SITE CHARACTERIZATION WORK PLAN

PROPOSED MTA PARATRANSIT FACILITY
COMMERCE AVENUE
BRONX, NEW YORK

NYSDEC SITE # 203074

Prepared for:

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For submittal to:

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April 20, 2015
(Rev. May 21, 2015)

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Commerce Avenue, Bronx, NY

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1.0 INTRODUCTION

1.1 Project Description and Purpose

Environmental Planning & Management, Inc. (EPM), on behalf of Hunter Roberts Construction Group and the New York City Economic Development Corporation (NYCEDC) has prepared this Site Characterization Work Plan at the request of the New York State Department of Environmental Conservation (NYSDEC) to further investigate the property proposed for the new Metropolitan Transportation Authority (MTA) Paratransit Facility, located on Commerce Avenue, Bronx, New York (Figure 1 – Project Site Location).

The site is currently vacant and occupies an approximate 94,958 square-foot portion of Block 3838, Lot 60. The Department of Housing, Preservation and Development currently has jurisdiction over Block 3838, Lot 60. The subject of this Work Plan ("the site") is the approximate 94,958 square-foot portion of Lot 60 that is proposed for development of the MTA Paratransit Facility. The remaining portion of Lot 60 is not proposed as part of the subject development, and reportedly will remain in its current commercial use. There are currently no plans to subdivide Lot 60 into separate legal lots after construction of the Paratransit Facility. The survey plot of the entire Lot 60 is included in Appendix A. Figure 2 indicates the area of Lot 60 that is the subject of this Work Plan (the site). Prior to beginning the investigation, the site boundaries will be surveyed and physically delineated with stakes and fencing to clearly separate the portion of Lot 60 that is being investigated from the portion that is not being investigated.

The proposed Paratransit Facility will comprise an approximate 5,000 square-foot building that will include a training room, administrative offices, and other back of house areas, as well as parking for approximately 150 Paratransit vehicles. The remainder of the site will be completed as paved parking, with small planting areas possible within the sidewalk area along Commerce Avenue. Preliminary site redevelopment plans are provided as **Appendix A.** It is expected that the new facility will serve to receive new vehicles from manufacturers and retired vehicles from private operators for temporary storage onsite until disbursed to new operators/owners, to perform asset recovery of selected vehicle equipment, and to train drivers and maintainers in the operation and maintenance of the vehicles.

A Phase I Environmental Site Assessment and a Phase II Environmental Site Investigation were completed at the site in 2013 on behalf of NYCEDC. The Phase II Investigation identified site soils to be impacted primarily with metals and semi-volatile organic compounds (SVOCs), and soil vapor impacted with VOCs including tetrachloroethene (PCE) and trichloroethene (TCE). Groundwater samples collected from temporary piezometers during the Phase II Investigation contained metals and SVOCs above NYSDEC Class GA groundwater standards/guidance values.

A Remedial Action Plan (RAP), dated April 21, 2014, was prepared based on the findings of the 2013 Phase II Investigation to describe procedures for mitigating hazardous material impacts during construction and operation of the Paratransit Facility. The primary components of the RAP are installation of a pavement cap over existing site soils, and installation of a sub-slab depressurization system beneath the new building to vent subsurface vapors. The RAP was accepted by the New York City Department of Environmental Protection (NYCDEP) in a letter dated May 23, 2014.

Subsequent to approval of the RAP, MTA requested that NYSDEC provide input and oversight concerning site mitigation requirements.

The main objectives of this proposed investigation are to further characterize onsite soil, groundwater, and soil vapor conditions; to investigate soil vapor and groundwater conditions offsite along Commerce Avenue; and, to determine surface aquifer flow patterns at the site.

1.2 Site History

1.2.1 Records Search

EPM completed a Phase I Environmental Site Assessment (ESA) for the project site, the results of which are provided in the *Phase I Environmental Site Assessment Report, Commerce Avenue, Bronx, NY, May 16, 2013*. According to historic Sanborn Maps, the site was undeveloped until as early as 1977, when the southern third was occupied by an automotive junk yard. The northern two-thirds of the property was used as a truck storage yard as early as 1981. The project site is also listed with NYSDEC as having a closed-status hazardous material spill reportedly associated with a scrap metal dealer improperly storing vehicles on the project site which lead to gasoline leaking onto the site. A subsequent site inspection by NYSDEC in August 2014 resulted in issuance of Active Spill Number 1405821 due to oil being observed on the ground surface in an area where five gallon containers of waste oil were dumped on the site. The NYSDEC Spill Report states that it appeared the waste oil containers were recently dumped at the site.

The areas adjacent to the project site have historically been occupied by commercial and industrial uses including bulk fuel and coal storage, metal works, and automotive repair. An area to the southwest of the project site was once occupied by a Manufactured Gas Plant as Bronx Gas and Electric, and a bulk fuel storage facility as Cirillo Brothers

Petroleum Company. This former MGP site is listed as a New York State Brownfield Site, a Major Oil Storage Facility, and Hazardous Material Spill site.

A prior Phase I ESA for the project site completed by Metcalf & Eddy in 2004 was reviewed. During the 2004 site inspection, evidence was observed of petroleum stained soils, abandoned vehicles, a tanker trailer, containers of identifiable hazardous materials and petroleum products and several containers of unidentifiable material. It is suspected that illegal dumping may also have occurred at the site over the years.

EPM's 2013 Phase I ESA included a review of prior soil and groundwater investigations performed at the project site by TRC Corporation in 2002 and GEI Consultants in 2005. These prior investigations identified volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), and metals in soil samples collected from the site above guidance values. VOCs and metals were detected in onsite groundwater samples, however only iron, manganese, and magnesium were found in concentrations exceeding NYSDEC Class GA values. A prior soil vapor sample collected by GEI in 2005 in the vicinity of the proposed Paratransit Training Structure contained concentrations of refrigerants and volatile organic compounds (VOCs) in excess of their onsite ambient concentrations, including Freon 11 and 12, methyl tert butyl ether (MTBE), hexane, methyl ethyl ketone (MEK), 1,1,1-trichloroethane, cyclohexane, toluene, tetrachloroethene, ethylbenzene, and xylenes.

1.2.2 2013 Phase II Site Investigation

EPM collected soil, groundwater, and soil vapor samples from the project site in June 2013 for laboratory analysis from a combination of Geoprobe soil borings and test pits. The findings are detailed in the *Site Investigation Findings Report, Proposed MTA Paratransit Training Facility, July 12, 2013, EPM, Inc.* The prior sampling locations and summary tables of the laboratory results are provided as **Appendix B**.

Existing Soil Conditions

Soils encountered in the borings and test pits generally consisted of urban fill with grey to dark brown sand and silt, and included glass, brick, masonry, plastic, textile, and automotive parts. SVOCs and metals were found at concentrations exceeding NYSDEC Part 375 Commercial Soil Cleanup Objectives (SCOs) in the majority of soil samples collected from the project site. PCBs, pesticides, and the VOCs 1,2,4-trimethylbenzene and mixed xylenes were detected at concentrations exceeding Part 375 Unrestricted SCOs.

Existing Groundwater Conditions

SVOCs and metals were detected in the onsite groundwater samples that were collected from temporary piezometers at concentrations above NYSDEC Class GA values. No VOCs were detected in onsite groundwater above Class GA values, which is consistent with the findings of the prior groundwater sampling performed at the site discussed in section 1.2.1.

