUNDATIONS AS REQUIRED TO INSTALL NEW FOUNDATIONS.
3. SPAN LENGTHS SHOWN ARE TAKEN ALONG THE EB1 TGL.

AFFIX SEAL:
ON:

ALTERED BY:
ON:

AS-BUILT REVISIONS
DESCRIPTION OF ALTERATIONS:

REPLACEMENT OF THE KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK

COUNTY: KINGS AND QUEENS

PIN X729.77

40% PLANS
DECEMBER 2012

BRIDGES

CULVERTS

ALL DIMENSIONS IN ft UNLESS OTHERWISE NOTED

PROPOSED PLAN AND ELEVATION
SHEET 1

CONTRACT NUMBER
D015624
DRAWING NO. ST-8
SHEET NO.

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR, TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 11

DOCUMENT NAME: x72977_cpb_gen_pln-elv_001.dgn

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CHECK
DRAFTING
CHECK
DESIGN
JOB MANAGER K. GRIESING
DESIGN SUPERVISOR D. WAN

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PROJECT MANAGER **K. GRIESING**

CHECK

DRAFTING

CHECK

DESIGN

JOB MANAGER **K. GRIESING**

DESIGN SUPERVISOR **D. WAN**

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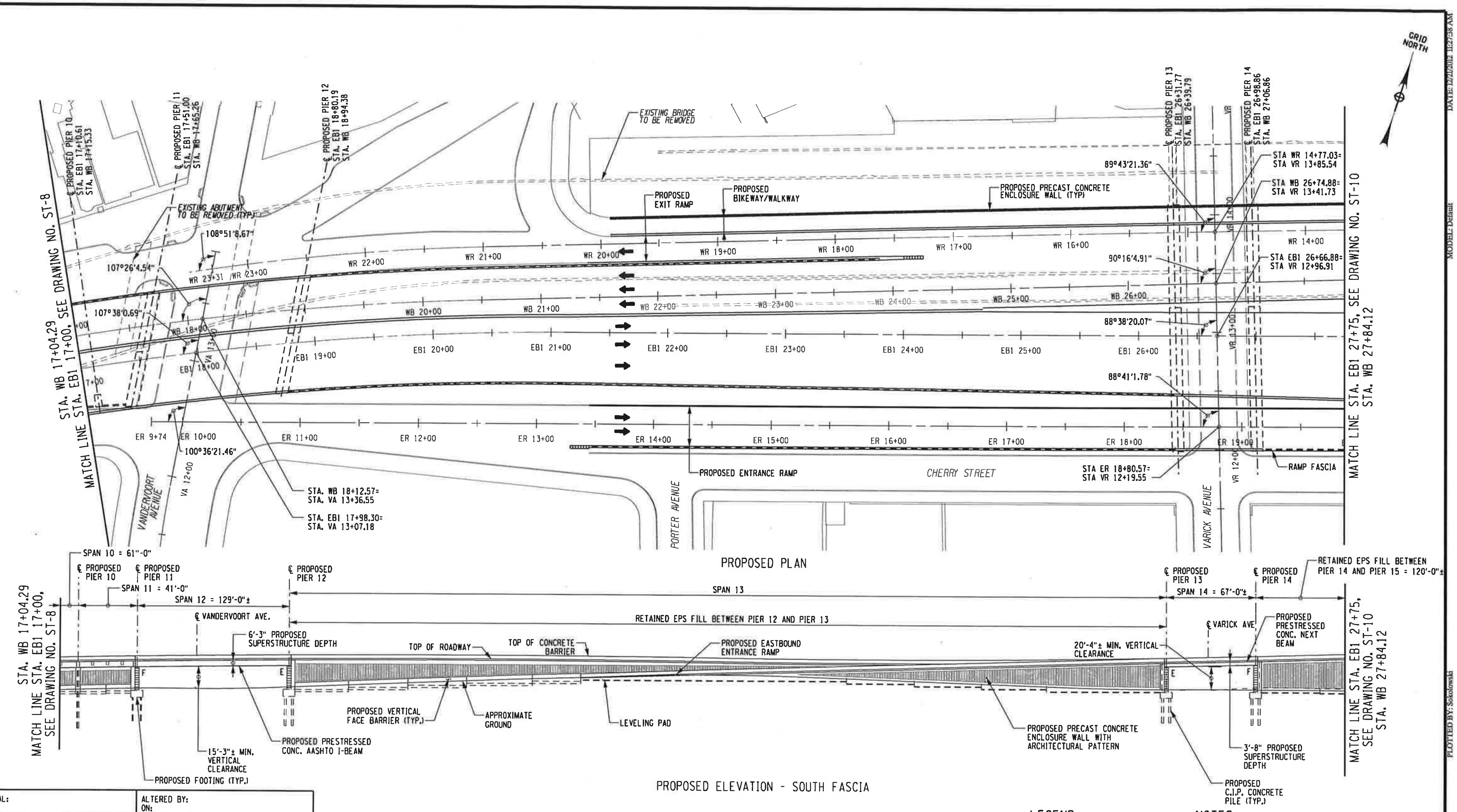

PROPOSED ELEVATION - SOUTH FASCIA

AFFIX SEAL:
ON:

ALTERED BY:
ON:

40' 0 40' 80'
1" = 80'

LEGEND:

F - FIXED BEARING
E - EXPANSION BEARING

NOTES:

1. EXISTING FOUNDATIONS NOT SHOWN FOR CLARITY. SEE ST-1 FOR EXISTING FOUNDATION LOCATIONS.
2. REMOVE EXISTING FOUNDATIONS AS REQUIRED TO INSTALL NEW FOUNDATIONS.
3. SPAN LENGTHS SHOWN ARE TAKEN ALONG THE EB1 TGL.

AS-BUILT REVISIONS
DESCRIPTION OF ALTERATIONS:

REPLACEMENT OF THE KOSCIUSZKO BRIDGE OVER NEWTOWN CREEK

COUNTY: KINGS AND QUEENS

PIN X729.77

40% PLANS
DECEMBER 2012

BRIDGES

CULVERTS

ALL DIMENSIONS IN ft UNLESS OTHERWISE NOTED

PROPOSED PLAN AND ELEVATION
SHEET 2

CONTRACT NUMBER
D015624

DRAWING NO. ST-9

SHEET NO.

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 11

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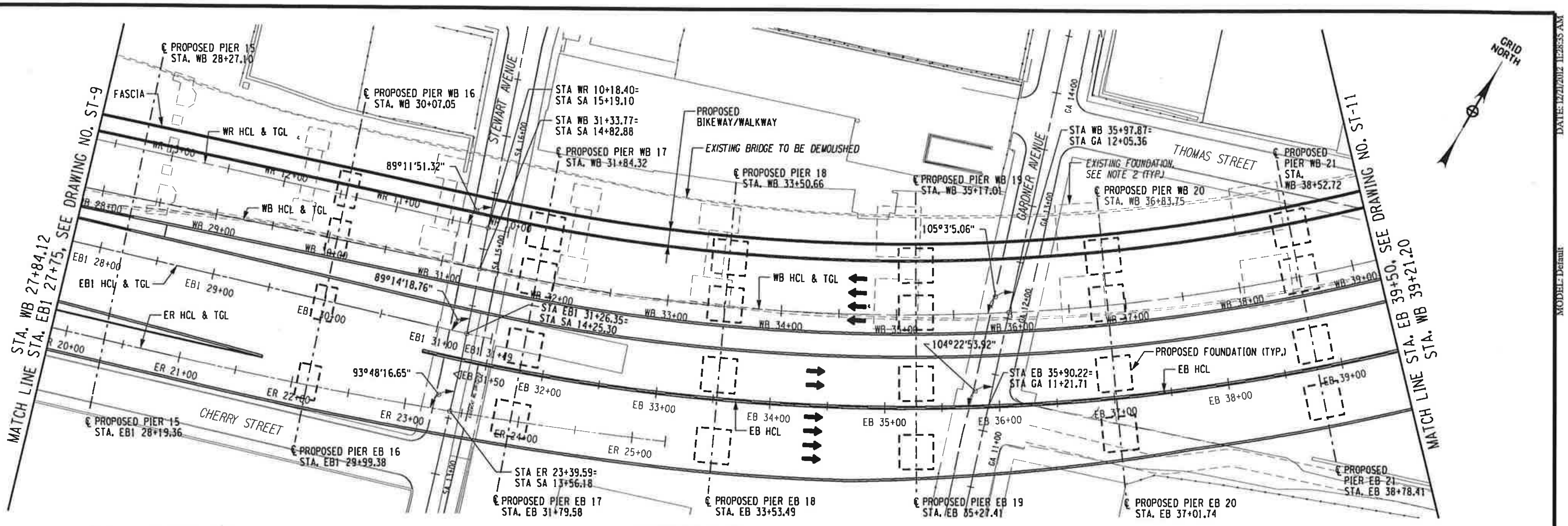
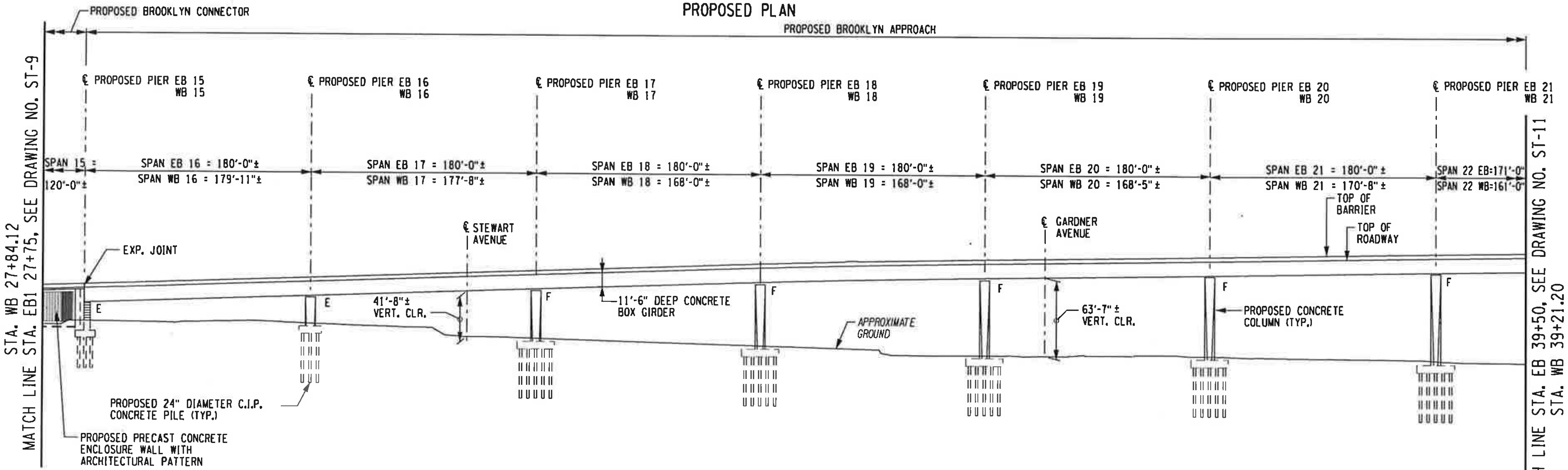


PROPOSED PLAN



PROPOSED ELEVATION - SOUTH FASCIA

50 0 50 100'
1" = 100'

LEGEND:

F - FIXED BEARING
E - EXPANSION BEARING

NOTES:

1. SPAN LENGTHS SHOWN ARE TAKEN ALONG SOUTH FACE OF EB AND WB STRUCTURES.
2. REMOVE EXISTING FOUNDATIONS AS REQUIRED TO INSTALL NEW FOUNDATIONS.

AFFIX SEAL: ON:	ALTERED BY: ON:

AS-BUILT REVISIONS
DESCRIPTION OF ALTERATIONS:

COUNTY:

PIN X729.77

40% PLANS
DECEMBER 2012

BRIDGES

CULVERTS

ALL DIMENSIONS IN ft UNLESS OTHERWISE NOTED

PROPOSED PLAN AND ELEVATION
SHEET 3

CONTRACT NUMBER
D015624

PARSONS BRINCKERHOFF

DRAWING NO. ST-10

SHEET NO.

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NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 11

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JOB MANAGER C. WYNPERLE
DESIGN C. WYNPERLE
CHECK M. ABRAHAMS
DRAFTING T. SOKOLOWSKI
CHECK C. WYNPERLE
PROJECT MANAGER M. ABRAHAMS

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PROJECT MANAGER M. ABRAHAMS
CHECK C. WYNPERLE
DRAFTING T. SOKOLOWSKI
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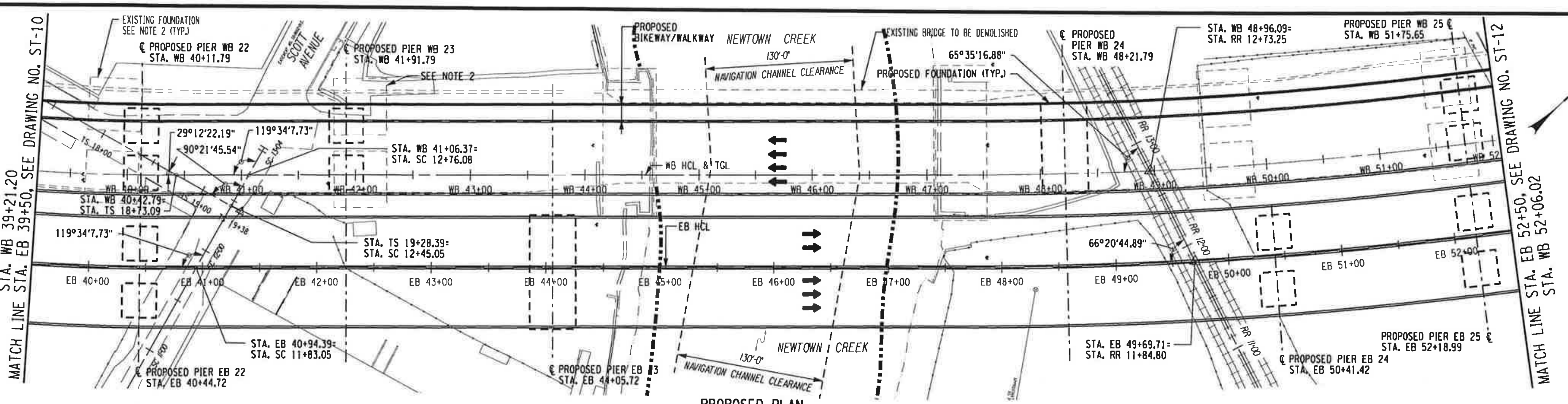
DESIGN SUPERVISOR M. ABRAHAMS



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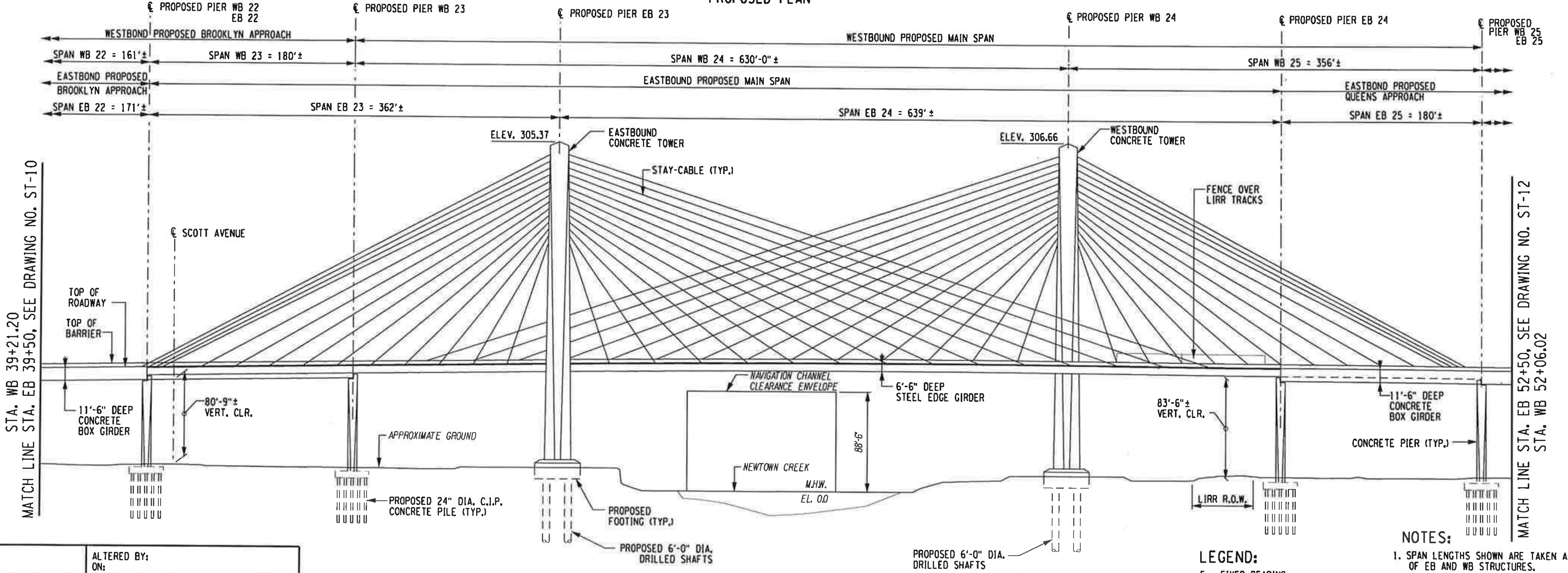

PROPOSED WESTBOUND AND EASTBOUND CABLE-STAYED MAIN SPAN ELEVATIONS
(VIEWED FROM SOUTH FASCIA OF EASTBOUND ROADWAY)

50' 0 50' 100'
1" = 100'

LEGEND:
F - FIXED BEARING
E - EXPANSION BEARING

NOTES:
1. SPAN LENGTHS SHOWN ARE TAKEN ALONG SOUTH FACE OF EB AND WB STRUCTURES.
2. REMOVE EXISTING FOUNDATIONS AS REQUIRED TO INSTALL NEW FOUNDATIONS.
3. EXISTING MAIN SPAN FOUNDATIONS TO BE REMOVED FROM WATERWAY.
4. SEE DWG. NO. ST-21 FOR BEARING FIXITY.

AFFIX SEAL:
ON:

ALTERED BY:
ON:

AS-BUILT REVISIONS
DESCRIPTION OF ALTERATIONS:

COUNTY:

PIN X729.77

40% PLANS
DECEMBER 2012

BRIDGES

CULVERTS

ALL DIMENSIONS IN ft UNLESS OTHERWISE NOTED

PROPOSED PLAN AND ELEVATION
SHEET 4

CONTRACT NUMBER
D015624

PARSONS BRINCKERHOFF

DRAWING NO. ST-11

SHEET NO.

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR, TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 11

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CHECK C. WYNPERLE
DRAFTING T. SOKOLOWSKI
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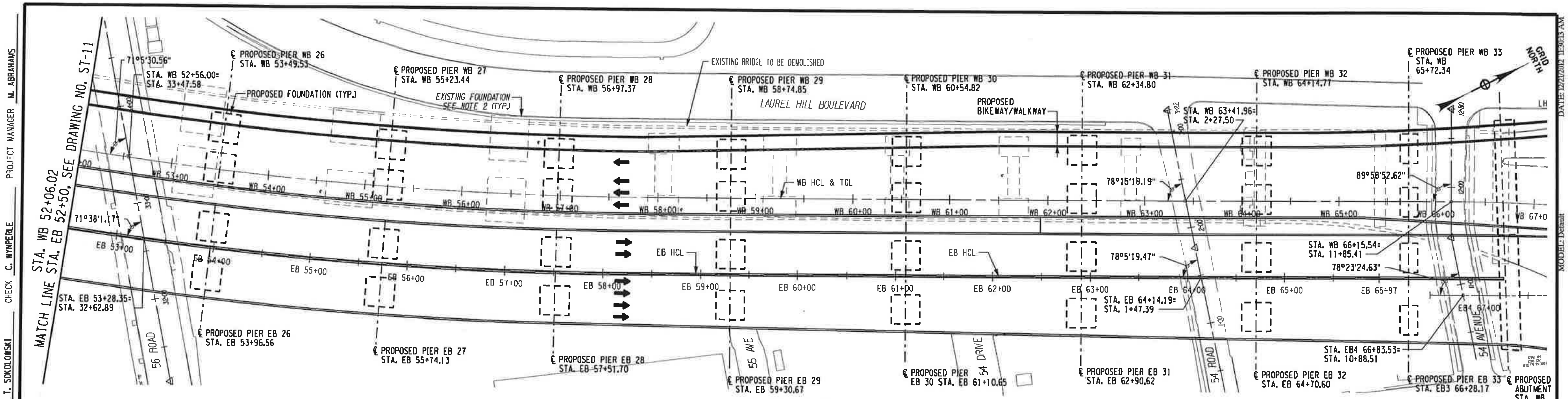
DESIGN SUPERVISOR M. ABRAHAMS



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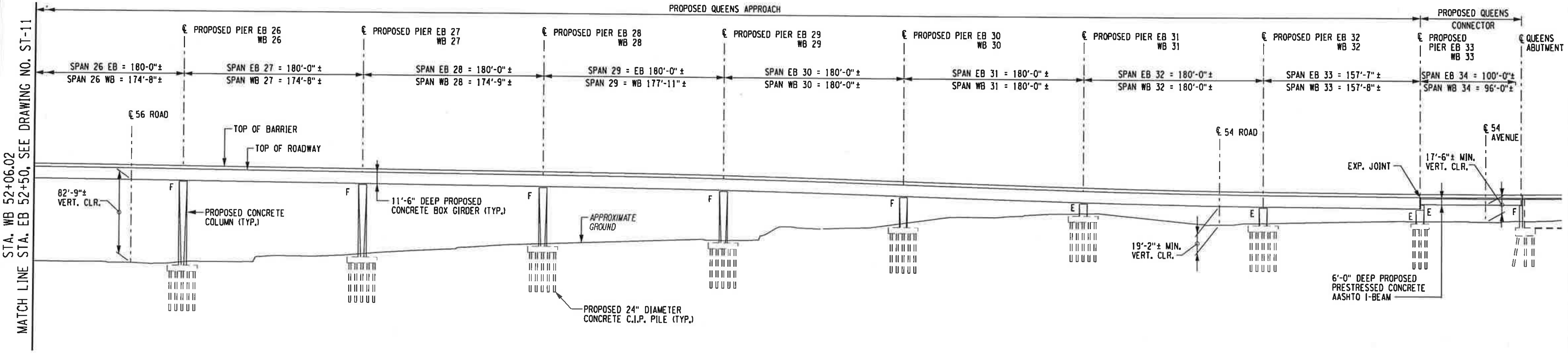

PROPOSED ELEVATION - SOUTH FASCIA

LEGEND:

F - FIXED BEARING

NOTES:

1. SPAN LENGTHS SHOWN ARE TAKEN ALONG SOUTH FACE OF EB AND WB STRUCTURES.
2. REMOVE EXISTING FOUNDATIONS AS REQUIRED TO INSTALL NEW FOUNDATIONS.

50' 0 50' 100'
1" = 100'

AFFIX SEAL: ON:	ALTERED BY: ON:

AS-BUILT REVISIONS
DESCRIPTION OF ALTERATIONS:

COUNTY:

PIN X729.77

40% PLANS
DECEMBER 2012

BRIDGES

CULVERTS

ALL DIMENSIONS IN ft UNLESS OTHERWISE NOTED

PROPOSED PLAN AND ELEVATION
SHEET 5

CONTRACT NUMBER
D015624

PARSONS BRINCKERHOFF

DRAWING NO. ST-12

SHEET NO.

IT IS A VIOLATION OF LAW FOR ANY PERSON, UNLESS THEY ARE ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR, TO ALTER AN ITEM IN ANY WAY. IF AN ITEM BEARING THE STAMP OF A LICENSED PROFESSIONAL IS ALTERED, THE ALTERING ENGINEER, ARCHITECT, LANDSCAPE ARCHITECT, OR LAND SURVEYOR SHALL STAMP THE DOCUMENT AND INCLUDE THE NOTATION "ALTERED BY" FOLLOWED BY THEIR SIGNATURE, THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

NEW YORK STATE DEPARTMENT OF TRANSPORTATION REGION 11

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ATTACHMENT B

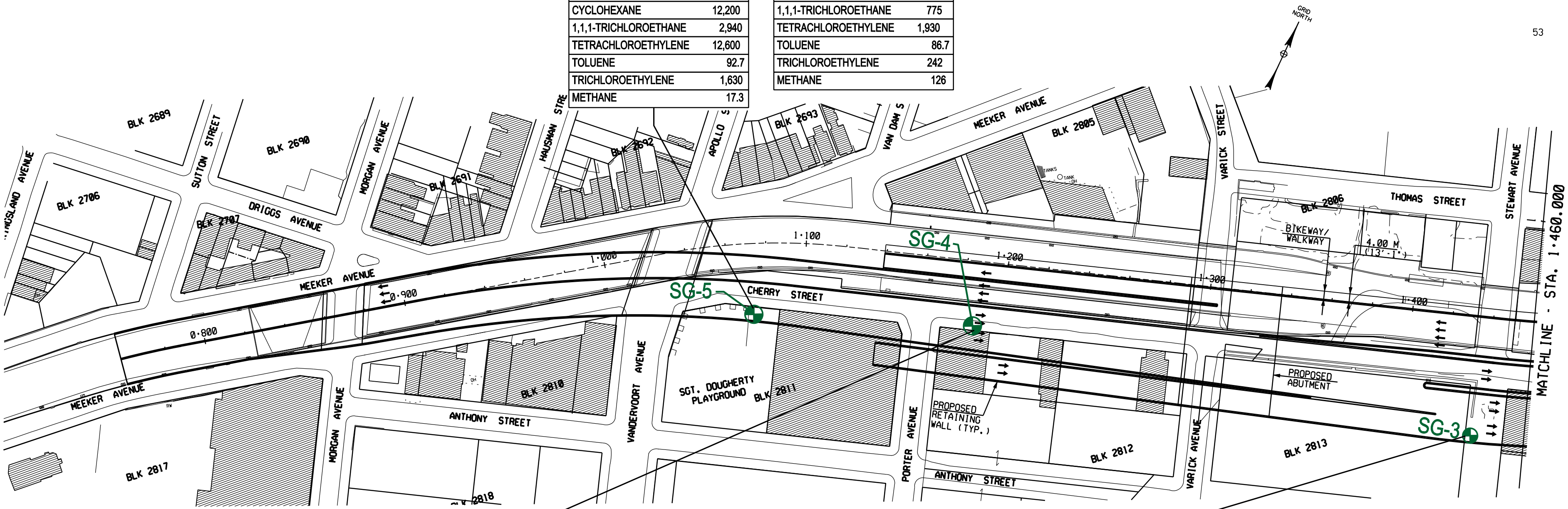
PREVIOUS SOIL VAPOR SAMPLING LOCATIONS

FED. RD. REG. NO.	STATE	CONTRACT NO.	SHEET NO.	TOTAL SHEETS
1	N.Y.		53	62

KOSCIUSZKO BRIDGE PROJECT
QUEENS AND KINGS COUNTIES
P.I.N. X729.77

SG-5 (8 FEET)	
BENZENE	126
1,1-DICHLOROETHANE	692
CIS-1,2- DICHLOROETHYLENE	1,710
HEPTANE	4,430
HEXANE	27,200
CYCLOHEXANE	12,200
1,1,1-TRICHLOROETHANE	2,940
TETRACHLOROETHYLENE	12,600
TOLUENE	92.7
TRICHLOROETHYLENE	1,630
METHANE	17.3

SG-5 (20 FEET)	
BENZENE	51.1
1,1-DICHLOROETHANE	317
CIS-1,2- DICHLOROETHYLENE	254
HEPTANE	3,000
HEXANE	10,700
1,1,1-TRICHLOROETHANE	775
TETRACHLOROETHYLENE	1,930
TOLUENE	86.7
TRICHLOROETHYLENE	242
METHANE	126



SG-4 (8 FEET)	
ACETONE	113
BENZENE	16
CARBON DISULFIDE	5.9
CHLOROBENZENE	33
CHLOROFORM	11
1.1 DICHLOROETHANE	3.5
CIS-1,2- DICHLOROETHYLENE	3.0
0-DICHLOROBENZENE	20
P-DICHLOROBENZENE	14
HEPTANE	8.6
HEXANE	13
METHYL ETHYL KETONE	29.8
STYRENE	2.0
1,1,1-TRICHLOROETHANE	47
1,2,4-TRIMETHYLBENZENE	15
1,3,5-TRIMETHYLBENZENE	7.4
TETRACHLOROETHYLENE	2,180
TRICHLOROETHYLENE	16
ETHANOL	44.1
ETHYLBENZENE	6.1
TOLUENE	22
TOTAL XYLENES	38
METHANE	8.9

SG-4 (20 FEET)	
BENZENE	29
CARBON DISULFIDE	4.4
CHLOROFORM	5.9
HEPTANE	9.0
HEXANE	22
STYRENE	1.7
1,1,1-TRICHLOROETHANE	16
1,2,4-TRIMETHYLBENZENE	44
1,3,5-TRIMETHYLBENZENE	13
2,2,4-TRIMETHYLPENTANE	53.2
TETRACHLOROETHYLENE	902
TOLUENE	78.4
CYCLOHEXANE	413
O-DICHLOROBENZENE	4.4
P-DICHLOROBENZENE	3.9
ETHANOL	64.6
ETHYLBENZENE	16
TOTAL XYLENES	95.1
METHANE	9.3

SG-3 (8 FEET)	
BENZENE	23
ETHYLBENZENE	23
HEPTANE	3,830
HEXANE	7,400
1,2,4-TRIMETHYLBENZENE	78.2
1,3,5-TRIMETHYLBENZENE	28
TETRACHLOROETHYLENE	52
TOLUENE	85.2
TRICHLOROETHYLENE	6.4
TRICHLOROFLUOROMETHANE	8.4
TOTAL XYLENES	184
METHANE	511

SG-3 (20 FEET)	
BENZENE	78
CHLOROFORM	11
1,1-DICHLOROETHANE	89
1,1-DICHLOROETHYLENE	259
1,2-DICHLOROETHANE	11
DICHLOROETHYLENE	2,660
CIS -1,2 - DICHLOROETHYLENE	1,880
ETHYLBENZENE	40
HEPTANE	97.5
CYCLOHEXANE	713
HEXANE	451
1,2,4-TRIMETHYLBENZENE	61.9
1,3,5-TRIMETHYLBENZENE	20
TETRACHLOROETHYLENE	1,560
TOLUENE	304
TRICHLOROETHYLENE	3,440
VINYL CHLORIDE	1,170
TOTAL XYLENES	184
METHANE	9,390

LEGEND

● SG-1= SOIL GAS SAMPLE LOCATION

BENZENE	213
METHANE	284,000

VOC CONCENTRATION IN MICROGRAMS PER CUBIC METER (UG/M)

METHANE CONCENTRATION IN PARTS PER MILLION BY VOLUME (ppmv)

GRAPHIC SCALE (IN METERS)

HORIZ. 20 0 10 20 40 60 80 100

FIGURE 6-1
SUMMARY OF SOIL GAS SAMPLE RESULTS

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION

ENVIRONMENTAL PLANNING & MANAGEMENT
1983 MARCUS AVE, SUITE 109, LAKE SUCCESS, NEW YORK 11042

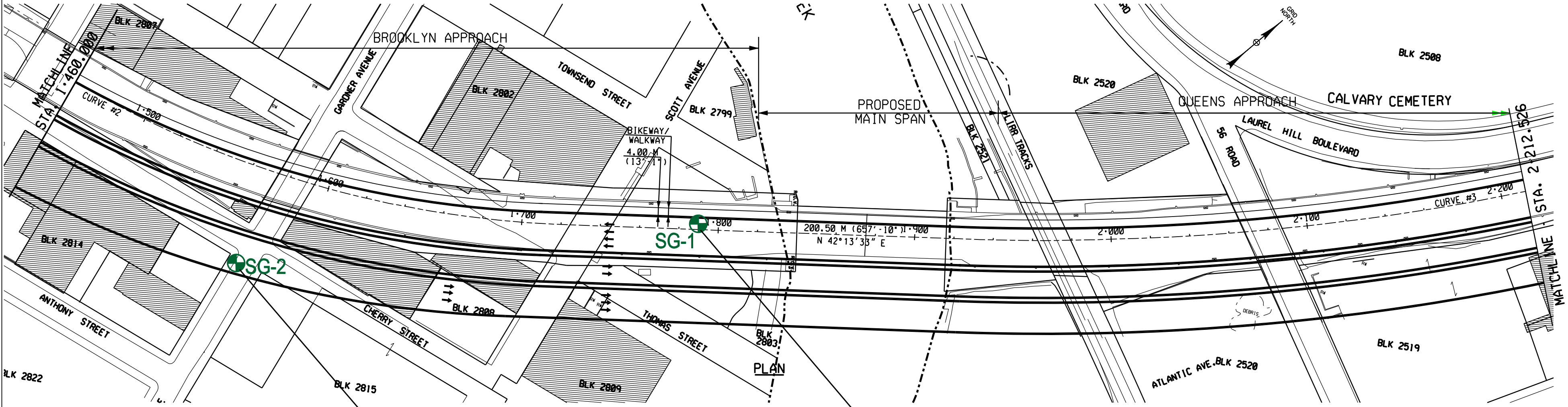
DRAWING NO.	SCALE	DATE	REGION
FIG. 6-1	AS NOTED	APRIL 2011	11

IN CHARGE OF ______ DESIGNED BY ______ CHECKED BY ______ ESTIMATED BY ______ CHECKED BY ______ DRAWN BY ______ CHECKED BY ______ DATE ______

$FILE$

FED. RD. REG. NO.	STATE	CONTRACT NO.	SHEET NO.	TOTAL SHEETS
1	N.Y.			

KOSCIUSZKO BRIDGE PROJECT
QUEENS AND KINGS COUNTIES
P.I.N. X729.77



SG-2 (8 FEET)	
ACETONE	113
BENZENE	47.3
CARBON DISULFIDE	8.4
CHLOROFORM	5.9
ETHYLBENZENE	25
FREON 113	5.3
HEPTANE	34
HEXANE	47.2
STYRENE	2.6
1,1,1-TRICHLOROETHANE	16
1,2,4-TRIMETHYLBENZENE	15
1,3,5-TRIMETHYLBENZENE	6.9
2,2,4-TRIMETHYLPENTANE	34
TETRACHLOROETHYLENE	244
TOLUENE	136
TRICHLOROETHYLENE	206
TRICHLOROFLUOROMETHANE	38
TOTAL XYLENES	92.1
METHANE	7.5

SG-2 (20 FEET)	
BENZENE	89.1
CARBON DISULFIDE	12
CHLOROFORM	8.3
2-CHLOROTOLUENE	20
HEPTANE	110
HEXANE	262
METHYL ETHYL KETONE	53.7
STYRENE	2.4
1,1,1-TRICHLOROETHANE	7.6
1,2,4-TRIMETHYLBENZENE	17
1,3,5-TRIMETHYLBENZENE	5.4
2,2,4-TRIMETHYLPENTANE	156
TETRACHLOROETHYLENE	62
TOLUENE	170
TRICHLOROETHYLENE	66.1
TRICHLOROFLUOROMETHANE	27
CYCLOHEXANE	44.4
ETHYLBENZENE	19
TOTAL XYLENES	63.4
METHANE	498

SG-1 (5 FEET)	
BENZENE	213
CARBON DISULFIDE	115
1,1-DICHLOROETHANE	43.7
CIS-1,2-DICHLOROETHYLENE	63.8
ETHYLBENZENE	351
HEPTANE	488
CYCLOHEXANE	527
HEXANE	2,460
METHYL ETHYL KETONE	186
METHYL ISOBUTYL KETONE	117
1,2,4-TRIMETHYLBENZENE	934
1,3,5-TRIMETHYLBENZENE	209
2,2,4-TRIMETHYLPENTANE	1,420
TETRACHLOROETHYLENE	22
TOLUENE	1,350
TRICHLOROETHYLENE	20
TRICHLOROFLUOROMETHANE	133
VINYL CHLORIDE	173
TOTAL XYLENES	660
METHANE	284,000

LEGEND

● SG-1= SOIL GAS SAMPLE LOCATION

BENZENE	213
METHANE	284,000

VOC CONCENTRATION IN MICROGRAMS PER CUBIC METER (UG/M)

METHANE CONCENTRATION IN PARTS PER MILLION BY VOLUME (ppmv)

GRAPHIC SCALE (IN METERS)

HORIZ.: 20 0 10 20 40 60 80 100

E PM ENVIRONMENTAL PLANNING & MANAGEMENT
1983 MARCUS AVE, SUITE 109, LAKE SUCCESS, NEW YORK 11042

FIGURE 6-2
SUMARY OF SOIL GAS SAMPLE RESULTS

STATE OF NEW YORK
DEPARTMENT OF TRANSPORTATION

DRAWING NO.	SCALE	DATE	REGION
FIG. 6-2	AS NOTED	APRIL 2011	11

IN CHARGE OF — DESIGNED BY — CHECKED BY — ESTIMATED BY — CHECKED BY — DRAWN BY — CHECKED BY — DATE

$FILE$

ATTACHMENT C

MATERIAL SAFETY DATA SHEETS AND PERMISSABLE EXPOSURE LEVELS FOR CHEMICALS OF CONCERN

Chemicals	**REL/PEL/STEL (ppm)**	**Health Hazards**
Polycyclic Aromatic Hydrocarbons (PAHs)	PEL = 5 mg/m^3	Harmful effects to skin, bodily fluids, and ability to fight disease, reproductive problems; [potential occupational carcinogen]
Arsenic	REL = 0.002 mg/m^3 PEL = 0.01 mg/m^3	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, respiratory irritation, hyper-pigmentation of skin, [potential occupational carcinogen]
Lead	REL = 0.1 mg/m^3 PEL = 0.05 mg/m^3	Weak, lassitude, insomnia; facial pallor, pale eye, anorexia, low-weight, malnutrition, constipation, abdominal pain, colic; anemia; gingival lead line; tremors, paralysis wrists and ankles; encephalopathy; kidney disease; irritation eyes; hypotension.
Cadmium	REL = No Standard PEL = 0.0005 mg/m^3	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]
Chromium	REL = 0.5 mg/m^3 PEL = 1 mg/m^3	Irritation eyes, skin; lung fibrosis (histologic)
Mercury	REL = 0.1 mg/m^3 PEL = 0.1 mg/m^3	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria
DDT	REL = 0.5 mg/m^3 PEL = 1.0 mg/m^3	Irritation eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]
PCBs	REL = 0.001 mg/m^3 PEL = 0.5 mg/m^3	Irritation eyes, chloracne; liver damage; reproductive effects; [potential occupational carcinogen]
Comments: REL = NIOSH Recommended Exposure Limit PEL = OSHA Permissible Exposure Limit STEL = OSHA Short Term Exposure Limit		

Chemicals	**REL/PEL/STEL (ppm)**	**Health Hazards**
Asbestos	REL = 0.1 fiber/cm^3 PEL = 0.1 fiber/cm^3	Asbestosis (chronic exposure): dyspnea (breathing difficulty), interstitial fibrosis, restricted pulmonary function, finger clubbing; irritation eyes; [potential occupational carcinogen]
Benzene	REL = 0.1 ppm PEL = 1 ppm STEL = 5 ppm	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude, dermatitis; bone marrow depression, potential occupational carcinogen.
Toluene	REL = 100 ppm PEL = 200 ppm STEL = 300 ppm	Irritation eyes, nose; lassitude, confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage.
Ethylbenzene	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma.
Xylenes	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, uncoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis.
2-Butanone (MEK)	REL = 200 ppm PEL = 200 ppm	Irritation eyes, skin, nose; headache; dizziness; vomiting; dermatitis
1,2-Dichloroethylene (DCE)	REL = 200 ppm PEL = 200 ppm	Irritation eyes, respiratory system; central nervous system depression
Tetrachloroethylene (PCE)	REL = (minimize) PEL = 100 ppm (TWA) PEL = 200 ppm (5 min) PEL = 300 ppm (max)	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]
Trichloroethylene (TCE)	REL = 25 ppm PEL = 100 ppm (TWA) PEL = 200 ppm (5 min) PEL = 300 ppm (max)	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]
Naphthalene	REL = 10 ppm PEL = 10 ppm	Irritation eyes; headache, confusion, excitement, malaise; nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

ARSENIC
CAS # 7440-38-2

Division of Toxicology and Environmental Medicine ToxFAQs™ September 2005

This fact sheet answers the most frequently asked health questions (FAQs) about arsenic. For more information, 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. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to higher than average levels of arsenic occur mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found in at least 784 of the 1,662 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 arsenic (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 plants.

What happens to arsenic when it enters the environment?

☐ Arsenic occurs naturally in soil and minerals and it therefore 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.

Organic arsenic compounds are less toxic than inorganic arsenic compounds. Exposure to high levels of some organic arsenic compounds may cause similar effects as inorganic arsenic.

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 lungs, bladder, liver, kidney and prostate. Inhalation of inorganic arsenic can cause increase risk of lung cancer. The Department of Health and Human Services (DHHS) has determined that inorganic arsenic is a known carcinogen. The International Agency for Research on Cancer (IARC), and the EPA have determined that inorganic arsenic is carcinogenic to humans.

How can arsenic affect children?

There is also some evidence that suggests that long-term exposure to arsenic in children may result in lower IQ scores. There is some information suggesting that children may be less efficient at converting inorganic arsenic to the less harmful organic forms. For this reason, children may be more susceptible to health effects from inorganic arsenic than adults.

There is some evidence that inhaled or ingested arsenic can injure pregnant women or their unborn babies, although the studies are not definitive. Studies in animals show that large doses of arsenic that cause illness in pregnant females can also cause low birth weight, fetal malformations, and even fetal death. Arsenic can cross the placenta and has been found in fetal tissues. Arsenic is found at low levels in breast milk.

How can families reduce the risks of exposure to arsenic?

☐ If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.

☐ If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.

Is there a medical test to determine whether I've been exposed to arsenic?

There are tests available to measure arsenic in your blood, urine, hair, and fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict how 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 μg/m^3) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Arsenic (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

ASBESTOS
CAS # 1332-21-4

Division of Toxicology ToxFAQs™ September 2001

This fact sheet answers the most frequently asked health questions (FAQs) about asbestos. For more information, 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. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, individual susceptibility and personal habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to asbestos usually occurs by breathing contaminated air in workplaces that make or use asbestos. Asbestos is also found in the air of buildings that are being torn down or renovated. Asbestos exposure can cause serious lung problems and cancer. This substance has been found at 83 of the 1,585 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is asbestos?

Asbestos is the name given to a group of six different fibrous minerals (amosite, chrysotile, crocidolite, and the fibrous varieties of tremolite, actinolite, and anthophyllite) that occur naturally in the environment. Asbestos minerals have separable long fibers that are strong and flexible enough to be spun and woven and are heat resistant. Because of these characteristics, asbestos has been used for a wide range of manufactured goods, mostly in building materials (roofing shingles, ceiling and floor tiles, paper products, and asbestos cement products), friction products (automobile clutch, brake, and transmission parts), heat-resistant fabrics, packaging, gaskets, and coatings. Some vermiculite or talc products products may contain asbestos.

What happens to asbestos when it enters the environment?

Asbestos fibers can enter the air or water from the breakdown of natural deposits and manufactured asbestos products. Asbestos fibers do not evaporate into air or dissolve in water. Small diameter fibers and particles may remain suspended in the air for a long time and be carried long distances by wind or water before settling down. Larger diameter fibers and particles tend to settle more quickly.

Asbestos fibers are not able to move through soil. Asbestos fibers are generally not broken down to other compounds and will remain virtually unchanged over long periods.

How might I be exposed to asbestos?

We are all exposed to low levels of asbestos in the air we breathe. These levels range from 0.00001 to 0.0001 fibers per milliliter of air and generally are highest in cities and industrial areas.

People working in industries that make or use asbestos products or who are involved in asbestos mining may be exposed to high levels of asbestos. People living near these industries may also be exposed to high levels of asbestos in air.

Asbestos fibers may be released into the air by the disturbance of asbestos-containing material during product use, demolition work, building or home maintenance, repair, and remodeling. In general, exposure may occur only when the asbestos-containing material is disturbed in some way to release particles and fibers into the air.

Drinking water may contain asbestos from natural sources or from asbestos-containing cement pipes.

How can asbestos affect my health?

Asbestos mainly affects the lungs and the membrane that surrounds the lungs. Breathing high levels of asbestos fibers for a long time may result in scar-like tissue in the lungs and in the pleural membrane (lining) that surrounds the lung. This disease is called asbestosis and is usually found in workers exposed to asbestos, but not in the general public. People with asbestosis have difficulty breathing, often a cough, and in severe cases heart enlargement. Asbestosis is a serious disease and can eventually lead to disability and death.

Breathing lower levels of asbestos may result in changes called plaques in the pleural membranes. Pleural plaques can occur in workers and sometimes in people living in areas with high environmental levels of asbestos. Effects on breathing from pleural plaques alone are not usually serious, but higher exposure can lead to a thickening of the pleural membrane that may restrict breathing.

How likely is asbestos to cause cancer?

The Department of Health and Human Services (DHHS), the World Health Organization (WHO), and the EPA have determined that asbestos is a human carcinogen.

It is known that breathing asbestos can increase the risk of cancer in people. There are two types of cancer caused by exposure to asbestos: lung cancer and mesothelioma. Mesothelioma is a cancer of the thin lining surrounding the lung (pleural membrane) or abdominal cavity (the peritoneum). Cancer from asbestos does not develop immediately, but shows up after a number of years. Studies of workers also suggest that breathing asbestos can increase chances of getting cancer in other parts of the body (stomach, intestines, esophagus, pancreas, and kidneys), but this is less certain. Early identification and treatment of any cancer can increase an individual's quality of life and survival.

Cigarette smoke and asbestos together significantly increase your chances of getting lung cancer. Therefore, if you have been exposed to asbestos you should stop smoking. This may be the most important action that you can take to improve your health and decrease your risk of cancer.

How can asbestos affect children?

We do not know if exposure to asbestos will result in birth defects or other developmental effects in people. Birth defects have not been observed in animals exposed to asbestos.

It is likely that health effects seen in children exposed to high levels of asbestos will be similar to the effects seen in adults.

How can families reduce the risk of exposure to asbestos?

Materials containing asbestos that are not disturbed or deteriorated do not, in general, pose a health risk and can be left alone. If you suspect that you may be exposed to asbestos in your home, contact your state or local health department or the regional offices of EPA to find out how to test your home and how to locate a company that is trained to remove or contain the fibers.

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

Low levels of asbestos fibers can be measured in urine, feces, mucus, or lung washings of the general public. Higher than average levels of asbestos fibers in tissue can confirm exposure but not determine whether you will experience any health effects.

A thorough history, physical exam, and diagnostic tests are needed to evaluate asbestos-related disease. Chest x-rays are the best screening tool to identify lung changes resulting from asbestos exposure. Lung function tests and CAT scans also assist in the diagnosis of asbestos-related disease.

Has the federal government made recommendations to protect human health?

In 1989, EPA banned all new uses of asbestos; uses established before this date are still allowed. EPA established regulations that require school systems to inspect for damaged asbestos and to eliminate or reduce the exposure by removing the asbestos or by covering it up. EPA regulates the release of asbestos from factories and during building demolition or renovation to prevent asbestos from getting into the environment.

EPA has proposed a concentration limit of 7 million fibers per liter of drinking water for long fibers (lengths greater than or equal to 5 µm). The Occupational Safety and Health Administration has set limits of 100,000 fibers with lengths greater than or equal to 5 µm per cubic meter of workplace air for 8-hour shifts and 40-hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2001. Toxicological Profile for Asbestos. Update. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html. 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

BENZENE
CAS # 71-43-2

Division of Toxicology and Environmental Medicine ToxFAQs™ September 2005

This fact sheet answers the most frequently asked health questions (FAQs) about benzene. For more information, 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. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 1,001 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is benzene?

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

☐ Industrial processes are the main source of benzene in the environment.
☐ Benzene can pass into the air from water and soil.
☐ It reacts with other chemicals in the air and breaks down within a few days.
☐ Benzene in the air can attach to rain or snow and be carried back down to the ground.
☐ It breaks down more slowly in water and soil, and can pass through the soil into underground water.
☐ Benzene does not build up in plants or animals.

How might I be exposed to benzene?

☐ Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
☐ Vapors (or gases) from products that contain benzene, such as glues, paints, furniture wax, and detergents, can also be a source of exposure.
☐ Air around hazardous waste sites or gas stations will contain higher levels of benzene.
☐ Working in industries that make or use benzene.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

The major effect of benzene from long-term exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection.

Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene will affect fertility in men.

How likely is benzene to cause cancer?