Existing Soil Vapor Conditions

The VOCs trichloroethene (TCE) and tetrachloroethene (PCE) were detected in soil vapor sample SV2 at concentrations of 240 micrograms per cubic meter (µg/m3) and 28,000 µg/m3, respectively. PCE was also detected at a concentration of 239 µg/m^3 in sample SV1. Methane was not detected in any of the soil gas samples above the lower explosive level for methane of 50,000 ppmv.

2.0 INVESTIGATION METHODS

The following sections describe the proposed methods to further investigate conditions on the site and offsite along Commerce Avenue.

2.1 Objectives

The objectives of this investigation are to further characterize onsite soil, groundwater, and soil vapor conditions; to investigate soil vapor and groundwater conditions offsite along Commerce Avenue; and, to determine overburden aquifer flow patterns. Shallow groundwater is expected to flow towards the east beneath the project site based on the proximity to Westchester Creek.

The results of the investigation will be used to identify appropriate mitigation measures to protect future users of the new Paratransit Facility from exposure to hazardous materials. The results will also be used to evaluate the likelihood of any onsite or offsite sources of groundwater or soil vapor impacts.

2.1.1 Data Quality Objectives

The data collected during the investigation will be utilized to provide information to satisfy the following Data Quality Objectives (DQOs):

- Further delineate soil, groundwater, and soil vapor conditions within the boundaries of the project site;

- Identify conditions in offsite soil vapor and offsite groundwater along Commerce Avenue; and,

- Determine groundwater flow patterns in the immediate vicinity of the site.

The data will be evaluated as follows:

- Onsite data will be used to determine if the mitigation measures contained in the existing RAP are sufficient for construction of the proposed Paratransit Facility;

- Offsite and onsite data will be evaluated in the context of groundwater flow patterns to determine the likelihood of any onsite or offsite contaminant sources.

2.2 Standards, Criteria and Guidance Values

Soil results will be compared to NYSDEC Part 375 Remedial Program Soil Cleanup Objectives (SCOs). Based on the proposed future use of the site as an MTA Paratransit Facility, achievement of Part 375 Commercial SCOs is the proposed surface soil cleanup goal for the site. The existing RAP assumes that construction of the new Paratransit Facility will include capping of the entire development area based on the detection of metals and SVOCs above Commercial SCOs in onsite soil samples.

Groundwater results will be compared to NYSDEC Division of Water Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations (Class GA), June 1998. Groundwater beneath the site is not proposed for potable use and strict adherence to the Class GA criteria may not be applicable.

The soil vapor sample results will be compared to the results of site-specific background air samples. Two background air samples will be collected in summa canisters for a duration of two hours on the same day the subsurface vapor samples are collected. The canisters for the background samples will be placed approximately 1 to 2 feet above the ground surface. The soil vapor sample results will be evaluated to delineate the extent of soil vapor impacts at the site, and to determine the potential for future vapor intrusion into the proposed building.

2.3 Installation of Soil Borings, Monitoring Wells and Soil Vapor Implants

Clearing and grubbing of the site will be performed prior to initiating the field investigation. A survey of the site boundaries will also be performed by a NYS Licensed Surveyor prior to initiating the field investigation. The boundaries of the site will be physically demarcated with stakes and fencing to clearly separate the portion of Lot 60 that is being investigated (the site) from the portion of Lot 60 that is not included in the investigation.

The proposed locations of the additional Geoprobe soil borings, groundwater monitoring wells, and soil vapor sampling implants are provided on **Figure 2 – Sample Location Plan.** The soil boring and monitoring well locations will be surveyed by a NYS Licensed Surveyor for placement on a site plan. Field observations and measurements will be recorded on logs to be included in the findings report.

2.3.1 Soil Borings

Additional soil delineation will be conducted across the site in general, and specifically around prior sample location B2 due to the discovery of elevated lead in soil samples collected from this boring. A Geoprobe® with direct push technology will be used to advance ten soil borings on the project site. The borings will be advanced to depths that encounter the groundwater table or to 15 feet below grade, whichever is greatest. Groundwater is located approximately 8 to 11 feet below grade at the site.

2.3.2 Groundwater Monitoring Wells

A hollow stem auger drill will be used to install five permanent groundwater monitoring wells on the project site, and to install three permanent wells to the northwest of the site within the sidewalk along Commerce Avenue. The wells will be constructed with 2-inch diameter 10-foot long 0.02 slot screens to bracket the ground water table (half of the screen will be submerged). The wells will be installed to approximately 5 feet below the water surface, with groundwater expected at approximately 8 to 11 feet below grade across the site. The wells will be gravel packed from one foot below the screen to one foot above the screen with Morie #2 gravel pack. A fine sand seal will be placed above the gravel pack and a 2-foot bentonite seal will be placed above the sand seal. The wells will be grouted from the bentonite seal to grade with a cement grout. The onsite wells will be finished with stick-up metal protective casings and locking caps. The offsite wells within the public sidewalk will be finished at grade with 8-inch diameter bolt down manholes. The wells will then be developed using surge and pump techniques by the drilling contractor.

2.3.3 Temporary Soil Vapor Implants

Three temporary soil vapor implant will be installed onsite, and three temporary soil vapor sampling implants will be installed offsite within the sidewalk along Commerce Avenue. One ambient surface air sample will also be collected. A Geoprobe will be used to advance the vapor implants as described in Section 2.5.3.

2.4 Investigative Derived Waste

Drill cuttings and well development water generated during installation of the offsite wells, along with all decontamination liquids/solids, and contaminated personal protective equipment will be collected in USDOT-approved 55-gallon drums and temporarily stored onsite pending waste classification testing and transport to a permitted disposal facility. Excess drill cuttings from the onsite borings will be returned to the borings they originated from unless gross signs of contamination are observed, in which case the cuttings will be drummed for offsite disposal. Likewise, well development water from the onsite wells will be discharged to the unpaved land surface of the site unless contamination is observed, in which case the liquids will be drummed for offsite disposal.

2.5 Sample Collection and Analysis

The following sections summarize the field sample collection procedures to be used. Detailed field sampling and laboratory analysis protocols are provided in the Sampling and Analysis Project Plan (SAPP) provided as **Appendix C**. The quality assurance/quality control methods to be used to ensure reliable accurate data are detailed in the Quality Assurance Project Plan (QAPP) provide as **Appendix D**. Field activities will be conducted in accordance with the Health and Safety Plan provided as **Appendix E.**

2.5.1 Soil

Soil samples from the ten Geoprobe borings will be continuously field screened from ground surface to the boring termination depth. The cores will be collected in 5-foot long dedicated acetate liners. The soil will be field screened with a freshly calibrated photo-ionization detector (PID) for indications of organic vapors, and for visual or odor evidence of contamination. Three soil samples will be collected for laboratory analysis from each boring. A soil sample will be collected from each boring for lab analysis from the 0 to 2-foot depth, a second soil sample will be collected from each boring from the 2-foot interval at the boring terminus, and a third sample will be collected from a location with the greatest field evidence of contamination from between the top 2 feet of soil and the bottom of the boring.