Long-term exposure to high levels of benzene in the air can cause leukemia, particularly acute myelogenous leukemia, often referred to as AML. This is a cancer of the blood-forming organs. The Department of Health and Human Services (DHHS) has determined that benzene is a known carcinogen. The International Agency for Research on Cancer (IARC) and the EPA have determined that benzene is carcinogenic to humans.

How can benzene affect children?

Children can be affected by benzene exposure in the same ways as adults. It is not known if children are more susceptible to benzene poisoning than adults.

Benzene can pass from the mother's blood to a fetus. Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How can families reduce the risks of exposure to benzene?

Benzene exposure can be reduced by limiting contact with gasoline and cigarette smoke. Families are encouraged not to smoke in their house, in enclosed environments, or near their children.

Is there a medical test to determine whether I've been exposed to benzene?

Several tests can show if you have been exposed to benzene. There is a test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood; however, since benzene disappears rapidly from the blood, this test is only useful for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. The metabolite S-phenylmercapturic acid in urine is a sensitive indicator of benzene exposure. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 5 parts benzene per billion parts of water (5 ppb).

The Occupational Safety and Health Administration (OSHA) has set limits of 1 part benzene per million parts of workplace air (1 ppm) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Benzene (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

2-BUTANONE

CAS # 78-93-3

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1995**

This fact sheet answers the most frequently asked health questions (FAQs) about 2-butanone. For more information, 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.

SUMMARY: Exposure to 2-butanone occurs in the workplace or from using consumer products containing it. Mild irritations of the eyes, nose, and throat were seen in people who breathed 2-butanone. This chemical has been found in at least 472 of 1,416 National Priorities List sites identified by the Environmental Protection Agency.

What is 2-butanone?

(Pronounced 2-byo͞o′tə-nōn)

2-Butanone is a manufactured chemical but it is also present in the environment from natural sources. It is a colorless liquid with a sharp, sweet odor. It is also known as methyl ethyl ketone (MEK).

2-Butanone is produced in large quantities. Nearly half of its use is in paints and other coatings because it will quickly evaporate into the air and it dissolves many substances. It is also used in glues and as a cleaning agent.

2-Butanone occurs as a natural product. It is made by some trees and found in some fruits and vegetables in small amounts. It is also released to the air from car and truck exhausts.

What happens to 2-butanone when it enters the environment?

- ☐ 2-Butanone enters the air during production, use and transport, and from hazardous waste sites.
- ☐ In air, one-half of it will break down from sunlight in 1 day or less.
- ☐ It dissolves in water and is broken down more slowly to a simpler chemical form in about 2 weeks.
- ☐ It does not stick to soil and will travel through the soil to the groundwater.
- ☐ Some of the 2-butanone in soil or water will evaporate into the air.
- ☐ It does not deposit in the bottom of rivers or lakes.
- ☐ It is not expected to concentrate in fish or increase in the tissues of animals further up the food chain.

How might I be exposed to 2-butanone?

- ☐ Breathing contaminated air from the production or use of paints, glues, coatings, or cleaning agents containing it.
- ☐ Breathing contaminated air near hazardous waste sites.
- ☐ Breathing cigarette smoke.
- ☐ Sniffing glues.
- ☐ Drinking contaminated water from wells near manufacturing or hazardous waste sites.
- ☐ Skin contact with the liquid during production or use.

How can 2-butanone affect my health?

The known health effects to people from exposure to 2-butanone are irritation of the nose, throat, skin, and eyes. No one has died from breathing 2-butanone alone. If 2-butanone is breathed along with other chemicals that damage health, it can increase the amount of damage that occurs.

Serious health effects in animals have been seen only at very high levels. When breathed, these effects included birth defects, loss of consciousness, and death.

When swallowed, rats had nervous system effects including drooping eyelids and uncoordinated muscle movements. There was no damage to the ability to reproduce.

Mice who breathed low levels for a short time showed temporary behavioral effects. Mild kidney damage was seen in animals that drank water with lower levels of 2-butanone for a short time.

There are no long-term studies with animals either breathing or drinking 2-butanone.

How likely is 2-butanone to cause cancer?

The Department of Health and Human Services has not classified 2-butanone as to its human carcinogenicity.

The International Agency for Research on Cancer and the Environmental Protection Agency (EPA) have also not classified 2-butanone as to its human carcinogenicity.

Two studies of workers exposed to 2-butanone and other chemicals did not find an increase in cancer. No animal studies are available that examine the potential for 2-butanone to cause cancer.

Is there a medical test to show whether I've been exposed to 2-butanone?

Tests are available to measure 2-butanone or its breakdown products in blood, breath, and urine. These tests are useful only to measure recent exposures because 2-butanone and its breakdown products leave the body rapidly. These tests are not usually performed at your doctor's office, but your doctor can take blood or urine samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA requires that discharges or spills into the environment of 5,000 pounds of more of 2-butanone be reported.

The Occupational Safety and Health Administration (OSHA) set an occupational exposure limit of 200 parts of 2-butanone per million parts of workplace air (200 ppm) for an 8-hour workday, 40-hour workweek.

The American Conference of Governmental Industrial Hygienists (ACGIH) and the National Institute for Occupational Safety and Health (NIOSH) have established the same guidelines as OSHA for the workplace.

Glossary

Carcinogenicity: Ability to cause cancer.
Evaporate: To change into a vapor or a gas.
ppm: Parts per million.
Long-term: Lasting one year or longer.
Short time: Lasting 14 days or less.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. Toxicological profile for 2-butanone. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html 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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CADMIUM
CAS # 7440-43-9

Agency for Toxic Substances and Disease Registry ToxFAQs June 1999

This fact sheet answers the most frequently asked health questions (FAQs) about cadmium. For more information, 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. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to cadmium happens mostly in the workplace where cadmium products are made. The general population is exposed from breathing cigarette smoke or eating cadmium contaminated foods. Cadmium damages the lungs, can cause kidney disease, and may irritate the digestive tract. This substance has been found in at least 776 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is cadmium?

(Pronounced kăd′mē-əm)

Cadmium is a natural element in the earth's crust. It is usually found as a mineral combined with other elements such as oxygen (cadmium oxide), chlorine (cadmium chloride), or sulfur (cadmium sulfate, cadmium sulfide).

All soils and rocks, including coal and mineral fertilizers, contain some cadmium. Most cadmium used in the United States is extracted during the production of other metals like zinc, lead, and copper. Cadmium does not corrode easily and has many uses, including batteries, pigments, metal coatings, and plastics.

What happens to cadmium when it enters the environment?

- ☐ Cadmium enters air from mining, industry, and burning coal and household wastes.
- ☐ Cadmium particles in air can travel long distances before falling to the ground or water.
- ☐ It enters water and soil from waste disposal and spills or leaks at hazardous waste sites.
- ☐ It binds strongly to soil particles.
- ☐ Some cadmium dissolves in water.
- ☐ It doesn't break down in the environment, but can change forms.
- ☐ Fish, plants, and animals take up cadmium from the environment.
- ☐ Cadmium stays in the body a very long time and can build up from many years of exposure to low levels.

How might I be exposed to cadmium?

- ☐ Breathing contaminated workplace air (battery manufacturing, metal soldering or welding).
- ☐ Eating foods containing it; low levels in all foods (highest in shellfish, liver, and kidney meats).
- ☐ Breathing cadmium in cigarette smoke (doubles the average daily intake).
- ☐ Drinking contaminated water.
- ☐ Breathing contaminated air near the burning of fossil fuels or municipal waste.

How can cadmium affect my health?

Breathing high levels of cadmium severely damages the lungs and can cause death. Eating food or drinking water with very high levels severely irritates the stomach, leading to vomiting and diarrhea. Long-term exposure to lower levels of cadmium in air, food, or water leads to a buildup of cadmium in the kidneys and possible kidney disease.

Other long-term effects are lung damage and fragile bones. Animals given cadmium in food or water had high blood pressure, iron-poor blood, liver disease, and nerve or brain damage.

We don't know if humans get any of these diseases from eating or drinking cadmium. Skin contact with cadmium is not known to cause health effects in humans or animals.

How likely is cadmium to cause cancer?

The Department of Health and Human Services (DHHS) has determined that cadmium and cadmium compounds may reasonably be anticipated to be carcinogens.

How can cadmium affect children?

The health effects in children are expected to be similar to those in adults (kidney, lung and intestinal damage).

We don't know if cadmium causes birth defects in people. Cadmium does not readily go from a pregnant woman's body into the developing child, but some portion can cross the placenta. It can also be found in breast milk. The babies of animals exposed to high levels of cadmium during pregnancy had changes in behavior and learning ability. Cadmium may also affect birth weight and the skeleton in developing animals.

Animal studies also indicate that more cadmium is absorbed into the body if the diet is low in calcium, protein, or iron, or is high in fat. A few studies show that younger animals absorb more cadmium and are more likely to lose bone and bone strength than adults.

How can families reduce the risk of exposure to cadmium?

In the home, store substances that contain cadmium safely, and keep nickel-cadmium batteries out of reach of young children. If you work with cadmium, use all safety precautions to avoid carrying cadmium-containing dust home from work on your clothing, skin, hair, or tools.

A balanced diet can reduce the amount of cadmium taken into the body from food and drink.

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

Tests are available in some medical laboratories that measure cadmium in blood, urine, hair, or nails. Blood levels show recent exposure to cadmium, and urine levels show both recent and earlier exposure. The reliability of tests for cadmium levels in hair or nails is unknown.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 5 parts of cadmium per billion parts of drinking water (5 ppb). EPA doesn't allow cadmium in pesticides.

The Food and Drug Administration (FDA) limits the amount of cadmium in food colors to 15 parts per million (15 ppm).

The Occupational Safety and Health Administration (OSHA) limits workplace air to 100 micrograms cadmium per cubic meter (100 $\mu g/m^3$) as cadmium fumes and 200 μg cadmium/m^3 as cadmium dust.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for cadmium. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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CHROMIUM
CAS # 7440-47-3

Division of Toxicology ToxFAQs™ **February 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about chromium. For more information, 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. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to chromium occurs from ingesting contaminated food or drinking water or breathing contaminated workplace air. Chromium(VI) at high levels can damage the nose and can cause cancer. Chromium has been found at 1,036 of the 1,591 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is chromium?

Chromium is a naturally occurring element found in rocks, animals, plants, soil, and in volcanic dust and gases. Chromium is present in the environment in several different forms. The most common forms are chromium(0), chromium(III), and chromium(VI). No taste or odor is associated with chromium compounds.

Chromium(III) occurs naturally in the environment and is an essential nutrient. Chromium(VI) and chromium(0) are generally produced by industrial processes.

The metal chromium, which is the chromium(0) form, is used for making steel. Chromium(VI) and chromium(III) are used for chrome plating, dyes and pigments, leather tanning, and wood preserving.

What happens to chromium when it enters the environment?

❑ Chromium enters the air, water, and soil mostly in the chromium(III) and chromium(VI) forms.
❑ In air, chromium compounds are present mostly as fine dust particles which eventually settle over land and water.
❑ Chromium can strongly attach to soil and only a small amount can dissolve in water and move deeper in the soil to underground water.
❑ Fish do not accumulate much chromium in their bodies from water.

How might I be exposed to chromium?

❑ Eating food containing chromium(III).
❑ Breathing contaminated workplace air or skin contact during use in the workplace.
❑ Drinking contaminated well water.
❑ Living near uncontrolled hazardous waste sites containing chromium or industries that use chromium.

How can chromium affect my health?

Chromium(III) is an essential nutrient that helps the body use sugar, protein, and fat.

Breathing high levels of chromium(VI) can cause irritation to the nose, such as runny nose, nosebleeds, and ulcers and holes in the nasal septum.

Ingesting large amounts of chromium(VI) can cause stomach upsets and ulcers, convulsions, kidney and liver damage, and even death.

Skin contact with certain chromium(VI) compounds can cause skin ulcers. Some people are extremely sensitive to chromium(VI) or chromium(III). Allergic reactions consisting of severe redness and swelling of the skin have been noted.

How likely is chromium to cause cancer?

Several studies have shown that chromium(VI) compounds can increase the risk of lung cancer. Animal studies have also shown an increased risk of cancer.

The World Health Organization (WHO) has determined that chromium(VI) is a human carcinogen.

The Department of Health and Human Services (DHHS) has determined that certain chromium(VI) compounds are known to cause cancer in humans.

The EPA has determined that chromium(VI) in air is a human carcinogen.

How can chromium affect children?

We do not know if exposure to chromium will result in birth defects or other developmental effects in people. Birth defects have been observed in animals exposed to chromium(VI).

It is likely that health effects seen in children exposed to high amounts of chromium will be similar to the effects seen in adults.

How can families reduce the risk of exposure to chromium?

☐ Children should avoid playing in soils near uncontrolled hazardous waste sites where chromium may have been discarded.

☐ Although chromium(III) is an essential nutrient, you should avoid excessive use of dietary supplements containing chromium.

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

Since chromium(III) is an essential element and naturally occurs in food, there will always be some level of chromium in your body. There are tests to measure the level of chromium in hair, urine, and blood. These tests are most useful for people exposed to high levels. These tests cannot determine the exact levels of chromium that you may have been exposed to or predict how the levels in your tissues will affect your health.

Has the federal government made recommendations to protect human health?

EPA has set a limit of 100 µg chromium(III) and chromium(VI) per liter of drinking water (100 µg/L).

The Occupational Safety and Health Administration (OSHA) has set limits of 500 µg water soluble chromium(III) compounds per cubic meter of workplace air (500 µg/m^3), 1,000 µg/m^3 for metallic chromium(0) and insoluble chromium compounds, and 52 µg/m^3 for chromium(VI) compounds for 8-hour work shifts and 40-hour work weeks.

References

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

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DDT, DDE, AND DDD

CAS # 50-29-3, 72-55-9, 72-54-8

Division of Toxicology ToxFAQs™ September 2002

This fact sheet answers the most frequently asked health questions (FAQs) about DDT, DDE, and DDD. For more information, 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. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to DDT, DDE, and DDD occurs mostly from eating foods containing small amounts of these compounds, particularly meat, fish and poultry. High levels of DDT can affect the nervous system causing excitability, tremors and seizures. In women, DDE can cause a reduction in the duration of lactation and an increased chance of having a premature baby. DDT, DDE, and DDD have been found in at least 441 of the 1,613 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are DDT, DDE, and DDD?

DDT (dichlorodiphenyltrichloroethane) is a pesticide once widely used to control insects in agriculture and insects that carry diseases such as malaria. DDT is a white, crystalline solid with no odor or taste. Its use in the U.S. was banned in 1972 because of damage to wildlife, but is still used in some countries.

DDE (dichlorodiphenyldichloroethylene) and DDD (dichlorodiphenyldichloroethane) are chemicals similar to DDT that contaminate commercial DDT preparations. DDE has no commercial use. DDD was also used to kill pests, but its use has also been banned. One form of DDD has been used medically to treat cancer of the adrenal gland.

What happens to DDT, DDE, and DDD when they enter the environment?

☐ DDT entered the environment when it was used as a pesticide; it still enters the environment due to current use in other countries.
☐ DDE enters the environment as contaminant or breakdown product of DDT; DDD also enters the environment as a breakdown product of DDT.
☐ DDT, DDE, and DDD in air are rapidly broken down by sunlight. Half of what's in air breaks down within 2 days.
☐ They stick strongly to soil; most DDT in soil is broken down slowly to DDE and DDD by microorganisms; half the DDT in soil will break down in 2-15 years, depending on the type of soil.
☐ Only a small amount will go through the soil into groundwater; they do not dissolve easily in water.
☐ DDT, and especially DDE, build up in plants and in fatty tissues of fish, birds, and other animals.

How might I be exposed to DDT, DDE, and DDD?

☐ Eating contaminated foods, such as root and leafy vegetables, fatty meat, fish, and poultry, but levels are very low.
☐ Eating contaminated imported foods from countries that still allow the use of DDT to control pests.
☐ Breathing contaminated air or drinking contaminated water near waste sites and landfills that may contain higher levels of these chemicals.
☐ Infants fed on breast milk from mothers who have been exposed.
☐ Breathing or swallowing soil particles near waste sites or landfills that contain these chemicals.

How can DDT, DDE, and DDD affect my health?

DDT affects the nervous system. People who accidentally swallowed large amounts of DDT became excitable and had tremors and seizures. These effects went away after the exposure stopped. No effects were seen in people who took small daily doses of DDT by capsule for 18 months.

A study in humans showed that women who had high amounts of a form of DDE in their breast milk were unable to breast feed their babies for as long as women who had little DDE in the breast milk. Another study in humans showed that women who had high amounts of DDE in breast milk had an increased chance of having premature babies.

In animals, short-term exposure to large amounts of DDT in food affected the nervous system, while long-term exposure to smaller amounts affected the liver. Also in animals, short-term oral exposure to small amounts of DDT or its breakdown products may also have harmful effects on reproduction.

How likely are DDT, DDE, and DDD to cause cancer?

Studies in DDT-exposed workers did not show increases in cancer. Studies in animals given DDT with the food have shown that DDT can cause liver cancer.

The Department of Health and Human Services (DHHS) determined that DDT may reasonable be anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) determined that DDT may possibly cause cancer in humans. The EPA determined that DDT, DDE, and DDD are probable human carcinogens.

How can DDT, DDE, and DDD affect children?

There are no studies on the health effects of children exposed to DDT, DDE, or DDD. We can assume that children exposed to large amounts of DDT will have health effects similar to the effects seen in adults. However, we do not know whether children differ from adults in their susceptibility to these substances.

There is no evidence that DDT, DDE, or DDD cause birth defects in people. A study showed that teenage boys whose mothers had higher DDE amounts in the blood when they were pregnant were taller than those whose mothers had lower DDE levels. However, a different study found the opposite in preteen girls. The reason for the discrepancy between these studies is unknown.

Studies in rats have shown that DDT and DDE can mimic the action of natural hormones and in this way affect the development of the reproductive and nervous systems. Puberty was delayed in male rats given high amounts of DDE as juveniles. This could possibly happen in humans.

A study in mice showed that exposure to DDT during the first weeks of life may cause neurobehavioral problems later in life.

How can families reduce the risk of exposure to DDT,DDE, and DDE?

☐ Most families will be exposed to DDT by eating food or drinking liquids contaminated with small amounts of DDT.
☐ Cooking will reduce the amount of DDT in fish.
☐ Washing fruit and vegetables will remove most DDT from their surface.
☐ Follow health advisories that tell you about consumption of fish and wildlife caught in contaminated areas.

Is there a medical test to show whether I've been exposed to DDT, DDE, and DDD?

Laboratory tests can detect DDT, DDE, and DDD in fat, blood, urine, semen, and breast milk. These tests may show low, moderate, or excessive exposure to these compounds, but cannot tell the exact amount you were exposed to, or whether you will experience adverse effects. These tests are not routinely available at the doctor's office because they require special equipment.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) sets a limit of 1 milligram of DDT per cubic meter of air (1 mg/m^3) in the workplace for an 8-hour shift, 40-hour workweek.

The Food and Drug Administration (FDA) has set limits for DDT, DDE, and DDD in foodstuff at or above which the agency will take legal action to remove the products from the market.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Toxicological Profile for DDT/DDE/DDD (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. 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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1,2-DICHLOROETHENE
CAS # 540-59-0, 156-59-2, and 156-60-5

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1997**

This fact sheet answers the most frequently asked health questions (FAQs) about 1,2-dichloroethene. For more information, 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: Exposure to 1,2-dichloroethene occurs mainly in workplaces where it is made or used. Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired. *cis*-1,2-Dichloroethene has been found in at least 146 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA). *trans*-1,2-Dichloroethene was found in at least 563 NPL sites. 1,2-Dichloroethene was found at 336 sites, but the isomer (*cis*- or *trans*-) was not specified.

What is 1,2-dichloroethene?
(Pronounced 1,2-dī-klôr′ ō-ĕth′ēn)

1,2-Dichloroethene, also called 1,2-dichloroethylene, is a highly flammable, colorless liquid with a sharp, harsh odor. It is used to produce solvents and in chemical mixtures. You can smell very small amounts of 1,2-dichloroethene in air (about 17 parts of 1,2-dichloroethene per million parts of air [17 ppm]).

There are two forms of 1,2-dichloroethene; one is called *cis*-1,2-dichloroethene and the other is called *trans*-1,2-dichloroethene. Sometimes both forms are present as a mixture.

What happens to 1,2-dichloroethene when it enters the environment?

- ☐ 1,2-Dichloroethene evaporates rapidly into air.
- ☐ In the air, it takes about 5-12 days for half of it to break down.
- ☐ Most 1,2-dichloroethene in the soil surface or bodies of water will evaporate into air.
- ☐ 1,2-Dichloroethene can travel through soil or dissolve in water in the soil. It is possible that it can contaminate groundwater.
- ☐ In groundwater, it takes about 13-48 weeks to break down.
- ☐ There is a slight chance that 1,2-dichloroethene will break down into vinyl chloride, a different chemical which is believed to be more toxic than 1,2-dichloroethene.

How might I be exposed to 1,2-dichloroethene?

- ☐ Breathing 1,2-dichloroethene that has leaked from hazardous waste sites and landfills.
- ☐ Drinking contaminated tap water or breathing vapors from contaminated water while cooking, bathing, or washing dishes.
- ☐ Breathing 1,2-dichloroethene, touching it, or touching contaminated materials in the workplace.

How can 1,2-dichloroethene affect my health?

Breathing high levels of 1,2-dichloroethene can make you feel nauseous, drowsy, and tired; breathing very high levels can kill you.

When animals breathed high levels of *trans*-1,2-dichloroethene for short or longer periods of time, their livers and lungs were damaged and the effects were more severe with longer exposure times. Animals that breathed very high levels of *trans*-1,2-dichloroethene had damaged hearts.

Animals that ingested extremely high doses of *cis*- or *trans*-1,2-dichloroethene died.

Lower doses of *cis*-1,2-dichloroethene caused effects on the blood, such as decreased numbers of red blood cells, and also effects on the liver.

The long-term (365 days or longer) human health effects after exposure to low concentrations of 1,2-dichloroethene aren't known. One animal study suggested that an exposed fetus may not grow as quickly as one that hasn't been exposed.

Exposure to 1,2-dichloroethene hasn't been shown to affect fertility in people or animals.

How likely is 1,2-dichloroethene to cause cancer?

The EPA has determined that *cis*-1,2-dichloroethene is not classifiable as to its human carcinogenicity.

No EPA cancer classification is available for *trans*-1,2-dichloroethene.

Is there a medical test to show whether I've been exposed to 1,2-dichloroethene?

Tests are available to measure concentrations of the breakdown products of 1,2-dichloroethene in blood, urine, and tissues. However, these tests aren't used routinely to determine whether a person has been exposed to this compound. This is because after you are exposed to 1,2-dichloroethene, the breakdown products in your body that are detected with these tests may be the same as those that come from exposure to other chemicals. These tests aren't available in most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum allowable level of *cis*-1,2-dichloroethene in drinking water at 0.07 milligrams per liter of water (0.07 mg/L) and *trans*-1,2-dichloroethene at 0.1 mg/L.

The EPA requires that any spills or accidental release of 1,000 pounds or more of 1,2-dichloroethene must be reported to the EPA.

The Occupational Health Safety and Health Administration (OSHA) has set the maximum allowable amount of 1,2-dichloroethene in workroom air during an 8-hour workday in a 40-hour workweek at 200 parts of 1,2-dichloroethene per million parts of air (200 ppm).

Glossary

Carcinogenicity: Ability of a substance to cause cancer.
CAS: Chemical Abstracts Service.
Fertility: Ability to reproduce.
Ingest: To eat or drink something.
Milligram (mg): One thousandth of a gram.
ppm: Parts per million.
Solvent: A chemical that can dissolve other substances.

References

This ToxFAQs information is taken from the 1996 Toxicological Profile for 1,2-Dichloroethene produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html 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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ETHYLBENZENE

CAS # 100-41-4

Agency for Toxic Substances and Disease Registry ToxFAQs June 1999

This fact sheet answers the most frequently asked health questions (FAQs) about ethylbenzene. For more information, 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. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Ethylbenzene is a colorless liquid found in a number of products including gasoline and paints. Breathing very high levels can cause dizziness and throat and eye irritation. Ethylbenzene has been found in at least 731 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is ethylbenzene?

(Pronounced ĕth′ əl bĕn′ zēn′)

Ethylbenzene is a colorless, flammable liquid that smells like gasoline. It is found in natural products such as coal tar and petroleum and is also found in manufactured products such as inks, insecticides, and paints.

Ethylbenzene is used primarily to make another chemical, styrene. Other uses include as a solvent, in fuels, and to make other chemicals.

What happens to ethylbenzene when it enters the environment?

☐ Ethylbenzene moves easily into the air from water and soil.

☐ It takes about 3 days for ethylbenzene to be broken down in air into other chemicals.

☐ Ethylbenzene may be released to water from industrial discharges or leaking underground storage tanks.

☐ In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water.

☐ In soil, it is broken down by soil bacteria.

How might I be exposed to ethylbenzene?

☐ Breathing air containing ethylbenzene, particularly in areas near factories or highways.

☐ Drinking contaminated tap water.

☐ Working in an industry where ethylbenzene is used or made.

☐ Using products containing it, such as gasoline, carpet glues, varnishes, and paints.

How can ethylbenzene affect my health?

Limited information is available on the effects of ethylbenzene on people's health. The available information shows dizziness, throat and eye irritation, tightening of the chest, and a burning sensation in the eyes of people exposed to high levels of ethylbenzene in air.

Animals studies have shown effects on the nervous system, liver, kidneys, and eyes from breathing ethylbenzene in air.

How likely is ethylbenzene to cause cancer?

The EPA has determined that ethylbenzene is not classifiable as to human carcinogenicity.

No studies in people have shown that ethylbenzene exposure can result in cancer. Two available animal studies suggest that ethylbenzene may cause tumors.

How can ethylbenzene affect children?

Children may be exposed to ethylbenzene through inhalation of consumer products, including gasoline, paints, inks, pesticides, and carpet glue. We do not know whether children are more sensitive to the effects of ethylbenzene than adults.

It is not known whether ethylbenzene can affect the development of the human fetus. Animal studies have shown that when pregnant animals were exposed to ethylbenzene in air, their babies had an increased number of birth defects.

How can families reduce the risk of exposure to ethylbenzene?

Exposure to ethylbenzene vapors from household products and newly installed carpeting can be minimized by using adequate ventilation.

Household chemicals should be stored out of reach of children to prevent accidental poisoning. Always store household chemicals in their original containers; never store them in containers children would find attractive to eat or drink from, such as old soda bottles. Gasoline should be stored in a gasoline can with a locked cap.

Sometimes older children sniff household chemicals, including ethylbenzene, in an attempt to get high. Talk with your children about the dangers of sniffing chemicals.

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

Ethylbenzene is found in the blood, urine, breath, and some body tissues of exposed people. The most common way to test for ethylbenzene is in the urine. This test measures substances formed by the breakdown of ethylbenzene. This test needs to be done within a few hours after exposure occurs, because the substances leave the body very quickly.

These tests can show you were exposed to ethylbenzene, but cannot predict the kind of health effects that might occur.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level of 0.7 milligrams of ethylbenzene per liter of drinking water (0.7 mg/L).

The EPA requires that spills or accidental releases into the environment of 1,000 pounds or more of ethylbenzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 100 parts of ethylbenzene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for ethylbenzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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LEAD

CAS # 7439-92-1

Division of Toxicology and Environmental Medicine ToxFAQs™ September 2005

This fact sheet answers the most frequently asked health questions (FAQs) about lead. For more information, 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. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead has been found in at least 1,280 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is lead?

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from gasoline, paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years.

What happens to lead when it enters the environment?

☐ Lead itself does not break down, but lead compounds are changed by sunlight, air, and water.

☐ When lead is released to the air, it may travel long distances before settling to the ground.

☐ Once lead falls onto soil, it usually sticks to soil particles.

☐ Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.

How might I be exposed to lead?

☐ Eating food or drinking water that contains lead. Water pipes in some older homes may contain lead solder. Lead can leach out into the water.

☐ Spending time in areas where lead-based paints have been used and are deteriorating. Deteriorating lead paint can contribute to lead dust.

☐ Working in a job where lead is used or engaging in certain hobbies in which lead is used, such stained glass.

☐ Using health-care products or folk remedies that contain lead.

How can lead affect my health?

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

How likely is lead to cause cancer?

We have no conclusive proof that lead causes cancer in humans. Kidney tumors have developed in rats and mice that had been given large doses of some kind of lead compounds. The Department of Health and Human Services (DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens and the EPA has determined that lead is a probable human carcinogen. The International Agency for Research on

Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans.

How can lead affect children?

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead. Some of these effects may persist beyond childhood.

How can families reduce the risks of exposure to lead?

☐ Avoid exposure to sources of lead.

☐ Do not allow children to chew or mouth painted surfaces that may have been painted with lead-based paint.

☐ If you have a water lead problem, run or flush water that has been standing overnight before drinking or cooking with it.

☐ Some types of paints and pigments that are used as make-up or hair coloring contain lead. Keep these kinds of products away from children

☐ If your home contains lead-based paint or you live in an area contaminated with lead, wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Is there a medical test to determine whether I've been exposed to lead?

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your recent exposure to lead. Blood tests are commonly used to screen children for lead poisoning. Lead in teeth or bones can be measured by X-ray techniques, but these methods are not widely available. 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). These tests usually require special analytical equipment that is not available in a doctor's office. However, your doctor can draw blood samples and send them to appropriate laboratories for analysis.

Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) recommends that states test children at ages 1 and 2 years. Children should be tested at ages 3-6 years if they have never been tested for lead, if they receive services from public assistance programs for the poor such as Medicaid or the Supplemental Food Program for Women, Infants, and Children, if they live in a building or frequently visit a house built before 1950; if they visit a home (house or apartment) built before 1978 that has been recently remodeled; and/or if they have a brother, sister, or playmate who has had lead poisoning. CDC considers a lead level of 10 µg/dL to be a level of concern for children.

EPA limits lead in drinking water to 15 µg per liter.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for lead (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

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MERCURY
CAS # 7439-97-6

Agency for Toxic Substances and Disease Registry ToxFAQs April 1999

This fact sheet answers the most frequently asked health questions (FAQs) about mercury. For more information, 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. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to mercury occurs from breathing contaminated air, ingesting contaminated water and food, and having dental and medical treatments. Mercury, at high levels, may damage the brain, kidneys, and developing fetus. This chemical has been found in at least 714 of 1,467 National Priorities List sites identified by the Environmental Protection Agency.

What is mercury?
(Pronounced mũr′kyə-rē)

Mercury is a naturally occurring metal which has several forms. The metallic mercury is a shiny, silver-white, odorless liquid. If heated, it is a colorless, odorless gas.

Mercury combines with other elements, such as chlorine, sulfur, or oxygen, to form inorganic mercury compounds or "salts," which are usually white powders or crystals. Mercury also combines with carbon to make organic mercury compounds. The most common one, methylmercury, is produced mainly by microscopic organisms in the water and soil. More mercury in the environment can increase the amounts of methylmercury that these small organisms make.

Metallic mercury is used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, and batteries. Mercury salts are sometimes used in skin lightening creams and as antiseptic creams and ointments.

What happens to mercury when it enters the environment?

☐ Inorganic mercury (metallic mercury and inorganic mercury compounds) enters the air from mining ore deposits, burning coal and waste, and from manufacturing plants.

☐ It enters the water or soil from natural deposits, disposal of wastes, and volcanic activity.

☐ Methylmercury may be formed in water and soil by small organisms called bacteria.

☐ Methylmercury builds up in the tissues of fish. Larger and older fish tend to have the highest levels of mercury.

How might I be exposed to mercury?

☐ Eating fish or shellfish contaminated with methylmercury.

☐ Breathing vapors in air from spills, incinerators, and industries that burn mercury-containing fuels.

☐ Release of mercury from dental work and medical treatments.

☐ Breathing contaminated workplace air or skin contact during use in the workplace (dental, health services, chemical, and other industries that use mercury).

☐ Practicing rituals that include mercury.

How can mercury affect my health?

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

How likely is mercury to cause cancer?

There are inadequate human cancer data available for all forms of mercury. Mercuric chloride has caused increases in several types of tumors in rats and mice, and methylmercury has caused kidney tumors in male mice. The EPA has determined that mercuric chloride and methylmercury are possible human carcinogens.

How can mercury affect children?

Very young children are more sensitive to mercury than adults. Mercury in the mother's body passes to the fetus and may accumulate there. It can also can pass to a nursing infant through breast milk. However, the benefits of breast feeding may be greater than the possible adverse effects of mercury in breast milk.

Mercury's harmful effects that may be passed from the mother to the fetus include brain damage, mental retardation, incoordination, blindness, seizures, and inability to speak. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage.

How can families reduce the risk of exposure to mercury?

Carefully handle and dispose of products that contain mercury, such as thermometers or fluorescent light bulbs. Do not vacuum up spilled mercury, because it will vaporize and increase exposure. If a large amount of mercury has been spilled, contact your health department. Teach children not to play with shiny, silver liquids.

Properly dispose of older medicines that contain mercury. Keep all mercury-containing medicines away from children.

Pregnant women and children should keep away from rooms where liquid mercury has been used.

Learn about wildlife and fish advisories in your area from your public health or natural resources department.

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

Tests are available to measure mercury levels in the body. Blood or urine samples are used to test for exposure to metallic mercury and to inorganic forms of mercury. Mercury in whole blood or in scalp hair is measured to determine exposure to methylmercury. Your doctor can take samples and send them to a testing laboratory.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 2 parts of mercury per billion parts of drinking water (2 ppb).

The Food and Drug Administration (FDA) has set a maximum permissible level of 1 part of methylmercury in a million parts of seafood (1 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 0.1 milligram of organic mercury per cubic meter of workplace air (0.1 mg/m^3) and 0.05 mg/m^3 of metallic mercury vapor for 8-hour shifts and 40-hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for mercury. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

Agency for Toxic Substances and Disease Registry ToxFAQs September 1996

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, 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.

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

What are polycyclic aromatic hydrocarbons?

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

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

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

What happens to PAHs when they enter the environment?

☐ PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.

☐ PAHs can occur in air attached to dust particles.

☐ Some PAH particles can readily evaporate into the air from soil or surface waters.

☐ PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.

☐ PAHs enter water through discharges from industrial and wastewater treatment plants.

☐ Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.

☐ Microorganisms can break down PAHs in soil or water after a period of weeks to months.

☐ In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.

☐ PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

☐ Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.

☐ Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.

☐ Coming in contact with air, water, or soil near hazardous waste sites.

☐ Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.

☐ Drinking contaminated water or cow's milk.

of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

How likely are PCBs to cause cancer?

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

How can PCBs affect children?

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

How can families reduce the risk of exposure to PCBs?

☐ You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.

☐ Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.

☐ Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.

☐ If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

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

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

Has the federal government made recommendations to protect human health?

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

References

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

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html. 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

TETRACHLOROETHYLENE

CAS # 127-18-4

Agency for Toxic Substances and Disease Registry ToxFAQs September 1997

This fact sheet answers the most frequently asked health questions (FAQs) about tetrachloroethylene. For more information, 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. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Tetrachloroethylene is a manufactured chemical used for dry cleaning and metal degreasing. Exposure to very high concentrations of tetrachloroethylene can cause dizziness, headaches, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. Tetrachloroethylene has been found in at least 771 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is tetrachloroethylene?

(Pronounced tĕt′rə-klôr′ ō-ĕth′ə-lēn′)

Tetrachloroethylene is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products.

Other names for tetrachloroethylene include perchloroethylene, PCE, and tetrachloroethene. It is a nonflammable liquid at room temperature. It evaporates easily into the air and has a sharp, sweet odor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part tetrachloroethylene per million parts of air (1 ppm) or more, although some can smell it at even lower levels.

What happens to tetrachloroethylene when it enters the environment?

☐ Much of the tetrachloroethylene that gets into water or soil evaporates into the air.

☐ Microorganisms can break down some of the tetrachloroethylene in soil or underground water.

☐ In the air, it is broken down by sunlight into other chemicals or brought back to the soil and water by rain.

☐ It does not appear to collect in fish or other animals that live in water.

How might I be exposed to tetrachloroethylene?

☐ When you bring clothes from the dry cleaners, they will release small amounts of tetrachloroethylene into the air.

☐ When you drink water containing tetrachloroethylene, you are exposed to it.

How can tetrachloroethylene affect my health?

High concentrations of tetrachloroethylene (particularly in closed, poorly ventilated areas) can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death.

Irritation may result from repeated or extended skin contact with it. These symptoms occur almost entirely in work (or hobby) environments when people have been accidentally exposed to high concentrations or have intentionally used tetrachloroethylene to get a "high."

In industry, most workers are exposed to levels lower than those causing obvious nervous system effects. The health effects of breathing in air or drinking water with low levels of tetrachloroethylene are not known.

Results from some studies suggest that women who work in dry cleaning industries where exposures to tetrachloroethylene can be quite high may have more menstrual problems and spontaneous abortions than women who are not exposed. However, it is not known if tetrachloroethylene was responsible for these problems because other possible causes were not considered.

Results of animal studies, conducted with amounts much higher than those that most people are exposed to, show that tetrachloroethylene can cause liver and kidney damage. Exposure to very high levels of tetrachloroethylene can be toxic to the unborn pups of pregnant rats and mice. Changes in behavior were observed in the offspring of rats that breathed high levels of the chemical while they were pregnant.

How likely is tetrachloroethylene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that tetrachloroethylene may reasonably be anticipated to be a carcinogen. Tetrachloroethylene has been shown to cause liver tumors in mice and kidney tumors in male rats.

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

One way of testing for tetrachloroethylene exposure is to measure the amount of the chemical in the breath, much the same way breath-alcohol measurements are used to determine the amount of alcohol in the blood.

Because it is stored in the body's fat and slowly released into the bloodstream, tetrachloroethylene can be detected in the breath for weeks following a heavy exposure.

Tetrachloroethylene and trichloroacetic acid (TCA), a breakdown product of tetrachloroethylene, can be detected in the blood. These tests are relatively simple to perform. These tests aren't available at most doctors' offices, but can be performed at special laboratories that have the right equipment.

Because exposure to other chemicals can produce the same breakdown products in the urine and blood, the tests for breakdown products cannot determine if you have been exposed to tetrachloroethylene or the other chemicals.

Has the federal government made recommendations to protect human health?

The EPA maximum contaminant level for the amount of tetrachloroethylene that can be in drinking water is 0.005 milligrams tetrachloroethylene per liter of water (0.005 mg/L).

The Occupational Safety and Health Administration (OSHA) has set a limit of 100 ppm for an 8-hour workday over a 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that tetrachloroethylene be handled as a potential carcinogen and recommends that levels in workplace air should be as low as possible.

Glossary

Carcinogen: A substance with the ability to cause cancer.
CAS: Chemical Abstracts Service.
Milligram (mg): One thousandth of a gram.
Nonflammable: Will not burn.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Tetrachloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TRICHLOROETHYLENE

CAS # 79-01-6

Division of Toxicology ToxFAQs™ July 2003

This fact sheet answers the most frequently asked health questions (FAQs) about trichloroethylene. For more information, 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: Trichloroethylene is a colorless liquid which is used as a solvent for cleaning metal parts. Drinking or breathing high levels of trichloroethylene may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, and possibly death. Trichloroethylene has been found in at least 852 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is trichloroethylene?

Trichloroethylene (TCE) is a nonflammable, colorless liquid with a somewhat sweet odor and a sweet, burning taste. It is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers.

Trichloroethylene is not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

What happens to trichloroethylene when it enters the environment?

☐ Trichloroethylene dissolves a little in water, but it can remain in ground water for a long time.
☐ Trichloroethylene quickly evaporates from surface water, so it is commonly found as a vapor in the air.
☐ Trichloroethylene evaporates less easily from the soil than from surface water. It may stick to particles and remain for a long time.
☐ Trichloroethylene may stick to particles in water, which will cause it to eventually settle to the bottom sediment.
☐ Trichloroethylene does not build up significantly in plants and animals.

How might I be exposed to trichloroethylene?

☐ Breathing air in and around the home which has been contaminated with trichloroethylene vapors from shower water or household products such as spot removers and typewriter correction fluid.
☐ Drinking, swimming, or showering in water that has been contaminated with trichloroethylene.
☐ Contact with soil contaminated with trichloroethylene, such as near a hazardous waste site.
☐ Contact with the skin or breathing contaminated air while manufacturing trichloroethylene or using it at work to wash paint or grease from skin or equipment.

How can trichloroethylene affect my health?

Breathing small amounts may cause headaches, lung irritation, dizziness, poor coordination, and difficulty concentrating.

Breathing large amounts of trichloroethylene may cause impaired heart function, unconsciousness, and death. Breathing it for long periods may cause nerve, kidney, and liver damage.

Drinking large amounts of trichloroethylene may cause nausea, liver damage, unconsciousness, impaired heart function, or death.

Drinking small amounts of trichloroethylene for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women, although the extent of some of these effects is not yet clear.

Skin contact with trichloroethylene for short periods may cause skin rashes.

How likely is trichloroethylene to cause cancer?

Some studies with mice and rats have suggested that high levels of trichloroethylene may cause liver, kidney, or lung cancer. Some studies of people exposed over long periods to high levels of trichloroethylene in drinking water or in workplace air have found evidence of increased cancer. Although, there are some concerns about the studies of people who were exposed to trichloroethylene, some of the effects found in people were similar to effects in animals.

In its 9th Report on Carcinogens, the National Toxicology Program (NTP) determined that trichloroethylene is "reasonably anticipated to be a human carcinogen." The International Agency for Research on Cancer (IARC) has determined that trichloroethylene is "probably carcinogenic to humans."

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

If you have recently been exposed to trichloroethylene, it can be detected in your breath, blood, or urine. The breath test, if it is performed soon after exposure, can tell if you have been exposed to even a small amount of trichloroethylene.

Exposure to larger amounts is assessed by blood and urine tests, which can detect trichloroethylene and many of its breakdown products for up to a week after exposure. However, exposure to other similar chemicals can produce the same breakdown products, so their detection is not absolute proof of exposure to trichloroethylene. This test isn't available at most doctors' offices, but can be done at special laboratories that have the right equipment.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level for trichloroethylene in drinking water at 0.005 milligrams per liter (0.005 mg/L) or 5 parts of TCE per billion parts water.

The EPA has also developed regulations for the handling and disposal of trichloroethylene.

The Occupational Safety and Health Administration (OSHA) has set an exposure limit of 100 parts of trichloroethylene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: The ability of a substance to cause cancer.
CAS: Chemical Abstracts Service.
Evaporate: To change into a vapor or gas.
Milligram (mg): One thousandth of a gram.
Nonflammable: Will not burn.
ppm: Parts per million.
Sediment: Mud and debris that have settled to the bottom of a body of water.
Solvent: A chemical that dissolves other substances.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Trichloroethylene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

TOLUENE
CAS # 108-88-3

Division of Toxicology ToxFAQs™ February 2001

This fact sheet answers the most frequently asked health questions (FAQs) about toluene. For more information, 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. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to toluene occurs from breathing contaminated workplace air, in automobile exhaust, some consumer products paints, paint thinners, fingernail polish, lacquers, and adhesives. Toluene affects the nervous system. Toluene has been found at 959 of the 1,591 National Priority List sites identified by the Environmental Protection Agency

What is toluene?

Toluene is a clear, colorless liquid with a distinctive smell. Toluene occurs naturally in crude oil and in the tolu tree. It is also produced in the process of making gasoline and other fuels from crude oil and making coke from coal.

Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes.

What happens to toluene when it enters the environment?

☐ Toluene enters the environment when you use materials that contain it. It can also enter surface water and groundwater from spills of solvents and petrolieum products as well as from leasking underground storage tanks at gasoline stations and other facilities.

☐ When toluene-containing products are placed in landfills or waste disposal sites, the toluene can enter the soil or water near the waste site.

☐ Toluene does not usually stay in the environment long.

☐ Toluene does not concentrate or buildup to high levels in animals.

How might I be exposed to toluene?

☐ Breathing contaminated workplace air or automobile exhaust.

☐ Working with gasoline, kerosene, heating oil, paints, and lacquers.

☐ Drinking contaminated well-water.

☐ Living near uncontrolled hazardous waste sites containing toluene products.

How can toluene affect my health?

Toluene may affect the nervous system. Low to moderate levles can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, loss of appetite, and hearing and color vision loss. These symptoms usually disappear when exposure is stopped.

Inhaling High levels of toluene in a short time can make you feel light-headed, dizzy, or sleepy. It can also cause unconsciousness, and even death.

High levels of toluene may affect your kidneys.

How likely is toluene to cause cancer?

Studies in humans and animals generally indicate that toluene does not cause cancer.

The EPA has determined that the carcinogenicity of toluene can not be classified.

How can toluene affect children?

It is likely that health effects seen in children exposed to toluene will be similar to the effects seen in adults.
Some studies in animals suggest that babies may be more sensitive than adults.

Breathing very high levels of toluene during pregnancy can result in children with birth defects and retard mental abilities, and growth. We do not know if toluene harms the unborn child if the mother is exposed to low levels of toluene during pregnancy.

How can families reduce the risk of exposure to toluene?

☐ Use toluene-containing products in well-ventilated areas.

☐ When not in use, toluene-containing products should be tightly covered to prevent evaporation into the air.

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

There are tests to measure the level of toluene or its breakdown products in exhaled air, urine, and blood. To determine if you have been exposed to toluene, your urine or blood must be checked within 12 hours of exposure. Several other chemicals are also changed into the same breakdown products as toluene, so some of these tests are not specific for toluene.

Has the federal government made recommendations to protect human health?

EPA has set a limit of 1 milligram per liter of drinking water (1 mg/L).

Discharges, releases, or spills of more than 1,000 pounds of toluene must be reported to the National Response Center.

The Occupational Safety and Health Administration has set a limit of 200 parts toluene per million of workplace air (200 ppm).

References

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

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html. 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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

XYLENE
CAS # 1330-20-7

Division of Toxicology and Environmental Medicine ToxFAQs™ September 2005

This fact sheet answers the most frequently asked health questions (FAQs) about xylene. For more information, 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. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to xylene occurs in the workplace and when you use paint, gasoline, paint thinners and other products that contain it. People who breathe high levels may have dizziness, confusion, and a change in their sense of balance. Xylene has been found in at least 844 of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is xylene?

There are three forms of xylene in which the methyl groups vary on the benzene ring: *meta*-xylene, *ortho*-xylene, and *para*-xylene (*m*-, *o*-, and *p*-xylene). These different forms are referred to as isomers.

Xylene is a colorless, sweet-smelling liquid that catches on fire easily. It occurs naturally in petroleum and coal tar. Chemical industries produce xylene from petroleum. It is one of the top 30 chemicals produced in the United States in terms of volume.

Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

What happens to xylene when it enters the environment?

☐ Xylene evaporates quickly from the soil and surface water into the air.
☐ In the air, it is broken down by sunlight into other less harmful chemicals.
☐ It is broken down by microorganisms in soil and water.
☐ Only a small amount of it builds up in fish, shellfish, plants, and other animals living in xylene-contaminated water.

How might I be exposed to xylene?

☐ Using a variety of consumer products including gasoline, pain, varnish, shellac, rust preventives, and cigarette smoke. Xylene can be absorbed through the respiratory tract and through the skin.
☐ Ingesting xylene-contaminated food or water, although these levels are likely to be very low.
☐ Working in a job that involves the use of xylene such as painters, paint industry workers, biomedical laboratory workers, automobile garage workers, metal workers, and furniture refinishers.

How can xylene affect my health?

No health effects have been noted at the background levels that people are exposed to on a daily basis.

High levels of exposure for short or long periods can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.

XYLENE
CAS # 1330-20-7

How likely is xylene to cause cancer?

Both the International Agency for Research on Cancer (IARC) and the EPA have found that there is insufficient information to determine whether or not xylene is carcinogenic.

How can xylene affect children?

The effects of xylene have not been studied in children, but it is likely that they would be similar to those seen in exposed adults. Although there is no direct evidence, children may be more sensitive to acute inhalation exposure than adults because their narrower airways would be more sensitive to swelling effects.

Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. We do not know if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy.

How can families reduce the risks of exposure to xylene?

☐ Exposure to xylene as solvents (in paints or gasoline) can be reduced if the products are used with adequate ventilation and if they are stored in tightly closed containers out of the reach of small children.

☐ Sometimes older children sniff household chemicals in attempt to get high. Talk with your children about the dangers of sniffing xylene.

☐ If products containing xylene are spilled on the skin, then the excess should be wiped off and the area cleaned with soap and water.

Is there a medical test to determine whether I've been exposed to xylene?

Laboratory tests can detect xylene or its breakdown products in exhaled air, blood, or urine. There is a high degree of agreement between the levels of exposure to xylene and the levels of xylene breakdown products in the urine. However, a urine sample must be provided very soon after exposure ends because xylene quickly leaves the body. These tests are not routinely available at your doctor's office.

Has the federal government made recommendations to protect human health?

The EPA set a limit of 10 parts xylene per million parts drinking water (10 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 100 parts xylene per million parts of workplace air (100 ppm) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Xylene (Draft for Public Comment). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. 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.