Soil samples will be prepared for the laboratory by placing the selected interval into a stainless steel mixing bowl, separating it into quarters, and placing an equal portion of each quarter into the proper laboratory provided containers. To minimize volatilization, soil samples collected for VOC analysis will not be composited in this manner, but rather will consist of discreet samples collected from locations with the greatest PID readings or other evidence of VOC impacts. The initial 24 inches of soil will be field screened for indications of VOCs at each boring. A discreet sample will be collected for VOC analysis from each boring from the location with the greatest evidence of impact from the upper 24 inches of soil, or from the upper 2 inches if no evidence of impacts are observed. The soil samples will be analyzed for Target Compound List (TCL) Volatile Organic Compounds+10 TICs (VOCs by Method 8260); TCL Semi-Volatile Organic Compounds+20 TICs (TCL SVOCs by Method 8270); PCBs by Method 8082, Pesticides by Method 8081, and Target Analyte List (TAL) metals by methods 6010/7000. The samples will be collected, stored, shipped, and analyzed according to the procedures detailed in the attached SAPP and QAPP. The QAPP contains a summary of the types of samples, analytical methods, and quality assurance samples that will be collected and analyzed.

2.5.2 Groundwater

After waiting a minimum of one week after well development, the six new wells will be measured for depth to water and free product with an electronic interface probe. After these measurements are recorded, the wells will be purged and sampled with a low flow method bladder pump utilizing USEPA low-flow sampling procedures. Field measurements will be recorded during purging for pH, temperature, specific conductance, turbidity, reduction-oxidation potential, and dissolved oxygen until these parameters stabilize indicating that the well contains a representative groundwater sample. The purge volumes and chemistry measurements will be recorded on Low Flow Purge and Sampling Logs, an example of which is included with the SAPP in Appendix C. One round of groundwater samples will be collected from the eight wells for laboratory analysis of TCL VOCs+10, SVOCs+20, PCBs, Pesticides, and TAL Metals (total unfiltered).

2.5.3 Soil Vapor

A Geoprobe will be used to advance 1.5-inch outer diameter rods with expendable vapor sampling points to a targeted sampling depth of six feet below grade. If groundwater is encountered at deeper than expected depths, a field decision will be made regarding placing the vapor probe deeper if possible. Current soil data for the site does not indicate a significant onsite source of VOCs in soil; however, the Geoprobe soil sampling will be performed prior to the soil vapor sampling so that the soil vapor locations can be adjusted to suspected source locations if identified.

The soil vapor samples will be collected in 6-liter summa canisters with a sampling duration of at least 2 hours. A 12-inch long stainless steel vapor sampling implant will be inserted through the rod such that it is positioned at the bottom of the borehole. Dedicated Teflon tubing will be attached to the disposable implant. The annular space around the screen implant will be backfilled with clean #1 sand to two feet above the implant screen. A bentonite seal will be placed above the sand extending to ground surface. The sample tubing will then be connected to a T connector 3-way valve apparatus with one end of the T connector attached to a vacuum pump and the other end attached to a batch certified summa canister with calibrated flow controller. The tubing will be purged at least approximately two volumes with a Gillian vacuum pump set at a flow rate of 0.2 liters per minute.

A tracer gas (helium) will be used to verify that ambient air does not dilute the soil gas sample being collected. The gas will be used to enrich the atmosphere where the sample tubing meets the ground surface to test the borehole seal and confirm that ambient air is not entering the sample. A 5-gallon bucket will be placed over the borehole and the tracer gas pumped into the bucket. A tedlar bag will be connected to the Gillian pump and filled with the purge gas as the helium is added to the bucket. Both the purge gas from the sample tubing and the helium enriched air in the bucket will be measured for helium with a Gas Check 3000 meter. If the tracer gas screening indicates the rate of helium detected in the sample tubing is greater than 20 percent of the helium detected in the bucket, the seals around the sampling apparatus will be reset and purged again until the tracer gas is no longer present at levels greater than 20 percent of the enriched air within the bucket.

After the purge and tracer gas verification procedures, the valve leading to the pump will be shut, the pump shut off, and the soil vapor then directed to the summa canister for collection of the sample. The flow controller on the summa canister will be set to a flow rate of 0.2 liters per minute or lower, and the soil vapor sample collected for a duration of 30 minutes. After the sample is collected, the borehole will be backfilled with clean sand, a bentonite seal, and grouted to the land surface. The summa canisters will then be shipped to the laboratory for analysis of VOCs by EPA Method TO-15. The purge data for each sample location will be recorded on the Soil Vapor Sampling Field Data Logs, with an example of this field log provided in the SAPP in Appendix C.

2.6 Field Decontamination Procedures

All non-disposable sampling equipment such as down-hole drilling equipment, stainless steel mixing bowls, trowels, spoons, etc. will be decontaminated prior to initial use, between sample locations, and prior to leaving the site as follows:

1. Scrub equipment with brush and non-phosphate detergent solution (Alconox);
2. Rinse with potable water;
3. Final rinse with distilled water;
4. Air dry the equipment; and,
5. Place on plastic for next use.

All decontamination liquids and solids will be collected and characterized for offsite disposal.

2.7 Quality Assurance / Quality Control

Refer to the QAPP provided as Appendix D for detailed QA/QC protocols. A New York State Department of Health Environmental Laboratory Approval Program (ELAP) Certified Laboratory will be used for all laboratory analysis. The lab will be instructed to provide the data in a NYSDEC ASP Category B Deliverable. The laboratory data report will undergo independent third party data validation, which will include preparation of a Data Usability Summary Report (DUSR). The quality control samples will include trip blanks, field blanks, duplicates, and matrix spike / matrix spike duplicates. The frequency of the QA/QC samples is detailed in the QAPP. The method reporting limits (MRLs) will be those included in NYSDEC ASP. All data will be submitted in an Electronic Data Deliverable (EDD) format compatible with EqUIS.

2.8 Health and Safety

A Site Specific Health and Safety Plan (HASP) is provided as Appendix E. All field personnel, including subcontractors and visitors to the site will be required to adhere to the HASP. The intent of the HASP will be to protect individuals working on the project, as well as the general public in the vicinity of the project area. Procedures for air monitoring to protect project workers and the surrounding community during ground intrusive activities during the investigation are included in the HASP.

2.9 Qualitative Human Health Exposure Assessment

A qualitative human health exposure assessment will be performed to determine the potential for future exposure to site contaminants in consideration of the proposed development. The exposure assessment will be performed in accordance with NYSDEC DER-10 – Technical Guidance for Site Investigation and Remediation, May 2010, Appendix 3B.

3.0 REPORTING AND SCHEDULE

A Site Characterization Findings Report will be prepared for submission to NYSDEC in accordance with the latest edition of NYSDEC DER-10 – Technical Guidance for Site Investigation and Remediation. All data will be submitted in an Electronic Data Deliverable (EDD) format compatible with EqUIS. The findings report will include a description of the work performed, graphical and tabular presentations of the findings, and conclusions regarding appropriate mitigation requirements for construction and operation of the MTA Paratransit Facility. Conclusions will also be drawn to the extent possible regarding the likelihood of any onsite or offsite sources of groundwater or soil vapor contamination.

The field investigation is expected to require approximately two to three weeks. The validated Category B laboratory results with DUSRs will be available within six weeks of sample collection. The Draft Site Characterization Findings Report will be submitted within approximately four weeks of receipt of the laboratory data.