== MSDS Safety Information ==

TOP

FSC: 9130 **NIIN:** 00−148−7104 **MSDS Date:** 04/09/1987 **MSDS Num:** BPBRW

Submitter: D DG **Tech Review:** 06/25/1999 **Status CD:** C

Product ID: 00351 UNLEADED REGULAR GASOLINE **MFN:** 01

Article: N **Kit Part:** N

Responsible Party **Cage:** 38431

Name: TEXACO INC.

Box: 509

City: BEACON **State:** NY **Zip:** 12508−0509

Country: US

Info Phone Number: 914−831−3400 EXT 204

Emergency Phone Number: 914−831−3400 EXT 204

Preparer's Name: R. T. RICHARDS

Proprietary Ind: N Review Ind: Y

Published: Y Special Project CD: N

== Contractor Summary ==

TOP

Cage:38431 **Name:**DIGITAL CONTROL SYSTEMS INC

Address:3160 GRAND MARAIS E

City:WINDSOR, N8W 4W5 **State:**ON **Zip:**00000

Country:CN **Phone:**NONE

Cage:7B131 **Name:**TEXACO INC

Address:UNKNOWN **Box:**509

City:BEACON **State:**NY **Zip:**12508−0509

Country:US **Phone:**914−831−3400

== Item Description Information ==

TOP

Item Manager:

Item Name: GASOLINE,AUTOMOTIVE

Specification Number: VV−V−00169A Type/Grade/Class: CL A,B,C,D,E;GR PREM

Unit of Issue: GL Quantitative Expression:

UI Container Qty: X Type of Container: BULK

== Ingredients ==

TOP

Cas: 71−43−2 Code: M RTECS #: CY1400000 Code: M

Name: **BENZENE (SARA III)**

% Text: 1−3.99 Environmental Wt:

			Other REC Limits:	NONE SPECIFIED	
OSHA PEL:	1PPM/5STEL;1910.1028	Code: M	OSHA STEL:		Code:
ACGIH TLV:	10 PPM; A2; 9192	Code: M	ACGIH STEL:	N/P	Code:
EPA Rpt Qty:	10 LBS		DOT Rpt Qty:	10 LBS	

Ozone Depleting Chemical: N

Cas:	108-88-3	Code: M	RTECS #:	XS5250000	Code: M
Name:	**TOLUENE (SARA III)**				
% Text:	4-10.99		Environmental Wt:		
			Other REC Limits:	NONE SPECIFIED	
OSHA PEL:	200 PPM/150 STEL	Code: M	OSHA STEL:		Code:
ACGIH TLV:	50 PPM; 9293	Code: M	ACGIH STEL:	N/P	Code:
EPA Rpt Qty:	1000 LBS		DOT Rpt Qty:	1000 LBS	

Ozone Depleting Chemical: N

Cas:	100-41-4	Code: M	RTECS #:	DA0700000	Code: M
Name:	**ETHYL BENZENE (SARA III)**				
% Text:	1-3.99		Environmental Wt:		
			Other REC Limits:	NONE SPECIFIED	
OSHA PEL:	100 PPM/125 STEL	Code: M	OSHA STEL:		Code:
ACGIH TLV:	100 PPM/125STEL 9192	Code: M	ACGIH STEL:	N/P	Code:
EPA Rpt Qty:	1000 LBS		DOT Rpt Qty:	1000 LBS	

Ozone Depleting Chemical: N

Cas:	1330-20-7	Code: M	RTECS #:	ZE2100000	Code: M
Name:	**XYLENES (O-,M-,P- ISOMERS) (SARA III)**				
% Text:	4-10.99		Environmental Wt:		
			Other REC Limits:	NONE SPECIFIED	
OSHA PEL:	100 PPM/150 STEL	Code: M	OSHA STEL:		Code:
ACGIH TLV:	100 PPM/150STEL;9192	Code: M	ACGIH STEL:	N/P	Code:
EPA Rpt Qty:	1000 LBS		DOT Rpt Qty:	1000 LBS	

Ozone Depleting Chemical: N

Cas:	95-63-6	Code: M	RTECS #:	DC3325000	Code: M
Name:	**1,2,4-TRIMETHYLBENZENE (SARA III)**				
% Text:	1-3.99		Environmental Wt:		
			Other REC Limits:	NONE SPECIFIED	
OSHA PEL:	25 PPM	Code: M	OSHA STEL:		Code:
ACGIH TLV:	25 PPM; 9192	Code: M	ACGIH STEL:	N/P	Code:

EPA Rpt Qty:		DOT Rpt Qty:	

Ozone Depleting Chemical: N

Cas:	1634−04−4	Code:	M	RTECS #:	KN5250000	Code:	M

Name: **METHYL TERT−BUTYL ETHER (SARA III)**

% Text:	0−10			Environmental Wt:			
				Other REC Limits:	NONE SPECIFIED		
OSHA PEL:	NOT ESTABLISHED	Code:	M	OSHA STEL:		Code:	
ACGIH TLV:	NOT ESTABLISHED	Code:	M	ACGIH STEL:	N/P	Code:	
EPA Rpt Qty:	1 LB			DOT Rpt Qty:	1 LB		

Ozone Depleting Chemical: N

== Health Hazards Data ==

TOP

LD50 LC50 Mixture ORAL LD50 (RAT) = 18.75 ML/KG

Route Of Entry Inds − Inhalation:YES	Skin:YES	Ingestion:NO
Carcinogenicity Inds − NTP:YES	IARC:YES	OSHA:YES

Health Hazards Acute And Chronic

ACUTE: EYES−CAUSES SLIGHT−MODERATE EYE IRRITATION. SKIN−MODERATELY IRRITATING. CHRONIC: RECENT STUDIES WITH LABORATORY ANIMALS HAVE SHOWN THAT GASOLINE VAPORS CAUSE KIDNEY DAMAGE & KIDNEY CANCER IN RA TS & LIVER CANCER IN MICE.

Explanation Of Carcinogenicity

PRODUCT CONTAINS BENZENE WHICH IS LISTED AS A CARCINOGEN BY NTP, IARC AND OSHA.

Signs And Symptions Of Overexposure

RESPIRATORY SYSTEM: MAY CAUSE DIZZINESS, IRRITATION OF EYES, NOSE AND THROAT, VOMITING, BLUISH COLOR OF THE SKIN AND CNS EFFECTS.

Medical Cond Aggravated By Exposure

NONE SPECIFIED BY MANUFACTURER.

First Aid

EYES: FLUSH WITH WATER FOR 15 MINUTES. SKIN: WASH EXPOSED AREA WITH SOAP AND WATER. INGESTION: DO NOT INDUCE VOMITING. MAY CAUSE CHEMICAL PNEUMONITIS. CALL A PHYSICIAN. INHALATION: SHOULD SYMPTOMS NOT ED UNDER EXPOSURE OCCUR, REMOVE TO FRESHAIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. (REMOVE GASOLINE−SOAKED CLOTHING)

Spill Release Procedures

ELIMINATE ALL IGNITION SOURCES INCLUDING INTERNAL COMBUSTION ENGINES AND POWER TOOLS. VENTILATE AREA. AVOID BREATHING VAPORS. USE SCBA OR SUPPLIED−AIR MASK FOR LARGE SPILLS IN CONFINED AREAS. CONTAIN SPILL IF POSSIBLE. REMOVE WITH INERT ABSORBENT.

Neutralizing Agent

NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Methods

PREVENT WASTE FROM CONTAMINATING SURROUNDING ENVIRONMENT. DISCARD ANY PRODUCT, RESIDUE, DISPOSAL CONTAINER OR LINER IN ACCORDANCE WITH ALL FEDERAL, STATE AND LOCAL REGULATIONS.

Handling And Storage Precautions

TRANSPORT, HANDLE AND STORE IN ACCORDANCE WITH OSHA REGULATION 1910.106 AND APPLICABLE D.O.T. REGULATIONS.

Other Precautions

DANGER! EXTREMELY FLAMMABLE. HARMFUL OR FATAL IF SWALLOWED. MAY BE FATAL IF INHALED; MAY CAUSE IRRITATION. MAY BE HARMFUL IF ABSORBED THROUGH THE SKIN. KEEP AWAY FROM HEAT, SPARKS AMD FLAMES. AVOID BR EATHING VAPORS. FOR USE AS MOTOR FUEL.

=== Fire and Explosion Hazard Information ===

TOP

Flash Point Method: COC

Flash Point:

Flash Point Text: −40F,−40C

Autoignition Temp:

Autoignition Temp Text: N/A

Lower Limits: 1.4 %

Upper Limits: 7.6 %

Extinguishing Media

DRY CHEMICAL, FOAM, CARBON DIOXIDE.

Fire Fighting Procedures

WATER MAY BE INEFFECTIVE ON FLAMES, BUT SHOULD BE USED TO COOL FIRE−EXPOSED CONTAINERS. IF A SPILL OR LEAK HAS NOT IGNITED, USE WATER SPRAY TO DISPERSE VAPORS.

Unusual Fire/Explosion Hazard

FLOWING GASOLINE CAN BE IGNITED BY SELF−GENERATED STATIC ELECTRICITY; USE ADEQUATE GROUNDING. CARBON MONOXIDE & CARBON DIOXIDE MAY BE FORMED ON BURNING IN AIR.

=== Control Measures ===

TOP

Respiratory Protection

SCBA OR SUPPLIED AIR RESPIRATORY PROTECTION REQUIRED FOR ENTRY INTO TANKS, VESSELS, OR OTHER CONFINED SPACES CONTAINING GASOLINE.

Ventilation

ADEQUATE TO MEET PERMISSIBLE CONCENTRATIONS.

Protective Gloves

NITRILE, TEFLON, VITON

Eye Protection

CHEMICAL−TYPE GOGGLES, FACE SHIELD

Other Protective Equipment

PROTECTIVE CLOTHING SUCH AS UNIFORMS, COVERALLS OR LAB COATS SHOULD BE WORN.

Work Hygienic Practices

LAUNDER OR DRY CLEAN WHEN SOILED.

Supplemental Safety and Health

WARNING STATEMENT: DANGER! EXTREMELY FLAMMABLE. HARMFUL OR FATAL IF SWALLOWED.

Physical/Chemical Properties

TOP

HCC: F1

NRC/State LIC No: N/R

Net Prop WT For Ammo:

Boiling Point:

B.P. Text: >90F,>32C

Melt/Freeze Pt:

M.P/F.P Text: NOT GIVEN

Decomp Temp:

Decomp Text: N.A.

Vapor Pres: >−350 MMHG

Vapor Density: 3 − 4.0

Volatile Org Content %:

Spec Gravity: 0.7 − .78

VOC Pounds/Gallon:

PH: N.A.

VOC Grams/Liter:

Viscosity: N/P

Evaporation Rate & Reference: N.D.

Solubility in Water: SLIGHT

Appearance and Odor: LIGHT STRAW TO LIGHT RED LIQUID

Percent Volatiles by Volume: 100 %

Corrosion Rate: N.A.

Reactivity Data

TOP

Stability Indicator: YES

Stability Condition To Avoid: HEAT, SPARKS, FLAME AND OTHER SOURCES OF IGNITION.

Materials To Avoid: STRONG OXIDIZERS

Hazardous Decomposition Products: TOXIC LEVELS OF CARBON MONOXIDE, CARBON DIOXIDE, IRRITATING ALDEHYDES AND KETONES.

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization NONE. WILL NOT OCCUR.

:

Toxicological Information

TOP

Toxicological Information: N/P

Ecological Information

TOP

Ecological: N/P

MSDS Transport Information

TOP

Transport Information: N/P

Regulatory Information

TOP

Sara Title III Information: N/P

Federal Regulatory Information: N/P

State Regulatory Information: N/P

=== Other Information ===

TOP

Other Information: N/P

===

Trade Name : Leaded Petrol

1. Chemical and Company Identification

Trade Name	All Leaded Gasolines
Product Code	None applicable
Supplier	Gulf Oil International, 3rd Floor, 16 Charles II Street, London SW1Y 4QU, U.K.
Routine Enquiries	(44) 20 7839 2402
Fax	(44) 20 7839 2399
Emergency Contact	GMT 0900 − 1800: (44) 20 7839 2402; IST 09.30 − 1800: (91) 22 839 0789
Chemical Description	Petrol/Gasolene

2. Composition and Ingredients

Components	CAS No.	Range in %
Petrol consists of mainly straight chain and branched paraffinic hydrocarbons, olefins, cycloparafins and aromatics in the C4 to C12 carbon range		100
Toluene	108883	10−20
Ethyl benzene	100414	<10
Xylene	1330207	<5
Benzene	71432	<5
Tetra Alkyl or Ethyl Lead	78002	<0.1

3. Hazards Identification

Warning Statements	EXTREMELY FLAMMABLE. HARMFUL OR FATAL IF SWALLOWED. LOW VISCOSITY PETROLEUM MIXUTURE. CAN CAUSE LUNG INJURY IF INHALED OR ASPIRATED. CONTAINS BENZENE A KNOWN CANCER HAZARD. MAY BE HARMFUL IF INHALED OR ABSORBED THROUGH SKIN. USE ONLY AS A FUEL. KEEP OUT OF REACH OF CHILDREN. AVOID PROLONGED AND REPEATED CONTACT WITH SKIN. IF SKIN CONTACT OCCURS, WASH EXPOSED AREA WITH SOAP AND WATER. LAUNDER CONTAMINATED CLOTHING.
Eyes	May cause severe eye irritation
Oral	Expected to be moderate acute toxicity by ingestion. May cause irritation of the digestive tract which may result in nausea, vomitting and diarrhea. Ingestion of this product and subsequent vomitting can result in aspiration into the lungs, causing chemical pneumonia and lung damage
Inhalation	May cause dizziness, irritationof eyes, nose and throat, vomitting and central nervous system effects upon inhalation. Convulsions, seizures and sudden loss of consciousness, coma and death are possible from extreme exposure. See Long term Toxic Effects and Section 11 for additional information.
Skin	Irritating to the skin with discomfort or pain, redness or swelling. Prolonged contact may cause more severe irritation and discomfort, seen as local redness and swelling. May produce systemic toxicity by skin absorption See Section 11 for additional information.
Long Term Toxic Effects	Cancer information available on this material or a component(s). See section 11 for additional information. This material or a component(s) may cause cardiac sensitization, including irregular hearbeats and death due to cardiac arrest. See Section 4, Advice to Doctor, for futher information

4. First Aid Measures

Eyes	Flush eyes immediately with fresh water for several minutes while holding the eyelids open. If irritation persists, see a doctor

Skin	Remove and launder contaminated clothing, including shoes. Wash skin thoroughly with soap and water. See a doctor if any signs or symptons described in this MSDS occur.
Ingestion	Do not induce vomitting. Aspiration of the material can cause serious lung injury such as chemical pnemonia. Call a doctor immediately. If spontaneous vomitting occurs, keep head below hips to prvent aspiration and monitor for breathing difficulty. Never give anything by mouth to an unconscious person..
Inhalation	If respiratory irritation or any signs or symptons as described in this MSDS occur, mover the person to fresh air. If any of these effects continue, see a doctor
Advice to Doctor	This product may present an aspiration hazard. See related comments in this MSDS. If spontaneous vomitting has occurred after ingestion, the patient should be monitored for difficult breathing, as adverse effects of aspiration into the lungs may be delayed up to 48 hours. Severe inhalation overexposure to this material may sensitize the heart to catecholamine−induced arrhythmias. Do not adminster catecholamines to overexposed individuals. Contact a poison control center for further treatment information.

5. Fire Fighting Measures

Ignition Temperature, deg C	390
Flammable Limits (% by Volume)	1.4 − 7.6
Flash Point, deg C	−40 TAG
Fire Extinguishing Agents	According to the US National Fire Protection Associtiion Guide, use dry chemical, foam or carbon dioxide. Water may be ineffective on the flames, but water may be used to keep fire−exposed containers cool. If a leak of spill has not ignited, use water to disperse the vapours
Explosion Hazards	Liquid evaporates and forms vapour which can catch fire or explode. Invisible vapour spreads easily and can be set on fire by ignition sources. Fire hazard is greater as liquid temperature rises above 29 deg C. Flowing liquid can be ignited by self−generating statif electricity − use adequate grounding. Full body flame−resistant clothing and/or turn−out gear recommended for persons attempting leak or spill control and for fire−fighting.

6. Accidential Release Measures

In case of Spill	Eliminate all ignition sources including internal combustion engines and power tools. Ventillate area. Keep people away. Stay upwind and warn of possible downwind explosion hazard. Avoid breathing vapours and eye or skin contact. Use respirator and protective clothing as discussed in this MSDS (See section 8). Use supplied−air respirator for large releases in confined area. Contain spill if possible. Remove with inert absorbent and place in container for disposal at an approved facility. Prvent entry into sewers and waterways.

7. Handling and Storage

Keep away from heat, sparks and flame. Handle and store in well−ventilated area and in accordance with local regulations regarding flammable liquids. Empty contgainers retain residue (liquid and/or vapor) and can be dangerous.DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARTKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION: THEY MAY EXPLOSE AND CAUSE INJURY OR DEATH. Do not attempt to clean since residue is difficult to remove. Empty drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. All othe containers should be disposed off in an environmentally safe manenr and in accordance with governmental regulations.

8. Exposure Control/Personal Protection

Eyes	Avoid eye contact. The wearing of chemical safety goggles or face shied is recommended.
Skin	Avoid contact withskin or street clothing. Skin contact can be minised by wearing protective clothing including coveralls, gloves and boots. Gloves and boots should be resistant to chemicals and petroleum distillates. Exposed employees should exercise reasonable personal clealiness; this includes cleansing exposed skin several times daily with soap and water, and laundering or dry cleaning soiled work clothing at least weekly..
Inhalation	If operating conditions create airborne concentrations which exceed the recommended exposure standard(s), the use of an approved respirator is recommended. Wear approved respiratory protection such as organic vapour cartridge respirator with particulate prefilter. Use approved supplied air respiratory protection for cleaning large spills or upon entry into tanks, vessels, or other confined spaces.
Ventilation	No special ventialtion is usually necessary. However, if operating conditions create high airborne concentrations of this material, engineering controls may be needed. Local exhuast ventilation and/or enclosure of the processes is preferred in these cases

Exposure Limits	TheACGIH TLV for benzene is 0.5 ppm for a daily 8 hour time weighted average. The short term exposure limit (STEL) is 2.5 ppm.The ACGIH TLV for toluene is 50 ppm for a daily 8 hour exposure.The ACGIH TLV for xlyene is 100 ppm for a daily 8 hour exposure. Short term exposure to xylene should not exceed 150 ppm as a ceiling limit The ACGIH TLV for ethyl benzene is 125 ppm for a daily 8 hour exposure. A minor component is tetra ethyl/alkyl lead.Exposure should not exceed the ACGIH TLV of 0.1 mg/m^3, In additiion, skin absorption may occur

9. Physical and Chemical Properties

Note: The following data may represent a range of approximate or typical values for products in the same family. Precise technical information is provided in Product Bulletins and can be obtained from your Marketing Representative.	
Appearance and Odor	Color can vary with Octane grade and country. Purple, green or yellow color liquid normally, Petroleum odor
Boiling Point	30−200
Vapor Pr (mmHG @ 25 deg C)	420
Density(kg/l at 15 deg C)	0.7 − 0.75
Vapor Density (Air=1)	3−4
Undiluted product’s pH	Not applicable
Solubility in Water	Slight
Percent Volatile by Volume	100
Evaporation	Not determined
Viscosity (All Product Grades)	<1.5 mm^2/sec at 40 deg C

10. Stability and Reactivity

Hazardous Polymerizations	DO NOT OCCUR
Products of Combustion	Carbon monoxide and carbon di oxide may be formed during burning in limited air supply
Conditions to Avoid	Heat, Strong oxidisers

11. Toxicological Information

General	Experimental chronic inhalation toxicology studies showed kidney disease, kidney cancer and liver cancer in animals following exposure to wholly vaporized petrol. Additional studies limited to the volatile fraction of petrol have not resulted in kidney damage, which is generally considered to be a precursor to kidney cancer. Many scientists do not believe that the male rat is an appropriate animal model or predictor of human kidney cancer. Epidemiology studies in human exposed to hydrocarbons have not indicated excess risk of kidney or liver cancer. Petrol typically contains benzene in concentrations from about 0.t to 5%. Excessive exposure to benzene may cause headaches, loss of appepite, rapid pulse, fatigue, increased bleeding tendencies, and liver and kidney damage. Prolonged and repeated exposure to benzene has been associated with injury to and/or cancer of the bloof−forming organs including aplastic anemia and leukemia. In animal studies, benzene has also been associated with effects on the developing fetus. While the benzene content of petrol is relatively low, it is important to minimize exposure to the skin and respiratory system to well within the current expsoure standards. Engineering controls including full enclosure, vapour recovery, or local exhuast ventilation are recommended where routine exposure may exceed applicable standards. Routine or intermittent skin contact should be avoided. Neoprene or nitrile gloves are recommended for routine handling of petrol/gasoline. Whole gasoline exhuast was reviewed by the International Agency for Research on Cancer (IARC). Evidence for causing cancer was considered inadequate in animals and inadequate in humans. IARC placed whole gasoline exhuast in Category 2B, considering it possibly carcinogenic to humans.

12. Ecological Information

Environmental Effects	Appreciable volatilization to air is expected in the environment. This material or its component(s) may be toxic to aquatic organisms and should be kept out of sewage and drainage systems, and all bodies of water.

13. Disposal Considerations

Waste Disposal	It is the responsibility of the use of products to determine, at the time of disposal, whether the product meets criteria for hazardous waste. Product uses, transformations, mixuture and processes, may render the resulting material hazardous.
Remarks	Do not allow to enter drains or sewers. Can cause explosion

14. Transport Information

UN Number	1203
Dangerous Goods Class	3
Proper Shipping Name	Motor Spirit or Gasoline or Petrol
Hazchem Code	3YE
Additional Information	Transport in accordance with local regulations regarding flammable liquids.

15. Regulatory Information

Respirator Information	In the absense of local approval authorities/standards, follow US NIOSH/MSHA, UK BSI regulations. Respirators must meet either the above or local standard for approved respirators

16. Other Information– No specific notes on this product.

To the best of our knowledge, the information provided in this MSDS document is correct. Access to this information is being provided via the internet too so that it can be made available to as many potential users as possible. We do not assume any liability for consequences of the use of this information since it may be applied under conditions beyond our control or knowledge. Also, it is possible that additional data could be made available after this MSDS was issued. Certain hazards are described herein, however, these may not be the only hazards that exist. All materials may present unknown hazards and should be used with caution.

Customers are encouraged to review this information, follow precautionsl and comply with all applicable laws and regulations regarding the use and disposal of this product. For specific technical data or advice concerning this product as supplied in your country please contact your local sales representative. The final determination of the suitability of any material is the sole responsibility of the user.