FIGURES

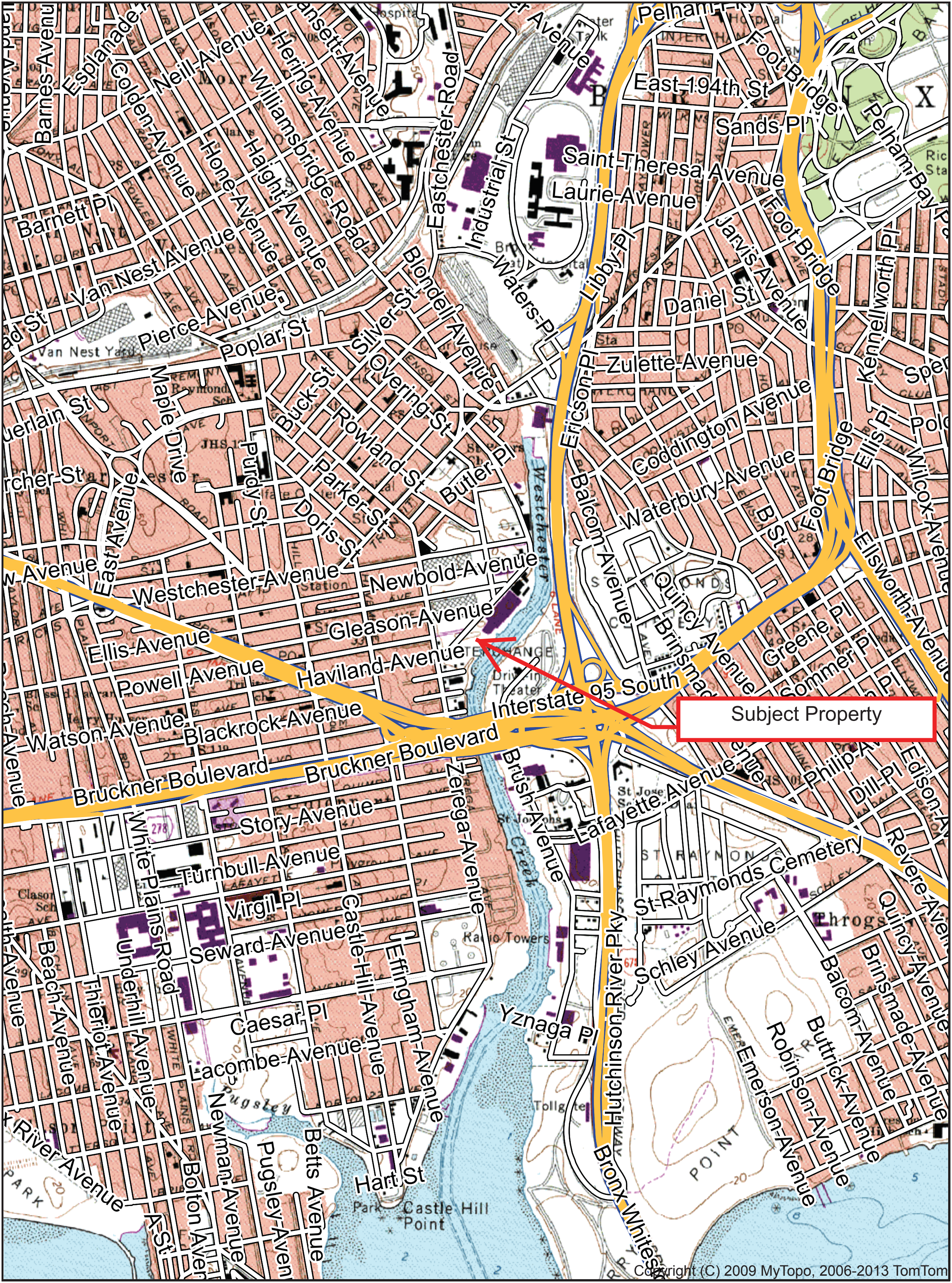


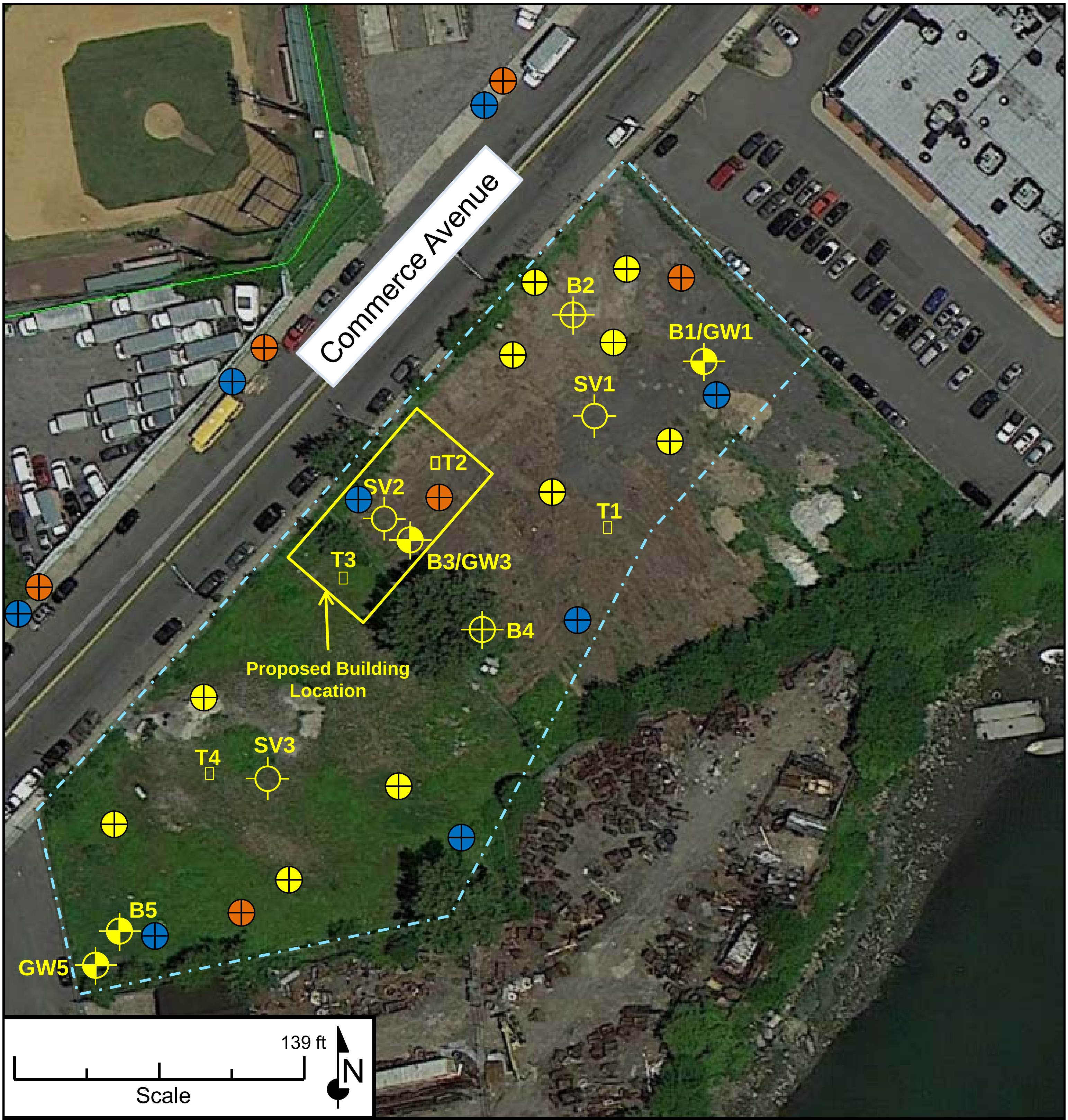
Figure 1 - Site Location Map

Map Name: FLUSHING
Horizontal Datum: NAD27
Scale: 1 inch = 2,000 ft.
Map Center: 040° 49' 54.39" N 073° 50'