MONSANTO CO -- ASKAREL CAT#:M-508A-1 & M-508A-2,(PCBS),AROCLOR SERIES(SUPP) -- 5910-00-197-4068

===================== Product Identification =====================

Product ID:ASKAREL CAT#:M-508A-1 & M-508A-2,(PCBS),AROCLOR SERIES(SUPP)
MSDS Date:09/01/1993
FSC:5910
NIIN:00-197-4068
MSDS Number: BWMPP
=== Responsible Party ===
Company Name:MONSANTO CO
Address:800 N LINDBERGH BLVD
City:ST LOUIS
State:MO
ZIP:63167
Country:US
Info Phone Num:314-694-6661
Emergency Phone Num:314-694-6661, CHEMTREC 800-424-9300
CAGE:76541
=== Contractor Identification ===
Company Name:ACCUSTANDARD INC
Address:125 MARKET ST
Box:City:NEW HAVEN
State:CT
ZIP:06513
Country:US
Phone:800-442-5290
CAGE:0U4A8
Company Name:MONSANTO COMPANY
Address:800 N LINDBERGH BLVD
Box:City:SAINT LOUIS
State:MO
ZIP:63167
Country:US
Phone:314-694-6661 OR 800-332-3111
CAGE:76541

============= Composition/Information on Ingredients =============

Ingred Name:POLYCHLORINATED BIPHENYLS (PCBS) (SARA III)
CAS:1336-36-3
RTECS #:TQ1350000
Other REC Limits:NONE RECOMMENDED
ACGIH TLV:1 MG/M3; 9394
EPA Rpt Qty:1 LB
DOT Rpt Qty:1 LB

Ingred Name:CHLORODIPHENYL;42% CHLORINE (AROCHLOR 1242) (SARA III)
CAS:53469-21-9
RTECS #:TQ1356000
Other REC Limits:NONE RECOMMENDED
OSHA PEL:S, 1 MG/M3
ACGIH TLV:S, 1MG/M3; 9394
EPA Rpt Qty:1 LB
DOT Rpt Qty:1 LB

Ingred Name:AROCLOR 1248 (SARA III)
CAS:12672-29-6
RTECS #:TQ1358000
Other REC Limits:NONE RECOMMENDED
EPA Rpt Qty:1 LB
DOT Rpt Qty:1 LB

Ingred Name:CHLORODIPHENYL;54% CHLORINE (AROCHLOR 1254) (SARA III)

CAS:11097-69-1
RTECS #:TQ1360000
Other REC Limits:NONE RECOMMENDED
OSHA PEL:S, 0.5 MG/M3
ACGIH TLV:S, 0.5MG/M3; 9394
EPA Rpt Qty:1 LB
DOT Rpt Qty:1 LB

Ingred Name:AROCLOR 1260 (SARA III)
CAS:11096-82-5
RTECS #:TQ1362000
Other REC Limits:NONE RECOMMENDED
EPA Rpt Qty:1 LB
DOT Rpt Qty:1 LB

Ingred Name:AROCLOR 1221, 1232 (SARA III)
CAS:1336-36-3
RTECS #:TQ1350000
Other REC Limits:NONE RECOMMENDED
ACGIH TLV:1 MG/M3; 9394
EPA Rpt Qty:1 LB
DOT Rpt Qty:1 LB

Ingred Name:AROCLOR 1016 (SARA III)
CAS:12674-11-2
RTECS #:TQ1351000
Other REC Limits:NONE RECOMMENDED
EPA Rpt Qty:1 LB
DOT Rpt Qty:1 LB

Ingred Name:OTHERS
Other REC Limits:NONE RECOMMENDED

===================== Hazards Identification =====================

Routes of Entry: Inhalation:YES Skin:YES Ingestion:YES
Reports of Carcinogenicity:NTP:YES IARC:YES OSHA:NO
Health Hazards Acute and Chronic:REPEAT/PROLONG CONTACT MAY CAUSE CHLORACNE IN SOME PEOPLE.SKIN:ABSROBED THRU INTACT SKIN.LOC ACTION SIMILAR TO COMMON ORG SOLVENTS-REMOVES NATURAL FATS/OILS RESULTING IN DRYING/CRACKING.EYE:MODERATELY IRRIT.INGEST:SLIGHTLY TOXIC.INHAL:ANIMAL EXPERIMENTS SHOWED 54% CHLORINATED MATL PRODUCES MORE LIVER INJURY THAN 42%.
Explanation of Carcinogenicity:PER MSDS:PCBS HAVE BEEN LISTED IN IARC GROUP 2B & IN NTP.
Effects of Overexposure:CHLORACNE. DRYING & CRACKING SKIN. MODERATELY EYE IRRITANT. SLIGHTLY TOXIC BY INGEST. LIVER INJURY.
Medical Cond Aggravated by Exposure:A POTENTIAL EXISTS FOR CONTRACTING OF CHLORACNE IN SOME PEOPLE.

======================= First Aid Measures =======================

First Aid:INGEST:CONSULT PHYSICIAN.DO NOT INDUCE VOMIT OR GIVE ANY OILY LAXATIVES.SKIN:IF LIQ/SOLID PCBS SPLASHED/SPILLED ON SKIN REMOVE CONTAMIN CLOTH.WASH SKIN THOROUGHLY W/SOAP/WATER.EYES:IRRIGATE IMMED W/CO PIOUS QUANT OF RUNNING WTER FOR @LEAST 15MINS.PETROLATUM-BASED OPHTHALMIC OINTMENT MAY BE APPLIED TO RELIEVE IRRIT EFFECTS.INHAL:REMOVE TO FRESH AIR.IF RASH/RESP IRRIT PERSIST CALL PHYSICIAN.(SUPPLEM)

===================== Fire Fighting Measures =====================

Flash Point:FIRE-RESISTANT
Extinguishing Media:PCBS ARE FIRE-RESISTANT COMPOUNDS.
Fire Fighting Procedures:STD FIREFIGHTING WEARING APPAREL & SCBA SHOULD BE WORN WHEN FIGHTING FIRES THAT INVOLVE POSSIBLE EXPO TO CHEM

COMBUST PROD.CLEAN WELL/DECONTAMIN EQMPT AFT USE.

Unusual Fire/Explosion Hazard:IF PCB TRANSFORMER INVOLVED IN FIRE-RLATED INCIDENT OWENR OF TRANSFORMER MAY BE REQUIRED TO REPORT INCIDENT.CONSULT/FOLLOW FED/STATE/LOC REGS.

================== Accidental Release Measures ==================

Spill Release Procedures:REMOVE NON-ESSENTIAL PERSONNEL.ADEQUATELY VENTILATED.CONTAIN SPILL/LEAK.PREVENT MATL ENTERING SEWER SYS/NAVIGABLE WATERWAYS/STREAMS.REMOVE BY MEANS OF ABSORPTIVE MATL(SAWDUST,VERMICULITE,DRYSAND,CLAY, DIRT,ETC)OR TRAP/REMOVE BY PUMPING.USE PPE.

====================== Handling and Storage ======================

Handling and Storage Precautions:NONE SPECIFIED BY MFG.

Other Precautions:FED REGS UNDER TSCA REQUIRE PCBS AND PCB ITEMS TO BE MARKED.(CHECK REGS FOR DETAILS).AVOID BREATH VAP/MIST.PCB IN ELECT EQPMT REPORTED TO PROD PCDD & PCDF DURING FIRE SITUATIONS-FROM NON PCB CMPD-SEE EQMPT MFG.

============= Exposure Controls/Personal Protection =============

Respiratory Protection:USE NIOSH/MSHA APPROVE EQPMT WHEN AIRBORNE EXPO LIMITS EXCEEDED.FULL FACEPIECE EQMPT RECOMMENDED-CAN REPLACE FACESHIELD &/OR CHEM SPLASH GOGG.CONSULT RESP MFG FOR TYP/CONDITIONS.OBSERVED RESP USE LIMI TATIONS.SCBA/SUP AIR RESP.29CFR1910.134.

Ventilation:PROVIDE VENTI TO CONTROL EXPO LEVELS BELOW AIRBORNE EXO LIMITS.USE LOC MECHANICAL EXHAU VENTI @SOURCES OF AIR CONTAMIN.

Protective Gloves:APPROP GLOVES(VITON)SEE MFG FOR TYP/OPER

Eye Protection:CHEM SPLASH GOGGLES & FACE SHIELD

Other Protective Equipment:EYEBATHS/SAFT SHOWER.PROT CLOTHING FOR BARRIER.PROT APRON.

Work Hygienic Practices:LAUNDER CONTAMIN CLOTH BEF REUSE.CLEAN PROT EQPMT BEF REUSE.WASH THOROUGHLY AFT HANDLING.AVOID BREATH VAP/MIST,CONTACT.

Supplemental Safety and Health

1016;1221;1232;1242;1248;1254;1260.FLPT:170C 1016;141 150C 1221;152-154C 1232;176-180C 1242;193-196C 1248;NONE 1254/1260.1STAID:DR:LG AMTS INGEST GASTRIC LAVAGE SUGGESTED.HOT PCBS MAY CAUSE THERMAL BU RNS.IF ELECTR EQMPT ARCS OVER PCBS/OTHER CHLORINATED HYDROCARBON DIELECTRIC FLUIDS MAY DECOMPOSE TO PRODUCE HCL-RESP IRR

================== Physical/Chemical Properties ==================

HCC:T6

Vapor Pres:VARIES

Spec Gravity:1.18-1.56 VAR

Viscosity:VARIES

Appearance and Odor:MOBILE OIL/VIS LIQ/STICKY RESIN;APHA COLOR 40/100/150;DEPENDS ON AROCLOR SELECT

================= Stability and Reactivity Data =================

Stability Indicator/Materials to Avoid:YES

NONE SPECIFIED BY MFG.

Stability Condition to Avoid:NONE SPECIFIED BY MFG.

Hazardous Decomposition Products:CO,CO2,HCL,PHENOLICS,ALDEHYDES & OTHER TOXIC COMBUST PRODS UNDER SEVERE CONDITIONS(EXPO TO FLAME/HOT SURFACE).

==================== Disposal Considerations ====================

Waste Disposal Methods:ALL WASTES/RESIDUES CONTAINING

PCBS:COLLECT,PLACE IN PROPER CNTNR,MARK,DISPOSE IN MANNER
PRESCRIBED BY EPA REGS(40CFR761)& APPLICABLE STATE/LOC REGS.VAR
FED/STATE/LOC REGS REQUIRE REPORTING PCB SPILLS & CLEANUP
LEVELS.CONSULT ATTORN/OFFICAILS.

CANADA
MÉTAL
(EST) LTÉE
(EASTERN) LTD.

MATERIAL SAFETY DATA SHEET

SECTION I - PRODUCT IDENTIFICATION

Trade Names and Synonyms	Arsenic
Chemical Names and Synonyms	Arsenic
Chemical Family	Metal

SECTION I I - INGREDIENTS

Ingredient	C.A.S. Number	% W/W		Exposure Limit	LD50 oral, rat
		Min	Max		
Arsenic	7440-38-2	99.90	99.99	0.01 mg/m3	763 mg/kg

SECTION I I I - PHYSICAL DATA

Boiling Point (deg C)	NA	Spec Gravity	573
Vapour Pressure (mm Hg)	NA	% Volatile (by volume)	NP
Vapour Density (Air=1)	> air		
Solubility in Water	Nil	Evaporation Rate (Ether = 1)	NP
Appearance	Silver Black Metal		
Odour	None	pH	NP
Form	Solid	Melting Point (deg C)	814

WHMIS Classification	D1-A, D2-A	TDG Information	
		Shipping Name:	Arsenic
NP - Not Pertinent:		UN Number:	UN 1558
U - Unknown:		Class / Division:	6.1 (9.2)
		Packing Group:	I I

SECTION IV - FIRE AND EXPLOSION HAZARDS

Flash Point (deg C) and Method	Flammable Limits in Air (Vol %)	
DUST MAY GENERATE A FIRE	Upper:	NP
	Lower:	NP
Means of Extinction:	Class D - Dry Chemical, or Dry Sand	

SECTION V - HEALTH HAZARD AND FIRST AID DATA

Ingestion	EFFECTS:	Signs of toxicity are dermal lesions, conjunctivitis, nausea, vomiting, peripheral neuritis,anemia,respiratory fatigue.
	FIRST AID:	If particles ingested, give 1 - 2 glasses of milk or water. Induce vomiting if victim not convulsed. Seek physician.
Eye Contact	EFFECTS:	Irritation of eyes.
	FIRST AID:	Flush with large amounts of water.
Skin Contact	EFFECTS:	Dermatitis.
	FIRST AID:	If dust or mist gets on skin, wash skin with soap and water. Remove clothing and launder.

Skin Absorption	NP
Inhalation	Recognized carcinogen by ATP and IARC. Can cause toxicity.
Effects of Acute Exposure	
Effects of Chronic Exposure	

Carcinogenicity:	IARC (Yes)				
Mutagenicity:	No	Teratogenicity:	No	Reproductive Effects:	No

::

SECTION V I - REACTIVITY DATA

Stability:	Stable - Yes	Conditions to Avoid:		NP	
Incompatible Materials	Water:	No	Acid: Yes	Oxidizers:	Yes
	Corrosive:	No	Alkali: No	Reducers:	No
	Other:	Yes			
Hazardous Decomposition Products:	Highly toxic fumes when in contact with acids.				
Hazardous Polymerization:	May Occur -	NO	Conditions to Avoid:		NP
	May not Occur -	X			

SECTION V I I - PREVENTIVE MEASURES

Steps to be Taken in Case Material is Released or Spilled: If spill of dust use clean-up methods which avoid dust generation. Use water and wetsweep or vacuum.

Waste Disposal Method: Dispose of in accordance with appropriate federal and local regulations.

Respiratory Protection: When engineering controls are not feasible to control over exposure, use appropriate NIOSH approved respirators.

Engineering Controls	Local Exhaust: Essential to keep worker exposure with-in allowable limits during welding or grinding.	Special:
	Mechanical (General):	Other:

Protective Gloves:	As needed to protect against physical hazards.	Eye Protection:	Safety glasses, goggles, face shield if molten.

Other Protective Equipment:

SECTION V I I I - SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storing: The scrap metal itself presents no health hazard unless it is welded, burned, ground or cut. Possible fumes may be generated. Should have complete evaluation done.

Special Precautions and Waste Disposal Methods: Excessive exposure has caused dermatitis, rhinitis, eye irritation, chest pain, internal disorder and neurological disorders. Caution in handling.

SECTION IX - PREPARATION INFORMATION

Prepared By: Health, Safety and Environmental Department

CANADA MÉTAL
(EST) LTÉE
(EASTERN) LTD.

8271 rue Lafrenaie ? St. Leonard, Quebec ? H1P 2B1
(514) 327-2011 Toll Free (800) 363-7110 Fax (514) 327-7810

After-Hours Emergency Contact Number: 1 (613) 966-6666

Date: 1 December, 2002

SIGMA-ALDRICH

MATERIAL SAFETY DATA SHEET

Date Printed: 05/15/2006
Date Updated: 01/31/2006
Version 1.7

Section 1 - Product and Company Information

Product Name	ARSENIC
Product Number	11303
Brand	RIEDEL
Company	Sigma-Aldrich
Address	3050 Spruce Street SAINT LOUIS MO 63103 US
Technical Phone:	800-325-5832
Fax:	800-325-5052
Emergency Phone:	314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
ARSENIC	7440-38-2	Yes

Formula	As
Synonyms	Arsen (German,Polish) * Arsenic (ACGIH:OSHA) * Arsenicals * Arsenic Black * Arsenic-75 * Colloidal arsenic * Grey arsenic * Metallic arsenic
RTECS Number:	CG0525000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Toxic. Dangerous for the environment.
May cause cancer. Toxic by inhalation and if swallowed. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Target organ(s): Lungs. Skin. Danger: Contains inorganic arsenic. Cancer Hazard. Harmful if inhaled or swallowed. Use only with adequate ventilation or respiratory protection.

HMIS RATING
HEALTH: 2*
FLAMMABILITY: 0
REACTIVITY: 0

NFPA RATING
HEALTH: 2
FLAMMABILITY: 0
REACTIVITY: 0

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE

If swallowed, wash out mouth with water provided person is conscious. Call a physician immediately.

INHALATION EXPOSURE

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

DERMAL EXPOSURE

In case of skin contact, flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing and shoes. Call a physician.

EYE EXPOSURE

In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

FLASH POINT

N/A

AUTOIGNITION TEMP

N/A

FLAMMABILITY

N/A

EXTINGUISHING MEDIA

Suitable: Noncombustible. Use extinguishing media appropriate to surrounding fire conditions.

FIREFIGHTING

Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes. Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL

Evacuate area.

PROCEDURE(S) OF PERSONAL PRECAUTION(S)

Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves. Wear disposable coveralls and discard them after use.

METHODS FOR CLEANING UP

Sweep up, place in a bag and hold for waste disposal. Avoid raising dust. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING

User Exposure: Do not breathe dust. Do not get in eyes, on skin, on clothing. Avoid prolonged or repeated exposure.

STORAGE

Suitable: Keep tightly closed.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS

Use only in a chemical fume hood. Safety shower and eye bath.

PERSONAL PROTECTIVE EQUIPMENT

Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N99 (US) or type P2 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.

Hand: Compatible chemical-resistant gloves.

Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES

Wash contaminated clothing before reuse. Wash thoroughly after handling.

SPECIAL PRECAUTIONS

For protection and handling requirements consult CFR title 29 part 1910.

EXPOSURE LIMITS, RTECS

Country	Source	Type	Value
USA	ACGIH	TWA	0.01 MG(AS)/M3
USA	MSHA Standard-air	TWA	0.5 MG/M3
USA	OSHA.	PEL	8H TWA 0.5 MG(AS)/M3
New Zealand	OEL		
Remarks: check ACGIH TLV			
USA	NIOSH	Ceiling	co0.002 MG(AS)/M3/15M

EXPOSURE LIMITS

Country	Source	Type	Value
Poland		NDS	0.01 MG/M3
Poland		NDSCh	-
Poland		NDSP	-

Section 9 - Physical/Chemical Properties

Appearance — Physical State: Solid
Color: Grey

Property	Value	At Temperature or Pressure
Molecular Weight	74.92 AMU	
pH	N/A	
BP/BP Range	N/A	
MP/MP Range	817 °C	
Freezing Point	N/A	
Vapor Pressure	N/A	
Vapor Density	N/A	
Saturated Vapor Conc.	N/A	
SG/Density	5.727 g/cm3	
Bulk Density	N/A	
Odor Threshold	N/A	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	
Solvent Content	N/A	
Evaporation Rate	N/A	
Viscosity	N/A	

Surface Tension	N/A
Partition Coefficient	N/A
Decomposition Temp.	N/A
Flash Point	N/A
Explosion Limits	N/A
Flammability	N/A
Autoignition Temp	N/A
Refractive Index	N/A
Optical Rotation	N/A
Miscellaneous Data	N/A
Solubility	N/A

N/A = not available

Section 10 - Stability and Reactivity

STABILITY

Conditions to Avoid: Heat. Exposure to air may affect product quality.

Materials to Avoid: Oxidizing agents, Halogens, Palladium undergoes a violent reaction with arsenic, Zinc, Platinum oxide, Nitrogen trichloride, Bromine azide.

HAZARDOUS DECOMPOSITION PRODUCTS

Hazardous Decomposition Products: Arsenic oxides.

HAZARDOUS POLYMERIZATION

Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

cancer hazard

ROUTE OF EXPOSURE

Skin Contact: May cause skin irritation.
Skin Absorption: May be harmful if absorbed through the skin.
Eye Contact: May cause eye irritation.
Inhalation: Material may be irritating to mucous membranes and upper respiratory tract. Toxic if inhaled.
Ingestion: Toxic if swallowed.

TARGET ORGAN(S) OR SYSTEM(S)

Lungs. Skin.

SIGNS AND SYMPTOMS OF EXPOSURE

Absorption into the body leads to the formation of methemoglobin which in sufficient concentration causes cyanosis. Onset may be delayed 2 to 4 hours or longer. Prolonged exposure to arsenic compounds can cause exfoliation and pigmentation of skin, herpes, inflammation of nerves, and nasal septum ulceration.

TOXICITY DATA

Oral
Rat
763 mg/kg
LD50
Remarks: Gastrointestinal:Hypermotility, diarrhea.
Behavioral:Ataxia.

Intraperitoneal
Rat

13390 UG/KG
LD50

Oral
Mouse
145 mg/kg
LD50
Remarks: Behavioral:Ataxia. Gastrointestinal:Hypermotility, diarrhea.

Intraperitoneal
Mouse
46200 UG/KG
LD50
Remarks: Behavioral:Ataxia. Gastrointestinal:Hypermotility, diarrhea.

CHRONIC EXPOSURE - CARCINOGEN

Result: This is or contains a component that has been reported to be carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Species: Man
Route of Application: Oral
Dose: 76 MG/KG
Exposure Time: 12Y
Frequency: I
Result: Blood: Hemorrhage. Liver:Tumors. Tumorigenic:Carcinogenic by RTECS criteria.

Species: Rabbit
Route of Application: Implant
Dose: 75 MG/KG
Result: Liver:Tumors. Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Lungs, Thorax, or Respiration:Tumors.

OSHA CARCINOGEN LIST

cancer hazard

IARC CARCINOGEN LIST

Rating: Group 1

ACGIH CARCINOGEN LIST

Rating: A1

CHRONIC EXPOSURE - TERATOGEN

Species: Rat
Dose: 580 UG/KG
Route of Application: Oral
Exposure Time: (30W PRE/1-20D PREG)
Result: Specific Developmental Abnormalities: Musculoskeletal system.

CHRONIC EXPOSURE - MUTAGEN

Species: Human
Route: Unreported
Dose: 4286 UG/KG

Mutation test: Cytogenetic analysis

Species: Mouse
Route: Oral
Dose: 280 MG/KG
Exposure Time: 8W
Mutation test: Cytogenetic analysis

CHRONIC EXPOSURE - REPRODUCTIVE HAZARD

Species: Rat
Dose: 605 UG/KG
Route of Application: Oral
Exposure Time: (35W PRE)
Result: Effects on Fertility: Pre-implantation mortality (e.g., reduction in number of implants per female; total number of implants per corpora lutea). Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).

Section 12 - Ecological Information

ACUTE ECOTOXICITY TESTS

Test Type: EC50 Daphnia
Species: Daphnia magna
Time: 48 h
Value: 3.8 mg/l

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION

Material in the elemental state should be recovered for reuse or recycling. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT
Proper Shipping Name: Arsenic
UN#: 1558
Class: 6.1
Packing Group: Packing Group II
Hazard Label: Toxic substances.
PIH: Not PIH

IATA
Proper Shipping Name: Arsenic
IATA UN Number: 1558
Hazard Class: 6.1
Packing Group: II

Section 15 - Regulatory Information

EU DIRECTIVES CLASSIFICATION
Symbol of Danger: T-N
Indication of Danger: Toxic. Dangerous for the environment.
R: 23/25-50/53
Risk Statements: Toxic by inhalation and if swallowed. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S: 20/21-28-45-60-61

Safety Statements: When using do not eat, drink, or smoke. After contact with skin, wash immediately with plenty of soap-suds. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). This material and its container must be disposed of as hazardous waste. Avoid release to the environment. Refer to special instructions/safety data sheets.

US CLASSIFICATION AND LABEL TEXT

Indication of Danger: Toxic. Dangerous for the environment.
Risk Statements: May cause cancer. Toxic by inhalation and if swallowed. Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Safety Statements: Avoid exposure - obtain special instructions before use. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). This material and its container must be disposed of as hazardous waste. Avoid release to the environment. Refer to special instructions/safety data sheets.
US Statements: Target organ(s): Lungs. Skin. Danger: Contains inorganic arsenic. Cancer Hazard. Harmful if inhaled or swallowed. Use only with adequate ventilation or respiratory protection.

UNITED STATES REGULATORY INFORMATION

SARA LISTED: Yes
DEMINIMIS: 0.1 %
NOTES: This product is subject to SARA section 313 reporting requirements.
TSCA INVENTORY ITEM: Yes

CANADA REGULATORY INFORMATION

WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER

For R&D use only. Not for drug, household or other uses.

WARRANTY

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

Material Safety Data Sheet

Catalog Number: 212080
Revision date: 26-Apr-2006

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY INFORMATION

Catalog Number: 212080

Product name: BARIUM

Supplier:
MP Biomedicals, LLC
29525 Fountain Parkway
Solon, OH 44139
tel: 440-337-1200

Emergency telephone number: CHEMTREC: 1-800-424-9300 (1-703-527-3887)

2. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS Number	Weight %	ACGIH Exposure Limits:	OSHA Exposure Limits:
BARIUM	7440-39-3	90 - 100%	0.5 mg/m³ TWA	0.5 mg/m³ TWA

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW: Harmful by inhalation, in contact with skin and if swallowed.

Category of Danger:
Harmful

Principle routes of exposure: Skin
Inhalation: Harmful by inhalation.
Ingestion: Harmful if swallowed.
Skin contact: Harmful in contact with skin.
Eye contact: Risk of serious damage to eyes

Statements of hazard HARMFUL IF SWALLOWED. MAY BE HARMFUL IF ABSORBED THROUGH SKIN OR INHALED.
Statement of Spill or Leak - ANSI Label Eliminate all ignition sources. Absorb and/or contain spill with inert materials (e.g., sand, vermiculite). Then place in appropriate container. For large spills, use water spray to disperse vapors, flush spill area. Prevent runoff from entering waterways or sewers.

4. FIRST AID MEASURES

General advice: In the case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
Inhalation: Move to fresh air. Call a physician immediately.
Skin contact: Rinse immediately with plenty of water and seek medical advice
Ingestion: Do not induce vomiting without medical advice.
Eye contact: In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
Protection of first-aiders: No information available

Medical conditions aggravated by exposure: None known

5. FIRE FIGHTING MEASURES

Suitable extinguishing media:	Use dry chemical, CO2, water spray or "alcohol" foam
Specific hazards:	Burning produces irritant fumes.
Unusual hazards:	None known
Special protective equipment for firefighters:	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear
Specific methods:	Water mist may be used to cool closed containers.
Flash point:	Not determined
Autoignition temperature:	Not determined
NFPA rating:	

NFPA Health:	2
NFPA Flammability:	2
NFPA Reactivity:	2
NFPA Special Note:	w

6. ACCIDENTAL RELEASE MEASURES

Personal precautions:	Use personal protective equipment.
Environmental precautions:	Prevent product from entering drains.
Methods for cleaning up:	Sweep up and shovel into suitable containers for disposal.

7. HANDLING AND STORAGE

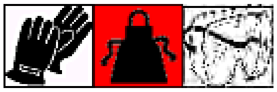
Storage:

ROOM TEMPERATURE
DESICCATE

Handling:	Use only in area provided with appropriate exhaust ventilation.
Safe handling advice:	Wear personal protective equipment.
Incompatible products:	Oxidising and spontaneously flammable products

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures: Ensure adequate ventilation.
PERSONAL PROTECTIVE EQUIPMENT
Respiratory protection: Breathing apparatus only if aerosol or dust is formed.
Hand protection: Pvc or other plastic material gloves
Skin and body protection: Usual safety precautions while handling the product will provide adequate protection against this potential effect.
Eye protection: Safety glasses with side-shields
Hygiene measures: Handle in accordance with good industrial hygiene and safety practice.



9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state:	Solid
Formula:	Ba
Molecular weight:	137.33
Melting point/range:	725 deg. C

Boiling point/range:	1640 deg. C
Density:	No data available
Vapor pressure:	10 mm Hg at 1049 °C
Evaporation rate:	No data available
Vapor density:	No data available
Solubility (in water):	Hydrolyses
Flash point:	Not determined
Autoignition temperature:	Not determined

10. STABILITY AND REACTIVITY

Stability:	Stable under recommended storage conditions.
Polymerization:	None under normal processing.
Hazardous decomposition products:	Thermal decomposition can lead to release of irritating gases and vapours such as carbon oxides.
Materials to avoid:	Strong oxidising agents
Conditions to avoid:	Exposure to air or moisture over prolonged periods.

11. TOXICOLOGICAL INFORMATION

Product Information

Acute toxicity

Components	**RTECS Number:**	**Selected LD50s and LC50s**
BARIUM	CQ8370000	Not Determined

Chronic toxicity:	Chronic exposure may cause nausea and vomiting, higher exposure causes unconsciousness.
Local effects:	Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting.
Specific effects:	May include moderate to severe erythema (redness) and moderate edema (raised skin), nausea, vomiting, headache.
Primary irritation:	No data is available on the product itself.
Carcinogenic effects:	No data is available on the product itself.
Mutagenic effects:	No data is available on the product itself.
Reproductive toxicity:	No data is available on the product itself.

Components	**NIOSH - Health Effects**	**NIOSH - Target Organs**
BARIUM	Eye, mucous membrane, and skin irritation	

12. ECOLOGICAL INFORMATION

Mobility:	No data available
Bioaccumulation:	No data available
Ecotoxicity effects:	No data available
Aquatic toxicity:	May cause long-term adverse effects in the aquatic environment.

Components	**U.S. DOT - Appendix B - Marine Pollutan**	**U.S. DOT - Appendix B - Severe Marine Pollutants**	**United Kingdom - The Red List:**
BARIUM	Not Listed	Not Listed	Not Listed

Components	**Germany VCI (WGK)**	**World Health Organization (WHO) - Drinking Water**	**Ecotoxicity - Fish Species Data**
BARIUM	Not Listed	0.7 mg/L	Not Listed

Components	**Ecotoxicity - Freshwater Algae Data**	**Ecotoxicity - Microtox Data**	**Ecotoxicity - Water Flea Data**
BARIUM	Not Listed	Not Listed	Not Listed

Components	**EPA - ATSDR Priority List**	**EPA - HPV Challenge Program Chemical List**	**California - Priority Toxic Pollutants**
BARIUM	Rank (of 275): 099	Not Listed	Not Listed

Components	**California - Priority Toxic Pollutants**	**California - Priority Toxic Pollutants**
BARIUM	Not Listed	Not Listed

13. DISPOSAL CONSIDERATIONS

Waste from residues / unused products:	Waste disposal must be in accordance with appropriate Federal, State, and local regulations. This product, if unaltered by use, may be disposed of by treatment at a permitted facility or as advised by your local hazardous waste regulatory authority. Residue from fires extinguished with this material may be hazardous.
Contaminated packaging:	Do not re-use empty containers

14. TRANSPORT INFORMATION

UN/Id No:	1400

DOT:

Proper shipping name:	Barium
IATA Hazard Label(s):	Dangerous When Wet
Hazard Class	4.3 **-** Water reactive substances
Packing group:	II

Emergency Response Guide Number (ERG):	138

Components	**U.S. DOT - Appendix A Table 1 - Reportable Quantities**
BARIUM	RQ = 1 pound (0.454 kg)

TDG (Canada):

WHMIS hazard class:	B6 reactive flammable material D2b toxic materials

: 

IMDG/IMO

Proper shipping name:	Barium
IMDG - Hazard Classifications	IMDG class or division = 4.3
IMDG - Potential Marine Pollutants	UN1564
IMDG - Regulated Substances	UN1400

Components	U.S. DOT - Appendix B - Marine Pollutan	U.S. DOT - Appendix B - Severe Marine Pollutants
BARIUM	Not Listed	Not Listed

IMO-labels:

15. REGULATORY INFORMATION

International Inventories

Components
BARIUM

Inventory - United States TSCA - Sect. 8(b)	Present
Canada DSL Inventory List -	Present
Australia (AICS):	Present
Inventory - China:	Present
EU EINECS List -	231-149-1; Ba
Korean KECL:	KE-02022
Philippines PICCS:	Present

U.S. regulations:

Components	California Proposition 65 -	Massachusetts Right to Know List:	New Jersey Right to Know List:	Pennsylvania Right to Know List:
BARIUM	Not Listed	[present]	sn 0180	environmental hazard (any compound of this substance is also an environmental hazard)

Components	Florida substance List:	Rhode Island Right to Know List:	Illinois - Toxic Air Contaminants	Connecticut - Hazardous Air Pollutants
BARIUM	[present]	Toxic	Not Listed	Not Listed

Components	SARA 313 Emission reporting/Toxic Release of Chemicals	CERCLA/SARA - Section 302 Extremely Haz	NTP:	IARC:
BARIUM	form R reporting required for 1.0% de minimis concentration	Not Listed	None	None

SARA 313 Notification: The above is your notification as to the SARA 313 listing for this product(s) pursuant to Section 313 of Title III of the Superfund Ammendments and Reauthorization Act of 1986 and 40 CFR Part 372.

If you are unsure if you are subject to the reporting requirements of Section 313, or need more information, please call the EPA Emergency Planning and Community Right-To-Know Information Hotline: (800) 535-0202 or (202) 479-2499 (in Washington, DC or Alaska).

State Notification: The above information is your notice as to the Right-to-Know listings of the stated product(s). Individual states will list chemicals for a variety of reasons including, but not limited to, the compounds toxicity; carcinogenic, tumorigenic and/or reproductive hazards; and the compounds environmental impact if accidentally released.

16. OTHER INFORMATION

Prepared by: Health & Safety

End of Safety Data Sheet

GFS CHEMICALS, INC.

P.O. Box 245 Powell, OH 43065
740-881-5501(Tel.) 740-881-5989(Fax)
1-800-424-9300(Chemtrec 24Hr. Info.)

MATERIAL SAFETY DATA SHEET

A1299

CADMIUM

CHEMICAL NAME & SYNONYMS	**DOT CLASS**	**SARA TITLE 313**
Cadmium	NR	Yes - Cadmium

FORMULA	**F.W.**	**CAS#**
Cd	112.41	7440-43-9

PHYSICAL DATA
Metal. M.p. 321 C; B.p. 767 C. Density 8.642. Vapor pressure 1 mm at 394 C.

APPEARANCE & ODOR
Silvery metallic granules or shot. Odorless.

REACTIVITY & CONDITIONS TO AVOID
Stable.

FIRE HAZARDS
Not combustible. Cadmium vapor may form in general fire. Avoid inhalation of fumes.

EXTINGUISHER	**FLASHPOINT**	**LEL**	**UEL**
Fight surrounding fire.	N/A	N/A	N/A

HEALTH HAZARDS
Vapor hazardous if inhaled. Must be heated strongly to produce vapor. Occupational exposure to Cd recm std: Air: TWA 200 ug/m 3 . TC_{Lo} (ihl-man) 88 ug/m^3/8.6Y:SYS. LD_{50} (oral-rat)225 mg/kg. Inhalation of dusts or vapors may lead to problems in respiratory tract or kidneys. Soluble compounds considered much more hazardous than metal pieces. Suspect carcinogen. On California prop. 65 list.

SPECIAL PRECAUTIONS
If vaporizing metals through heating, use good ventilation or suitable respirator to avoid inhalation of vapors.

FIRST AID
Wash up with water after contact. If swallowed, get medical attention.

SPILLS & LEAKS
Sweep up spill and save for recovery. Wash area well with water. Disposal to hazardous waste.

CATALOG #	**PREPARED BY**	**DATE**
A1299	LM	7/2/96

SIGMA-ALDRICH

MATERIAL SAFETY DATA SHEET

Date Printed: 05/11/2006
Date Updated: 01/31/2006
Version 1.8

Section 1 - Product and Company Information

Product Name	CHROMIUM
Product Number	12219
Brand	RIEDEL
Company	Sigma-Aldrich
Address	3050 Spruce Street SAINT LOUIS MO 63103 US
Technical Phone:	800-325-5832
Fax:	800-325-5052
Emergency Phone:	314-776-6555

Section 2 - Composition/Information on Ingredient

Substance Name	CAS #	SARA 313
CHROMIUM (POWDERS)	7440-47-3	Yes

Formula	Cr
Synonyms	Chrome * Chromium, metal (ACGIH)
RTECS Number:	GB4200000

Section 3 - Hazards Identification

EMERGENCY OVERVIEW
Target organ(s): Liver. Kidneys. Possible sensitizer.

HMIS RATING
HEALTH: 2*
FLAMMABILITY: 0
REACTIVITY: 0

NFPA RATING
HEALTH: 2
FLAMMABILITY: 0
REACTIVITY: 0

*additional chronic hazards present.

For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE
If swallowed, wash out mouth with water provided person is conscious. Call a physician.

INHALATION EXPOSURE
If inhaled, remove to fresh air. If breathing becomes difficult, call a physician.

DERMAL EXPOSURE
In case of contact, immediately wash skin with soap and copious

amounts of water.

EYE EXPOSURE

In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician.

Section 5 - Fire Fighting Measures

FLASH POINT

N/A

AUTOIGNITION TEMP

N/A

FLAMMABILITY

N/A

EXTINGUISHING MEDIA

Suitable: Water spray. Carbon dioxide, dry chemical powder, or appropriate foam.

FIREFIGHTING

Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes.
Specific Hazard(s): Emits toxic fumes under fire conditions.

Section 6 - Accidental Release Measures

PROCEDURE(S) OF PERSONAL PRECAUTION(S)

Exercise appropriate precautions to minimize direct contact with skin or eyes and prevent inhalation of dust.

METHODS FOR CLEANING UP

Sweep up, place in a bag and hold for waste disposal. Avoid raising dust. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

HANDLING

User Exposure: Avoid inhalation. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure.

STORAGE

Suitable: Keep tightly closed.

SPECIAL REQUIREMENTS

Air sensitive.

Section 8 - Exposure Controls / PPE

ENGINEERING CONTROLS

Safety shower and eye bath. Mechanical exhaust required.

PERSONAL PROTECTIVE EQUIPMENT

Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks.
Hand: Protective gloves.

Eye: Chemical safety goggles.

GENERAL HYGIENE MEASURES

Wash thoroughly after handling.

EXPOSURE LIMITS, RTECS

Country	Source	Type	Value
USA	ACGIH	TWA	0.5 MG(CR)/M3
USA	MSHA Standard-air	TWA	0.5 MG/M3
USA	OSHA.	PEL	8H TWA 1 MG(CR)/M3
New Zealand OEL			
Remarks: check ACGIH TLV			
USA	NIOSH	TWA	0.5 MG/M3

EXPOSURE LIMITS

Country	Source	Type	Value
Poland		NDS	0.5 MG/M3
Poland		NDSCh	-
Poland		NDSP	-

Section 9 - Physical/Chemical Properties

Appearance	Physical State: Solid Color: Light grey Form: Powder

Property	Value	At Temperature or Pressure
Molecular Weight	52 AMU	
pH	N/A	
BP/BP Range	N/A	
MP/MP Range	N/A	
Freezing Point	N/A	
Vapor Pressure	N/A	
Vapor Density	N/A	
Saturated Vapor Conc.	N/A	
SG/Density	7.14 g/cm3	
Bulk Density	N/A	
Odor Threshold	N/A	
Volatile%	N/A	
VOC Content	N/A	
Water Content	N/A	
Solvent Content	N/A	
Evaporation Rate	N/A	
Viscosity	N/A	
Surface Tension	N/A	
Partition Coefficient	N/A	
Decomposition Temp.	N/A	
Flash Point	N/A	
Explosion Limits	N/A	
Flammability	N/A	
Autoignition Temp	N/A	
Refractive Index	N/A	
Optical Rotation	N/A	
Miscellaneous Data	N/A	
Solubility	N/A	

N/A = not available

Section 10 - Stability and Reactivity

STABILITY

Stable: Stable.
Conditions of Instability: May decompose on exposure to air.
Materials to Avoid: Strong acids, Strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS

Hazardous Decomposition Products: Nature of decomposition products not known.

HAZARDOUS POLYMERIZATION

Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE

Skin Contact: May cause skin irritation.
Skin Absorption: May be harmful if absorbed through the skin.
Eye Contact: May cause eye irritation.
Inhalation: May be harmful if inhaled. Material may be irritating to mucous membranes and upper respiratory tract.
Ingestion: May be harmful if swallowed.

SENSITIZATION

Sensitization: Prolonged or repeated exposure may cause allergic reactions in certain sensitive individuals.

TARGET ORGAN(S) OR SYSTEM(S)

Kidneys. Liver.

SIGNS AND SYMPTOMS OF EXPOSURE

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

CHRONIC EXPOSURE - CARCINOGEN

Result: This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

Species: Rat
Route of Application: Intravenous
Dose: 2160 UG/KG
Exposure Time: 6W
Frequency: I
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Gastrointestinal:Tumors. Blood:Lymphomas including Hodgkin's disease.

Species: Rat
Route of Application: Implant
Dose: 1200 UG/KG
Exposure Time: 6W
Frequency: I
Result: Blood:Lymphomas including Hodgkin's disease. Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Tumorigenic:Tumors at site or application.

Species: Rabbit
Route of Application: Implant
Dose: 75 MG/KG
Result: Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Musculoskeletal:Tumors.

IARC CARCINOGEN LIST

Rating: Group 3

ACGIH CARCINOGEN LIST

Rating: A4

Section 12 - Ecological Information

No data available.

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION

Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT

Proper Shipping Name: Environmentally hazardous substances, solid, n.o.s.
UN#: 3077
Class: 9
Packing Group: Packing Group III
Hazard Label: Class 9
PIH: Not PIH

IATA

Non-Hazardous for Air Transport: Non-hazardous for air transport.

Section 15 - Regulatory Information

US CLASSIFICATION AND LABEL TEXT

US Statements: Target organ(s): Liver. Kidneys. Possible sensitizer.

UNITED STATES REGULATORY INFORMATION

SARA LISTED: Yes
DEMINIMIS: 0.1 %
NOTES: This product is subject to SARA section 313 reporting requirements.
TSCA INVENTORY ITEM: Yes

CANADA REGULATORY INFORMATION

WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR.
DSL: Yes
NDSL: No

Section 16 - Other Information

DISCLAIMER

For R&D use only. Not for drug, household or other uses.

WARRANTY

The above information is believed to be correct but does not

LEAD METAL
MATERIAL SAFETY DATA SHEET

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product Identity: Lead Metal

Manufacturer:
Teck Metals Ltd.
Trail Operations
Trail, British Columbia
V1R 4L8
Emergency Telephone: 250-364-4214

Supplier:
Teck Metals Ltd.
1500-120 Adelaide Street, W.
Toronto, Ontario
M5H 1T1

MSDS Preparer:
Teck Metals Ltd.
Suite 3300 – 550 Burrard Street
Vancouver, British Columbia
V6C 0B3

Date of Last MSDS Revision/Edit: January 4, 2010.

Product Use: Used as a construction material for tank linings, piping, and equipment used in the manufacture of sulfuric acid and the refining and processing of petroleum; used in x-ray and atomic radiation shielding; used in the manufacture of tetraethyl lead, paint pigments, organic and inorganic lead compounds, lead shot, lead wire for bullets, ballast, and lead solders; used as a bearing metal or alloy; used in the manufacture of storage batteries, ceramics, plastics, and electronic devices; used in the metallurgy of steel and other metals; and used in the form of lead oxide for batteries.

SECTION 2. COMPOSITION / INFORMATION ON INGREDIENTS

Hazardous Ingredient	Approximate Percent by Weight	CAS Number	Occupational Exposure Limits (OELs)		LD_{50} / LC_{50} Species and Route
Lead	99+%	7439-92-1	OSHA PEL	0.05 mg/m^3	No Data
			ACGIH TLV	0.05 mg/m^3	
			NIOSH REL	0.05 mg/m^3	

NOTE: OELs for individual jurisdictions may differ from OSHA PELs. Check with local authorities for the applicable OELs in your jurisdiction. OSHA - Occupational Safety and Health Administration; ACGIH - American Conference of Governmental Industrial Hygienists; NIOSH - National Institute for Occupational Safety and Health. OEL – Occupational Exposure Limit, PEL – Permissible Exposure Limit, TLV – Threshold Limit Value, REL – Recommended Exposure Limit.

Trade Names and Synonyms: Lead; Pb; Plumbum; Metallic Lead; Inorganic Lead; ASTM B29; TADANAC Lead, Low-Alpha Lead.

SECTION 3. HAZARDS IDENTIFICATION

Emergency Overview: A bluish-white to silvery-grey heavy, soft metal that does not burn in bulk. Finely-divided lead dust clouds are a moderate fire and explosion hazard, however. When heated strongly in air, highly toxic lead oxide fumes can be generated. Inhalation or ingestion of lead may produce both acute and chronic health effects. Possible cancer and reproductive hazard. SCBA and full protective clothing are required for fire emergency response personnel.

Potential Health Effects: Inhalation or ingestion of lead dust or fumes may result in headache, nausea, vomiting, abdominal spasms, fatigue, sleep disturbances, weight loss, anemia and leg, arm, and joint pain. Prolonged exposure may also cause central nervous system damage, hypertension, gastrointestinal disturbances, anemia, kidney dysfunction and possible reproductive effects. Pregnant women should be protected from excessive exposure in order to prevent lead crossing the placental barrier and causing infant neurological disorders. Lead and inorganic lead compounds are listed as an *A3 Carcinogen (Confirmed Animal Carcinogen with Unknown Relevance to Humans)* by the ACGIH. IARC has listed lead compounds as *Group 2A Carcinogens (Probably Carcinogenic to Humans)* while lead metal is listed as *Group 2B (Possibly Carcinogenic to Humans)*. The NTP has recently listed lead and lead compounds as *Reasonably Anticipated to be a Human Carcinogen*. OSHA and the EU does not currently list lead as a human carcinogen. (See Toxicological Information, Section 11)

Potential Environmental Effects: Lead metal has relatively low bioavailability; however, compounds which it forms with other elements can be toxic to both aquatic and terrestrial organisms at low concentrations. These compounds can be particularly toxic in the aquatic environment. Lead bioaccumulates in plants and animals in both aquatic and terrestrial environments (see Ecological Information, Section 12).

EU Risk Phrase(s): R61 - May cause harm to unborn child; R62 – Risk of impaired fertility; R20/22 - Harmful by inhalation and if swallowed; R33 - Danger of cumulative effects.

SECTION 4. FIRST AID MEASURES

Eye Contact: Do not allow victim to rub eye(s). Let the eye(s) water naturally for a few minutes. If particle/dust does not dislodge, flush with lukewarm, gently flowing water for 5 minutes or until particle/dust is removed, while holding eyelid(s) open. If irritation persists, immediately obtain medical attention. DO NOT attempt to manually remove anything stuck to the eye.

Skin Contact: *Dust:* Remove contaminated clothing, shoes and leather goods (e.g. watchbands, belts). Quickly and gently blot or brush away excess chemical. Wash gently and thoroughly with lukewarm gently flowing water and non-abrasive soap for 5 minutes. If irritation persists, repeat flushing. Obtain medical advice. Completely decontaminate clothing, shoes and leather goods before reuse or else discard. *Molten Metal:* Flush contact area to solidify and cool but do not attempt to remove encrusted material or clothing. Cover burns and seek medical attention immediately.

Inhalation: Remove victim from exposure area to fresh air immediately. If breathing has stopped, trained personnel should begin artificial respiration. Medical oxygen may be administered by trained personnel, where breathing is difficult. If the heart has stopped, immediately start cardiopulmonary resuscitation (CPR), or automated external defibrillation (AED). Quickly transport victim to an emergency care facility.

Ingestion: Never give anything by mouth if victim is rapidly losing consciousness, or is unconscious or convulsing. Have victim rinse mouth thoroughly with water. DO NOT INDUCE VOMITING. Have victim drink 2 – 8 oz. (60 – 240 ml) of water. If vomiting occurs naturally, have victim rinse mouth with water again. Obtain medical advice and bring a copy of this MSDS.

SECTION 5. FIRE FIGHTING MEASURES

Fire and Explosion Hazards: Massive metal is not flammable or combustible. Finely-divided lead dust or powder is a moderate fire hazard and moderate explosion hazard when dispersed in the air at high concentrations and exposed to heat, flame, or other ignition sources. Explosions may also occur upon contact with certain incompatible materials (see Stability and Reactivity, Section 10).

Extinguishing Media: Use any means of extinction appropriate for surrounding fire conditions such as water spray, carbon dioxide, dry chemical, or foam.

Fire Fighting: If possible, move material from fire area and cool material exposed to flame. Highly toxic lead oxide fumes may evolve in fires. Fire fighters must be fully trained and wear full protective clothing including an approved, self-contained breathing apparatus which supplies a positive air pressure within a full face-piece mask.

Flashpoint and Method: Not Applicable.

Upper and Lower Flammable Limit: Not Applicable.

Autoignition Temperature: Not Applicable.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Procedures for Cleanup: Control source of spillage if possible to do so safely. Restrict access to the area until completion of clean-up. Clean up spilled material immediately, observing precautions in Section 8, Personal Protection. Molten metal should be allowed to solidify before cleanup. If solid metal, wear gloves, pick up and return to process. If dust, wear recommended personal protective equipment (see Section 8) and use methods which will minimize dust generation (e.g., vacuum solids). Return uncontaminated spilled material to the process if possible. Place contaminated material in suitable labelled containers for later recovery or disposal. Treat or dispose of waste material in accordance with all local, regional, and national requirements.

Personal Precautions: Persons responding to an accidental release should wear protective clothing, gloves and a respirator (see also Section 8). Close-fitting safety goggles may be necessary in some circumstances to prevent eye contact with dust and fume. Where molten metal is involved, wear heat-resistant gloves and suitable clothing for protection from hot-metal splash as well as a respirator to protect against inhalation of lead fume. Workers should wash and change clothing following cleanup of a lead spill to prevent personal contamination with lead dust.

Environmental Precautions: Lead metal has low bioavailability; however, compounds which it forms with other elements can be toxic to aquatic and terrestrial organisms. Releases of the product to water and soil should be prevented.

SECTION 7. HANDLING AND STORAGE

Store in a DRY, covered area, separate from strong acids, other incompatible materials, active metals and food or feedstuffs. Solid metal suspected of containing moisture should be THOROUGHLY DRIED before being added to a molten bath. Otherwise, entrained moisture could expand explosively and spatter molten metal out of the bath. Always practice good personal hygiene. Refrain from eating, drinking, or smoking in work areas. Thoroughly wash hands before eating, drinking, or smoking in appropriate, designated areas as well as at the end of the workday. No special packaging materials are required.

EU Safety Phrase(s): S53 - Avoid exposure - obtain special instructions before use; S45 – In case of accident, or if you feel unwell, seek medical advice immediately (show label where possible)

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Protective Clothing: Gloves and coveralls or other work clothing are recommended to prevent prolonged or repeated direct skin contact when lead is processed. Appropriate eye protection should be worn where fume or dust is generated. Where hot or molten metal is handled, heat resistant gloves, goggles or face shield, and clothing to protect from hot metal splash should be worn. Safety type boots are recommended.