Declination

GN 0.75° E
MN 13.18° W

SCALE 1:24000



Legend

-·- Site boundary
⊕ Proposed soil boring
⊕ Proposed monitoring well
⊕ Proposed soil vapor sample
⊕ Prior soil/groundwater sample
⊕ Prior soil boring location
○ Prior soil vapor sample
▯ Prior test pit

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PLANNING &
MANAGEMENT, INC.

Figure 2:

Proposed Sample Location Plan

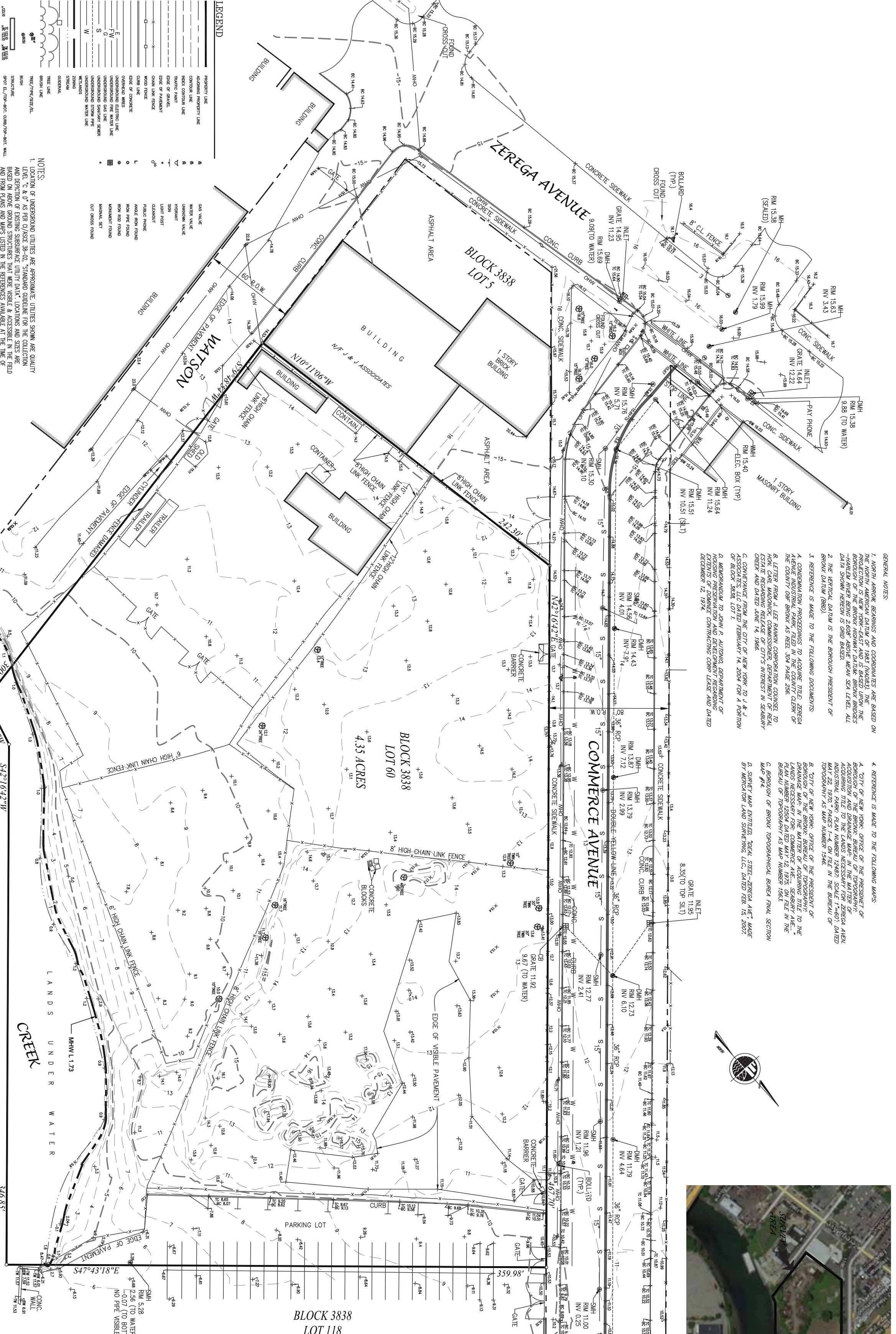
Site Characterization
Proposed Paratransit Facility
Commerce Avenue
Bronx, NY 10462
April 20, 2015

APPENDICES

APPENDIX A

Survey Plot of Block 3838, Lot 60
&
Proposed Redevelopment Plans

FILE NAME: P:\Proj120\120536.04\11_Survey\2. Survey Working\1. LM DWGs\1. Current\BBD (for use)\120536.04 Topographic Survey-BBD.dwg PLOT TIME: Mon, 21 Oct 2013 - 4:07pm LAST SAVE: Mon, 21 Oct 2013 - 2:24pm BY: SLeung



COMBINED PEIRHEAD & BULKHEAD LINE AS APPROVED BY DEPT. OF WAR SEPT. 24, 1913.

GENERAL NOTES:

1. NORTH ARROW, BEARINGS AND COORDINATES ARE BASED ON THE NORTH AMERICAN DATUM OF 1983 (NAD83). THE PROJECTION IS NEW YORK-EAST AND IS BASED UPON THE BOROUGH OF THE BRONX HIGHWAY DATUM: BRONX BRIDGES -HARLEM RIVER BEING 2.608' ABOVE MEAN SEA LEVEL. ALL DATA SHOWN HEREON IS GRID BASED.

2. THE VERTICAL DATUM IS THE BOROUGH PRESIDENT OF BRONX DATUM (BBD).

3. REFERENCE IS MADE TO THE FOLLOWING DOCUMENTS:

A. CONDEMNATION PROCEEDINGS TO ACQUIRE TITLE: ZEREGA AVENUE INDUSTRIAL PARK, FILED IN THE COUNTY CLERK OF THE COUNTY 09F BRONX AS REEL 304 PAGE 256.

B. LETTER FROM J. LEE RANKIN CORPORATION COUNSEL TO HON. CARL MADONICK, COMMISSIONER, DEPARTMENT OF REAL ESTATE REGARDING RELEASE OF CITY'S INTEREST IN SEABURY CREEK AND DATED JUNE 14, 1966.

C. CONVEYANCE FROM THE CITY OF NEW YORK TO J & J ASSOCIATES, LLC DATED FEBRUARY 14, 2004 FOR A PORTION OF BLOCK 3838, LOT 1.