Do not eat, drink or smoke in work areas. Thoroughly wash hands before eating, drinking, or smoking in appropriate, designated areas as well as at the end of the workday. A double locker-shower system with separate clean and dirty sides is usually required for lead handling operations to avoid cross-contamination of street clothes. Contaminated clothing should be changed frequently and laundered before each reuse. Inform laundry personnel of contaminants' hazards. Workers should not take dirty work clothes home and launder them with other personal clothing.

Ventilation: Use adequate local or general ventilation to maintain the concentration of lead fumes in the working environment well below recommended occupational exposure limits. Supply sufficient replacement air to make up for air removed by the exhaust system. Local exhaust is recommended for melting, casting, welding, grinding, flame cutting or burning, and use of lead powders.

Respirators: Where lead dust or fumes are generated and cannot be controlled to within acceptable levels by engineering means, use appropriate NIOSH-approved respiratory protection equipment (a 42CFR84 Class N, R or P-100 particulate filter cartridge). When exposure levels are obviously high but the actual concentration is unknown, a self-contained breathing apparatus which supplies a positive air pressure within a full face-piece mask should be worn.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Malleable, bluish-white to silvery-grey metal	**Odour:** None	**Physical State:** Solid	**pH:** Not Applicable
Vapour Pressure: 1.3 mm Hg at 970°C (negligible @ 20°C)	**Vapour Density:** Not Applicable	**Boiling Point/Range:** 1,740°C	**Melting Point/Range:** 328°C
Specific Gravity: 11.34	**Evaporation Rate:** Not Applicable	**Coefficient of Water/Oil Distribution:** Not Applicable	**Odour Threshold:** None
Solubility: Insoluble in water			

SECTION 10. STABILITY AND REACTIVITY

Stability & Reactivity: Massive metal is stable and not considered reactive under normal temperatures and pressures. Hazardous polymerization or runaway reactions will not occur. Freshly cut or cast lead surfaces tarnish rapidly due to the formation of an insoluble protective layer of basic lead carbonate.

Incompatibilities: Lead reacts vigorously with strong acids (e.g. hot concentrated nitric acid, boiling concentrated hydrochloric acid, etc.), strong oxidizers such as peroxides, chlorates, nitrates and halogen or interhalogen compounds such as chlorine trifluoride. Powdered lead metal in contact with disodium acetylide, chlorine trifluoride, sodium carbide or fused ammonium nitrate poses a risk of explosion. Solutions of sodium azide in contact with lead metal can form lead azide, which is a detonating compound. Vigorous reactions can also occur between molten lead and active metals, such as sodium, potassium, lithium and calcium. A lead-zirconium alloy (10-70% Zr) will ignite when struck with a hammer.

Hazardous Decomposition Products: High temperature operations such as oxy-acetylene cutting or burning, electric arc welding or overheating a molten bath will generate highly toxic lead oxide fume. Lead oxide is highly soluble in body fluids and the particle size of the metal fumes is largely within the respirable size range, which increases the likelihood of inhalation and deposition of the fume within the body.

SECTION 11. TOXICOLOGICAL INFORMATION

General: Lead accumulates in bone and body organs once it enters the body. Elimination from the body is slow. Initial and periodic medical examinations are advised for persons repeatedly exposed to levels above the exposure limits of lead dust or fumes. Once lead enters the body, it can affect a variety of organ systems, including the nervous system, kidneys, reproductive system, blood formation, and gastrointestinal system. The primary routes of exposure to lead are inhalation or ingestion of dust and fumes.

Acute:
Skin/Eye: Contact with dust or fume may cause local irritation but would not cause tissue damage.

Inhalation: Exposure to lead dust or fume may cause headache, nausea, vomiting, abdominal spasms, fatigue, sleep disturbances, weight loss, anemia, and pain in legs, arms, and joints. An intense, short-term exposure to lead could cause acute encephalopathy with seizures, coma, and death. However, short-term exposures of this magnitude are unlikely in industry today. Kidney damage, as well as anemia, can occur from acute exposure.

Ingestion: Symptoms due to ingestion of lead dust or fume would be similar to those from inhalation. Other health effects such as metallic taste in the mouth and constipation or bloody diarrhea might also occur.

Chronic:
Prolonged exposure to lead dust and fume may produce many of the symptoms of short-term exposure and may also cause central nervous system damage, gastrointestinal disturbances, anemia, and, rarely, wrist drop. Reduced hemoglobin production has been associated with low lead exposures. Symptoms of central nervous system damage due to moderate lead exposure include fatigue, headaches, tremors and hypertension. Very high lead exposure can result in lead encephalopathy with symptoms of hallucinations, convulsions, and delirium. Kidney dysfunction and possible injury has also been associated with chronic lead poisoning. Chronic over-exposure to lead has been implicated as a causative agent for the impairment of male and female reproductive capacity. Pregnant women should be protected from excessive exposure as lead can cross the placental barrier and unborn children may suffer neurological damage or developmental problems due to excessive lead exposure. Teratogenic and mutagenic effects from exposure to lead have been reported in some studies but not in others. The literature is inconsistent and no firm conclusions can be drawn at this time. Lead and lead compounds are listed as an *A3 Carcinogen (Confirmed Animal Carcinogen with Unknown Relevance to Humans)* by the ACGIH. IARC has listed lead compounds as *Group 2A Carcinogens (Probably Carcinogenic to Humans)* while lead metal is listed as *Group 2B (Possibly Carcinogenic to Humans)*. The NTP has recently listed lead and lead compounds as *Reasonably Anticipated to be a Human Carcinogen*. OSHA and the EU do not currently list lead as a human carcinogen.

SECTION 12. ECOLOGICAL INFORMATION

While lead metal is relatively insoluble, its processing or extended exposure in aquatic and terrestrial environments may lead to the release of lead compounds in more bioavailable forms. While lead compounds are not particularly mobile in the aquatic environment, they can be toxic to aquatic organisms, especially fish, at low concentrations. Water hardness, pH and dissolved organic carbon content are three major factors which regulate the degree of lead toxicity. Lead in soil is generally neither very mobile nor bioavailable, as it can become strongly sorbed onto soil particles, increasingly so over time, to a degree related to physical properties of the soil. Lead bioaccumulates in plants and animals in both aquatic and terrestrial environments.

SECTION 13. DISPOSAL CONSIDERATIONS

If material cannot be returned to process or salvage, dispose of in accordance with applicable regulations.

SECTION 14. TRANSPORT INFORMATION

PROPER SHIPPING NAME.. Not a regulated product in ingot form.

TRANSPORT CANADA AND U.S. DOT CLASSIFICATION	Not Applicable
TRANSPORT CANADA AND U.S. DOT PIN	Not Applicable
MARINE POLLUTANT	No
IMO CLASSIFICATION	Not Regulated

SECTION 15. REGULATORY INFORMATION

U.S.

Ingredient Listed on TSCA Inventory	Yes
Hazardous Under Hazard Communication Standard	Yes
CERCLA Section 103 Hazardous Substances	Lead ....RQ: 10 lbs. (4.54 kg.)*
EPCRA Section 302 Extremely Hazardous Substance	No
EPCRA Section 311/312 Hazard Categories	Delayed (chronic) health hazard - Carcinogen Delayed (chronic) health hazard – Reproductive toxin
EPCRA Section 313 Toxic Release Inventory	Lead CAS No. 7439-92-1 Percent by Weight - At least 99%

*reporting not required when diameter of the pieces of solid metal released is equal to or exceeds 100 micrometers (0.004 inches).

CANADIAN:

Ingredient Listed on Domestic Substances List	Yes
WHMIS CLASSIFICATION	D2A, Materials Causing Other Toxic Effects – Very Toxic

EUROPEAN UNION:

Ingredients Listed on the European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
EU Classification	Toxic, ; Repr. Cat. 1 – Reproductive Toxin (Developmental Toxin); Repr. Cat. 3 – Reproductive Toxin (Fertility)

SECTION 16. OTHER INFORMATION

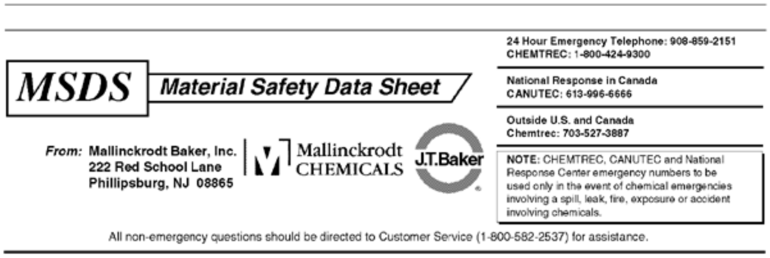
The information in this Material Safety Data Sheet is based on the following references:

- American Conference of Governmental Industrial Hygienists, 2004, Documentation of the Threshold Limit Values and Biological Exposure Indices, Seventh Edition plus updates.
- American Conference of Governmental Industrial Hygienists, 2009, Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.
- American Conference of Governmental Industrial Hygienists, Guide to Occupational Exposure Values – 2009.
- Bretherick’s Handbook of Reactive Chemical Hazards, 20th Anniversary Edition. (P. G. Urben, Ed), 1995.
- Canadian Centre for Occupational Health and Safety, Hamilton, ON, CHEMINFO Record No. 608 - Lead (Rev. 2009-05).
- European Economic Community, Commission Directives 91/155/EEC and 67/548/EEC.
- Industry Canada, SOR/88-66, Controlled Products Regulations, as amended.
- International Agency for Research on Cancer (IARC), Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, 1972 – 2009, (multi-volume work), World Health Organization, Geneva.
- International Chemical Safety Cards (WHO/IPCS/ILO), ICSC:0052 - Lead.
- Merck & Co., Inc., 2001, The Merck Index, An Encyclopedia of Chemicals, Drugs, and Biologicals, Thirteenth Edition.
- National Library of Medicine, National Toxicology Information Program, Hazardous Substance Data Bank (online version).
- Patty’s Toxicology, Fifth Edition, 2001: E. Bingham, B. Cohrssen & C.H. Powell, Ed.
- U.S. Department of Health and Human Services, National Institute of Environmental Health Sciences, National Toxicology Program (NTP), 11th Report on Carcinogens, January 2005.
- U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health, NIOSH Pocket Guide to Chemical Hazards. CD ROM Edition September 2005.
- U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry, Toxicological Profile for Lead, September 2005.
- U.S. Occupational Safety and Health Administration, 1989, Code of Federal Regulations, Title 29, Part 1910.

Notice to Reader

Although reasonable precautions have been taken in the preparation of the data contained herein, it is offered solely for your information, consideration and investigation. Teck Metals Ltd. extends no warranty and assumes no responsibility for the accuracy of the content and expressly disclaims all liability for reliance thereon. This material safety data sheet provides guidelines for the safe handling and processing of this product; it does not and cannot advise on all possible situations, therefore, your specific use of this product should be evaluated to determine if additional precautions are required. Individuals exposed to this product should read and understand this information and be provided pertinent training prior to working with this product.

MSDS Number: **M1599** * * * * * *Effective Date:* ***08/20/08*** * * * * * *Supercedes:* ***12/19/05***



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

MSDS Material Safety Data Sheet

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

Mallinckrodt CHEMICALS J.T.Baker

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. Gastrointenstinal 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 irritaton 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 concentraiton 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.

```
--------\Cancer Lists\------------------------------------------------------
                                           ---NTP Carcinogen---
Ingredient                                 Known    Anticipated    IARC Category
------------------------------------       -----    -----------    -------------
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

---

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\---------------------------------
                                                        --Canada--
 Ingredient                                       Korea  DSL   NDSL  Phil.
 -----------------------------------------------  -----  ---   ----  -----
 Mercury (7439-97-6)                               Yes   Yes   No     Yes

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

 --------\Federal, State & International Regulations - Part 2\----------------
                                                     -RCRA-    -TSCA-
 Ingredient                               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:
No Changes.
Disclaimer:
****
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****
Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

ATTACHMENT D

HEAT AND COLD STRESS INFORMATION

Table of Contents

1.0 HEAT STRESS

Excessive exposure to a hot environment can bring a variety of heat-induced disorders. The four main types of heat stress related illnesses: heat rash, heat cramps, heat exhaustion, and heat stroke are discussed.

1.1 Heat Rash

Heat rash, also known as prickly heat, is likely to occur in hot, humid environments where sweat is not readily removed from the surface of the skin by evaporation and the skin remains wet most of the time. The sweat ducts become plugged, and a skin rash soon appears. When the rash is extensive or when it is complicated by an infection, prickly heat can be very uncomfortable and may reduce a worker's performance. The worker can prevent this condition by resting in a cool place part of each day and by regularly bathing and drying the skin.

1.2 Heat Cramps

Heat cramps are painful spasms of the muscles that occur among those who sweat profusely in heat, drink large quantities of water, but do not adequately replace the body's salt loss. Drinking large quantities of water tends to dilute the body's fluids, while the body continues to lose salt. Shortly thereafter, the low salt level in the muscles causes painful cramps. The affected muscles may be part of the arms, legs or abdomen, but tired muscles (those used to perform the work) are usually the ones most susceptible to cramps. Cramps may occur during or after work hours and may be relieved by taking salted liquids by mouth, such as the variety of sports drinks on the market.

CAUTION SHOULD BE EXERSIZED BY PEOPLE WITH HEART PROBLEMS OR THOSE ON LOW SODIUM DIETS WHO WORK IN HOT ENVIRONMENTS. THESE PEOPLE SHOULD CONSULT A PHYSICIAN ABOUT WHAT TO DO UNDER THESE CONDITIONS.

1.3 Heat Exhaustion

Heat exhaustion includes several clinical disorders having symptoms that may resemble the early symptoms of heat stroke. Heat exhaustion is caused by the loss of large amounts of fluid by sweating, sometimes with excessive loss of salt. A worker suffering from this condition still sweats but experiences extreme weakness or fatigue, giddiness, nausea, or headache. In more serious cases, the victim may vomit or lose consciousness. The skin is clammy and moist, the complexion is pale or flushed, and the body temperature is normal or only slightly elevated.

A summary of the key symptoms of heat exhaustion are as follows:

- Clammy skin
- Confusion

- Dizziness
- Fainting
- Fatigue
- Heat Rash
- Light-headedness
- Nausea
- Profuse sweating
- Slurred Speech
- Weak Pulse

In most cases, treatment involves having the victim rest in a cool place and drink plenty of fluids. Victims with mild cases of heat exhaustion usually recover spontaneously with this treatment. Those with severe cases may require extended care for several days. There are no known permanent effects.

AS WITH HEAT CRAMPS, CERTAIN PERSONS SHOULD CONSULT WITH THEIR PHYSICIAN ABOUT WHAT TO DO UNDER THESE CONDITIONS.

1.4 Heat Stroke

This is the most serious of health problems associated with working in hot environments. It occurs when the body's temperature regulatory system fails and sweating becomes inadequate. The body's only effective means of removing excess heat is compromised with little warning to the victim that a crisis stage has been reached.

A heat stroke victim's skin is hot, usually dry, red or spotted. Body temperature is usually 105°F or higher, and the victim is mentally confused, delirious, perhaps in convulsions, or unconscious. Unless the victim receives quick and appropriate treatment, death can occur.

A summary of key symptoms of heat stroke are as follows:

- Confusion
- Convulsions
- Incoherent Speech
- Staggering Gait
- Unconsciousness
- Sweating stops
- Hot skin, high temperature (yet extremities may feel chilled)

Any person with signs or symptoms of heat stroke requires immediate hospitalization. However, first aid should be immediately administered. This includes moving the victim to a cool area, thoroughly soaking the clothing with water, and vigorously fanning the body to increase cooling. Further treatment at a medical facility should include continuation of the cooling process and the monitoring of complications that often accompany the heat stroke. Early recognition and treatment of heat stroke are the only means of preventing permanent brain damage or death.

1.5 Preparing for the Heat

Humans, to a large extent, are capable of adjusting to heat. This acclimation to heat, under normal circumstances, usually takes about 5-7 days, during which time the body will undergo a series of changes that will make continued exposure to heat more tolerable.

On the first day of exposure, body temperature, pulse rate, and general discomfort will be higher. With each succeeding day of exposure, all of these responses will gradually decrease, while the sweat rate will increase. When the body does become acclimated to the heat, the worker will find it possible to perform work with less strain and distress.

A gradual exposure to heat gives the body time to become accustomed to higher temperatures, such as those encountered in chemical protective clothing.

1.6 Protecting against Heat Stress

There are several methods that can be used to reduce heat stress:

- Limit duration of work periods
- Use protective clothing with cooling devices
- Enforce the use of the “Buddy System”
- Consume electrolyte solutions prior to suiting up
- Monitor workers for pulse recovery rates, body fluid loss, body weight loss, and excess fatigue
- Screen for heat stress susceptible candidates in your medical surveillance program
- Have all personnel know the signs and symptoms of heat stress

2.0 COLD STRESS

Persons working outdoors in temperatures at or below freezing may be frostbitten. Extreme cold for a short time may cause severe injury to the surface of the body, or result in profound generalized cooling, causing death. Areas of the body that have high surface area-to-volume ratio such as fingers, toes, and ears, are the most susceptible. Two factors influence the development of a cold injury; ambient temperature and the velocity of the wind. Wind chill is used to describe the chilling effect of moving air in combination with low temperature. For instance, 10 degrees Fahrenheit with a wind of 15 miles per hour (mph) is equivalent in chilling effect to still air at minus 18 degrees Fahrenheit.

As a general rule, the greatest incremental increase in wind chill occurs when a wind of 5 mph increases to 10 mph. Additionally, water conducts heat 240 times faster than air. Thus, the body cools suddenly when chemical-protective equipment is removed if the clothing underneath is perspiration soaked.

2.1 Frostbite

Local injury resulting from cold is included in the generic term frostbite. There are several degrees of damage. Frostbite of the extremities can be categorized into:

- Frost Nip or Initial Frostbite: characterized by suddenly blanching or whitening of skin.
- Superficial Frostbite: skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient.
- Deep Frostbite: tissues are cold, pale, and solid; extremely serious injury.

2.2 Hypothermia

Systemic hypothermia is caused by exposure to freezing or rapidly dropping temperature. Its symptoms are usually exhibited in five stages:

- Shivering
- Apathy, listlessness, sleepiness, and (sometimes rapid cooling of the body to less than 95 degree Fahrenheit)
- Unconsciousness, glassy stage, slow pulse, and slow respiratory rate
- Freezing of the extremities
- Death

Thermal socks, long cotton or thermal underwear, hard hat liners and other cold weather gear can aid in the prevention of hypothermia. Blankets and warm drinks (other than caffeinated coffee) are also recommended.

Measures shall be taken to keep workers from getting wet, such as issuance of rain gear. Workers whose clothes become wet shall be given the opportunity to dry off and change clothes.

ATTACHMENT E

HASP ACKNOWLEDGEMENT FORM

NEW EMPLOYEE ORIENTATION FORM

INCIDENT / ACCIDENT INVESTIGATION FORMS

ACKNOWLEDGEMENT FORM (HASP)

The following personnel have read the site-specififc HASP and have been trained and informed of its contents through daily tailgate safety briefings.

Print Name	***Signature***	***Company***	***Function***	***Date***

NEW EMPLOYEE ORIENTATION CHECKLIST

Employee Name: ________________________ Contractor ___________________
Start Date: _____________________________ Date of Orientation:________________

1. Statement of the Contractor’s commitment to Safety & Health:
   Safety & Health is a value associated with every priority _________

2. Personal Protective Equipment & Clothing:

   Hard Hat: ____________________
   Safety Glasses: ____________________
   Safety Shoes: ____________________
   Gloves: ____________________
   Hearing Protection: ____________________

3. Company’s Drug and Alcohol Policy _______________________

4. The four major hazards:

   Falls and fall protection policy: ___________________
   Electrocution: ___________________
   Struck by/ Caught In between: ___________________
   Hazardous Materials/ HazCom:___________________

5. Special Training as appropriate (scaffolds, trenching, cranes, etc.)

   _______________________________.

6. Procedures for reporting accidents and injuries: ___________________.

7. Emergency Evacuation Procedures: _____________________________.

8. Positive Discipline Policy- Consequences ________________________.

9. Followed by a job walk down pointing out the exposures:

   ____.

Comments: ____.
____.

Signature of Employee: ________________________________
Orientation Performed By: ________________________________

INCIDENT REPORT FORM

Employee(s) name(s): ____

____

Time & date of accident/incident: ____________________________________

Job title(s) and department(s): _______________________________________

____

Supervisor/lead person: ____

Witnesses: ____

____

Brief description of the accident or incident: ____________________________

____

____

Indicate body part affected:

Did the injured employee(s) see a doctor? ( ) Yes ( ) No

If yes, did you file an employer's portion of a worker's compensation form? ( ) Yes ( ) No

Did the injured employee(s) go home during their work shift? ( ) Yes ( ) No

If yes, list the date and time injured employee(s) left job(s): ________________

____

Supervisor's Comments: ____

____

What could have been done to prevent this accident/incident? _______________

____

Have the unsafe conditions been corrected? ( ) Yes ( ) No

If yes, what has been done? ____

____

____

If no, what needs to be done? ____________________________

____

____

Employer or Supervisor’s signature: __________________________

Date: _____________________________________

Additional comments/notes: ____________________________

____

____

____

ATTACHMENT F

EXAMPLE OF A TYPICAL STATIONARY AIR MONITORING STATION

Ashtead
TECHNOLOGY
INSTRUMENT DIVISION

C.A.M.P. SITE
Remote Environmental Monitoring System
Ashtead TECHNOLOGY

The Most Advanced Environmental Monitoring System Available

Ashtead Technology introduces a new environmental monitoring system which utilizes the most recent communications technology via cloud computing. Despite simple setup and mobilization of new systems, CAMPSite's capabilities are extensive when it comes to the remote monitoring of field data. Choose from a variety of instrumentation and powerful reporting features to generate real-time data that is accurate and viewable from almost anywhere in the world via the internet or mobile devices and provide quick off-site support, preventative maintenance measures and trouble shooting.

Real Time Data
Remote Access

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Ashtead
TECHNOLOGY
INSTRUMENT DIVISION

C.A.M.P. SITE

Remote Environmental Monitoring System

Ashtead TECHNOLOGY

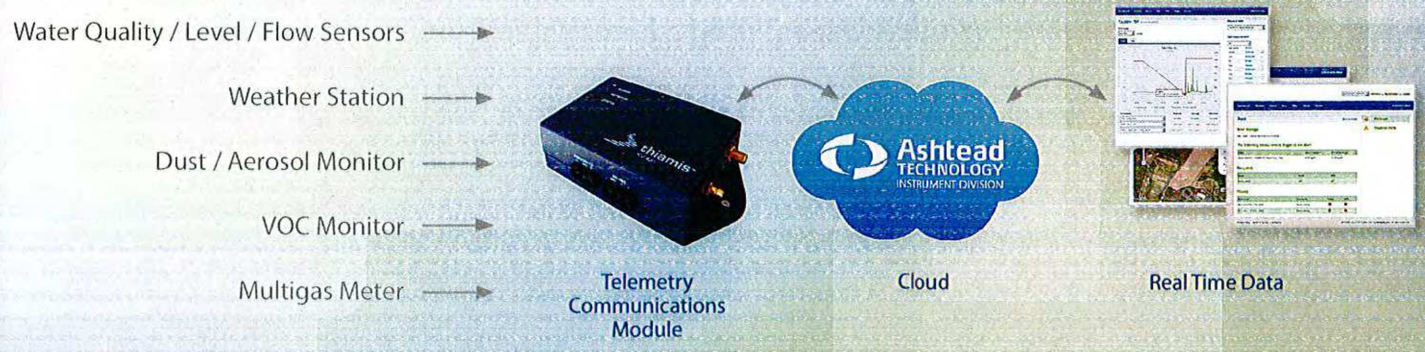
Features:

- *Real-Time alerts and alarms, local and remote via text messaging and e-mail*
- *Compatibility with most instruments from well-known manufacturers such as TSI, Rae Systems, YSI, Thermo Environmental, etc.*
- *GPS mapping of individual monitoring stations*
- *Easy to use web application software to customize your project's unique requirements*

Benefits:

- *Access to data anytime, anywhere via web or mobile devices*
- *Complete, fully hosted solution*
- *Robust and secure remote monitoring and data storage*
- *Cost effective*

Access & view your sampling data on line, in real time


Water Quality / Level / Flow Sensors

Weather Station

Dust / Aerosol Monitor

VOC Monitor

Multigas Meter

Telemetry Communications Module

Ashtead TECHNOLOGY INSTRUMENT DIVISION

Cloud

Real Time Data

Ashtead TECHNOLOGY INSTRUMENT DIVISION

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