D. MEMORANDUM TO JOHN P. AUTONIO, DEPARTMENT OF HOUSING PRESERVATION AND DEVELOPMENT REGARDING EXTENTS OF DOMINEE CONTRACTING CORP LEASE AND DATED DECEMBER 12, 1974.

4. REFERENCE IS MADE TO THE FOLLOWING MAPS:

A. "CITY OF NEW YORK: OFFICE OF THE PRESIDENT OF BOROUGH OF THE BRONX: BUREAU OF TOPOGRAPHY: ACQUISITION AND DRAINAGE MAP: IN THE MATTER OF ACQUIRING TITLE TO THE LANDS NECESSARY FOR ZEREGA AVEN. INDUSTRIAL PARK: PLAN NUMBER 12487: SCALE 1"=60'. DATED MAY 22, 1970." PAGES 1-4, ON FILE IN THE BUREAU OF TOPOGRAPHY AS MAP NUMBER 1546.

B. "CITY OF NEW YORK: OFFICE OF THE PRESIDENT OF BOROUGH OF THE BRONX: BUREAU OF TOPOGRAPHY: DRAINAGE MAP: IN THE MATTER OF ACQUIRING TITLE TO THE LANDS NECESSARY FOR: COMMERCE AVE...: SEABURY AVE..." PLAN NUMBER 12504 DATED MAY 12, 1975. ON FILE IN THE BUREAU OF TOPOGRAPHY AS MAP NUMBER 1563.

C. BOROUGH OF BRONX TOPOGRAPHICAL BUREA FINAL SECTION MAP #14.

D. SURVEY MAP ENTITLED, "IDEAL STEEL-ZEREGA AVE" MADE BY MERCATOR LAND SURVEYING, LLC., DATED FEB. 15, 2007.

	NAVD88	BBD
MHHW	3.6418	2.0917
MHW	3.2816	1.7315
BBD	1.5501	0
NAVD88	0	-1.5501
MTL	-0.249	-1.755
MLW	-3.6915	-5.2416
MLLW	-3.9815	-5.5316

NOTE: TIDAL DATUMS ARE TAKEN FROM NOAA'S VERTICAL DATUM TRANSFORMATION SOFTWARE.

LEGEND

PROPERTY LINE
ADJOINING PROPERTY LINE
CONTOUR LINE
INDEX CONTOUR LINE
TRAFFIC PAINT
EDGE OF GRAVEL
EDGE OF PAVEMENT
CHAIN LINK FENCE
WOOD FENCE
CURB LINE
EDGE OF CONCRETE
OVERHEAD WIRES
UNDERGROUND ELECTRIC LINE
UNDERGROUND FIRE WATER LINE
UNDERGROUND GAS LINE
UNDERGROUND SANITARY SEWER
UNDERGROUND STORM PIPE
UNDERGROUND WATER LINE
WETLANDS
ZONING
STREAM
GUIDERAIL
TREE LINE
BRUSH LINE
TREE/TYPE/SIZE/EL.
BUSH
STRUCTURE
SPOT EL./TOP-BOT. CURB/TOP-BOT. WALL
SPOT ELEVATION UNDER ROADWAY
UTILITY POLE
CATCH BASIN
FIELD INLET
MANHOLE
MANHOLE (DRAINAGE)
MANHOLE (ELECTRIC)
MANHOLE (FIREMAN)
MANHOLE (SANITARY SEWER)
MANHOLE (TELEPHONE)
MANHOLE (WATER)

GAS VALVE
WATER VALVE
UNKNOWN VALVE
HYDRANT
SIGN
LIGHT POST
CLEANOUT
PUBLIC PHONE
ANGLE IRON FOUND
IRON PIPE FOUND
IRON ROD FOUND
MONUMENT FOUND
MAGNAIL SET
CUT CROSS FOUND

WARNING – IT IS A VIOLATION OF NEW YORK STATE EDUCATIONAL LAW, SECTION 7209.2, FOR ANY PERSON, UNLESS HE IS ACTING UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER OR LAND SURVEYOR, TO ALTER THIS DOCUMENT IN ANY WAY. IF ALTERED, THE ALTERING PERSON SHALL COMPLY WITH THE REQUIREMENTS OF NEW YORK EDUCATIONAL LAW, SECTION 7209.2

NOTES:

1. LOCATION OF UNDERGROUND UTILITIES ARE APPROXIMATE. UTILITIES SHOWN ARE QUALITY LEVEL "C & D" AS PER CI/ASCE 38-02, "STANDARD GUIDELINE FOR THE COLLECTION AND DEPICTION OF EXISTING SUBSURFACE UTILITY DATA". LOCATIONS AND SIZES ARE BASED ON ABOVE GROUND STRUCTURES THAT WERE VISIBLE & ACCESSIBLE IN THE FIELD AND FROM PLANS AND MAPS LISTED IN THE REFERENCES AVAILABLE AT THE TIME OF THE SURVEY. AVAILABLE AS-BUILT PLANS AND DEPICTION OF SURFACE UTILITY STRUCTURES DOES NOT ENSURE MAPPING OF ALL UNDERGROUND UTILITIES AND STRUCTURES. BEFORE ANY EXCAVATION IS TO BEGIN ALL UNDERGROUND UTILITIES SHOULD BE VERIFIED AS TO THEIR LOCATION, SIZE AND TYPE BY THE PROPER UTILITY COMPANIES. LANDMETRICS ENGINEERING AND LAND SURVEYING P.C. DOES NOT GUARANTEE THE UTILITIES SHOWN COMPRISE ALL SUCH UTILITIES IN THE AREA, EITHER IN SERVICE OR ABANDONED.
2. SUBJECT TO ABOVE AND/OR UNDERGROUND INSTALLATIONS EXISTING OR AS OF RECORD.
3. THIS SURVEY WAS PERFORMED WITHOUT BENEFIT OF AN ABSTRACT OF TITLE AND/OR A TITLE REPORT AND SUBJECT TO ANY FINDINGS EXISTING OR AS OF RECORD.
4. BUILDING DIMENSIONS AND/OR OFFSETS ARE SHOWN FOR REFERENCE ONLY AND ARE NOT TO BE USED FOR CONSTRUCTION OF ANY TYPE.
5. BLOCK AND LOT NUMBERS, STREET NAMES AND ROW WIDTHS AS PER CURRENT TAX MAP INFORMATION.
6. SAID GUARANTEES AND/OR CERTIFICATIONS SHALL RUN ONLY TO THE PERSON FOR WHOM THE SURVEY IS PREPARED AND SUCH GUARANTEES AND/OR CERTIFICATIONS ARE NOT TRANSFERABLE TO ADDITIONAL OR SUBSEQUENT OWNERS.

I, DONALD O. VIELE, PLS (NYS LS # 050454) THAT THIS MAP WAS PREPARED FROM A FIELD SURVEY PERFORMED UNDER MY DIRECTION DURING MAY/2013

ONLY COPIES FROM THE ORIGINAL OF THIS SURVEY MARKED WITH AN ORIGINAL OF THE LAND SURVEYOR'S EMBOSSED SEAL SHALL BE CONSIDERED TO BE VALID TRUE COPIES.

UNAUTHORIZED ALTERATION OR ADDITION TO A SURVEY MAP BEARING A LICENSED LAND SURVEYOR'S SEAL IS A VIOLATION OF SECTION 7208 SUBDIVISION 2 OF THE NEW YORK STATE EDUCATION LAW.

SHTS	1 of 1
CHECKED BY	DOV
DRAWN BY	BJO/JED/CCW
DATE	6-12-2013
SCALE	1"=30'
PROJECT NO.	120536.04
SEAL	DONALD O. VIELE P.L.S. 050454

PROJECT

SURVEY OF
BLOCK 3838 - LOT 60
LYING ON COMMERCE AVENUE

BRONX, NEW YORK

NO.	DATE	REVISION	BY

LandMetrics ENGINEERING & LAND SURVEYING, PC
100 Snake Hill Road, West Nyack, NY 10994
A DIVISION OF THE McLAREN ENGINEERING GROUP

McLaren ENGINEERING GROUP
applied ingenuity
M. G. McLAREN, P.C.
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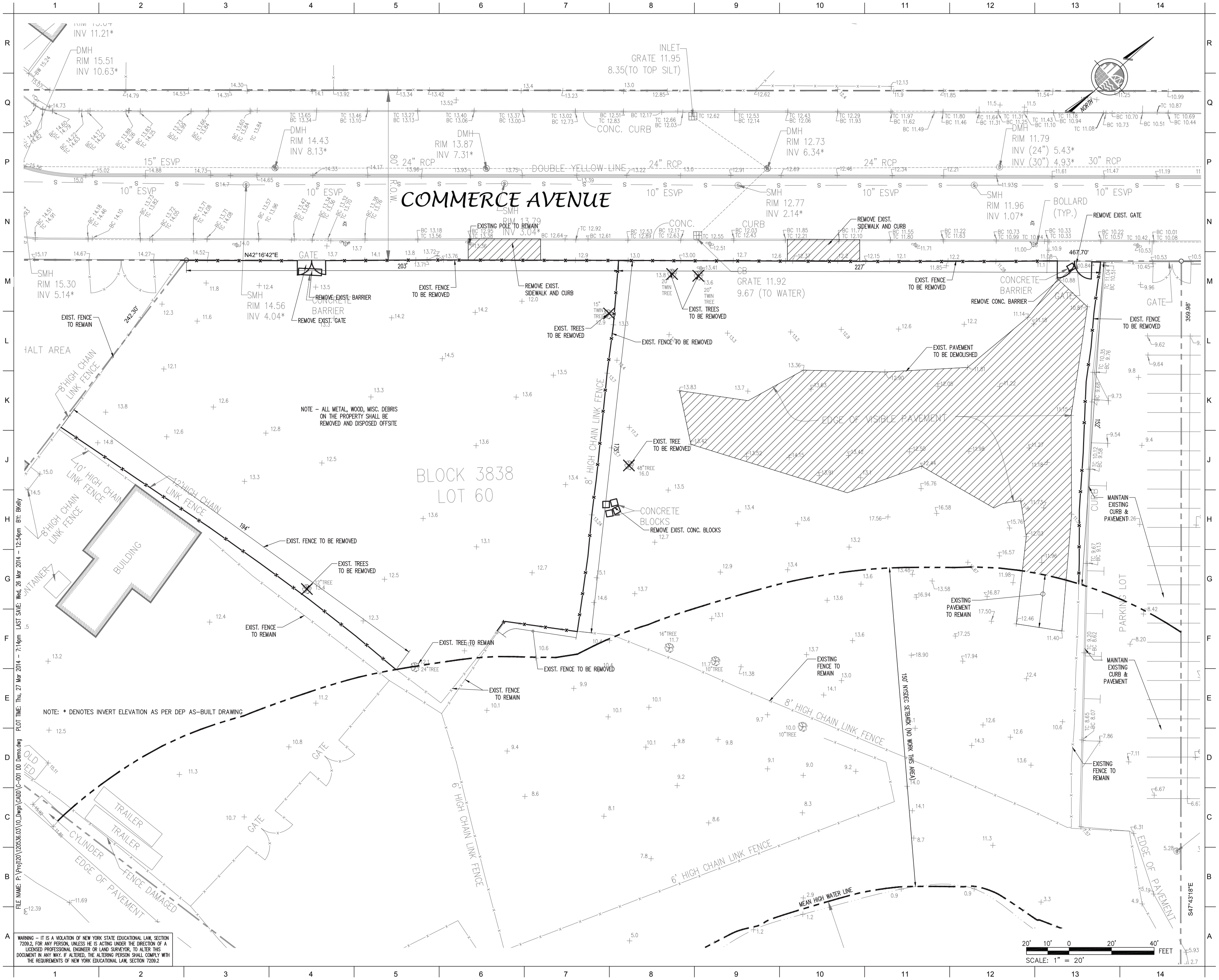

FILE NAME: P:\Proj20\120536.03\10_Dwgs\CADD\C-001 DD Demo.dwg PLOT TIME: Thu, 27 Mar 2014 - 7:14pm LAST SAVE: Wed, 26 Mar 2014 - 12:54pm BY: Bkelly

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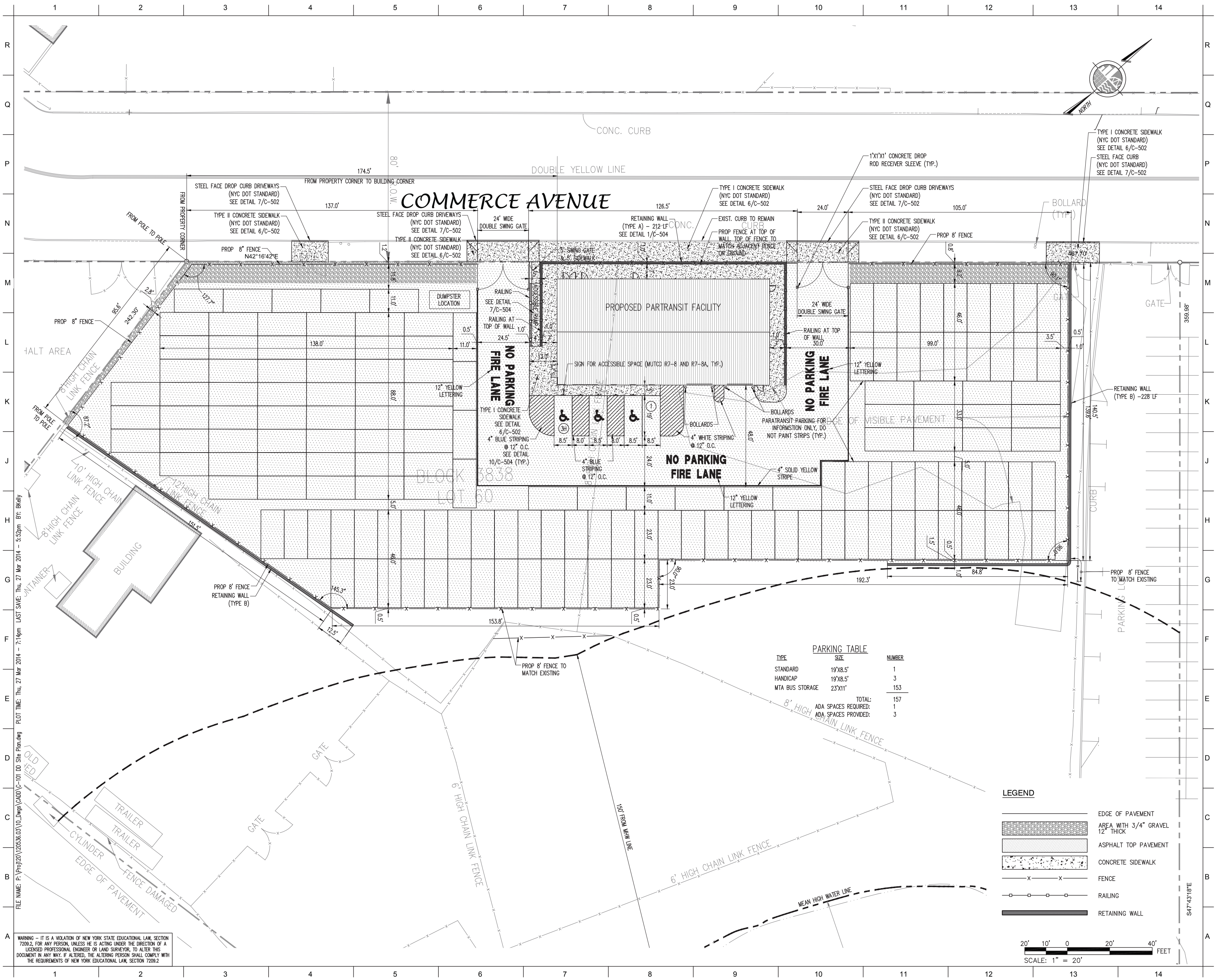
NO.	SUBMISSIONS / REVISIONS	DATE
-	MTA REVIEW COMMENTS 3-11-14	03/28/2014
-	100% CD SUBMISSION	12/20/2013

PROJECT
RELOCATED MTA PARATRANSIT FACILITY
COMMERCE AVENUE BRONX, NY 10462

DEMOLITION PLAN

SEAL & SIGNATURE

DATE: PROJ. ISSUE DATE
PROJECT No: MEG: 120536
SCALE: AS SHOWN
DRAWING BY: -
CHECKED BY: SLG
DWG No: C-001
NYC DOB Number:



PARKING TABLE

TYPE	SIZE	NUMBER
STANDARD	19'X8.5'	1
HANDICAP	19'X8.5'	3
MTA BUS STORAGE	23'X11'	153
	TOTAL:	157
	ADA SPACES REQUIRED:	1
	ADA SPACES PROVIDED:	3

LEGEND

—	EDGE OF PAVEMENT
▨	AREA WITH 3/4" GRAVEL 12" THICK
░	ASPHALT TOP PAVEMENT
▒	CONCRETE SIDEWALK
—x—x—	FENCE
—□—□—	RAILING
▬	RETAINING WALL

SCALE: 1" = 20'

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FILE NAME: P:\Proj120\120536.03\10_Dwgs\CADD\C-101 DD Site Plan.dwg PLOT TIME: Thu, 27 Mar 2014 – 7:14pm LAST SAVE: Thu, 27 Mar 2014 – 5:52pm BY: BKelly

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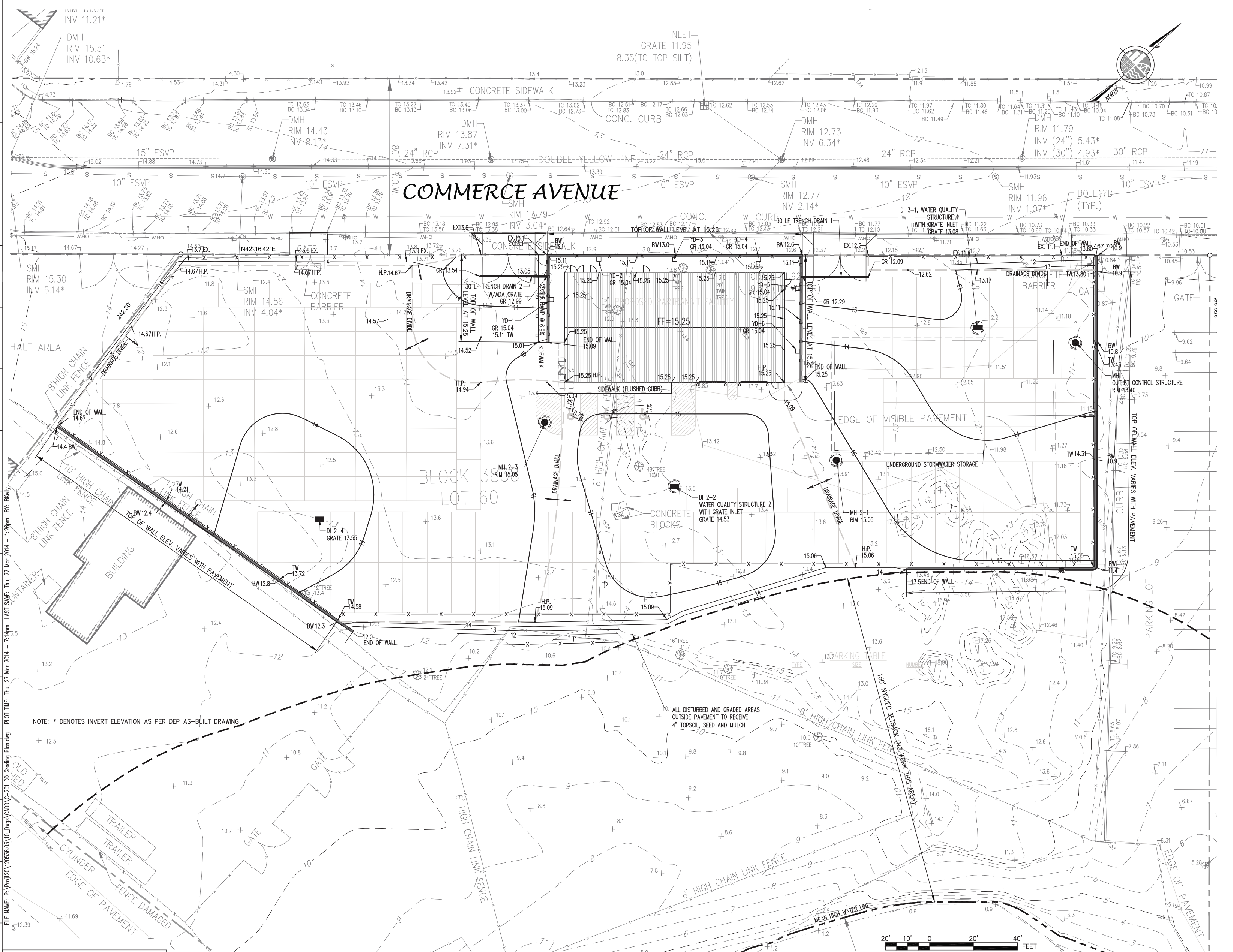
NO.	SUBMISSIONS / REVISIONS	DATE
-	MTA REVIEW COMMENTS 3-11-14	03/28/2014
-	100% CD SUBMISSION	12/20/2013

PROJECT
RELOCATED MTA
PARATRANSIT FACILITY
COMMERCE AVENUE BRONX, NY 10462

SITE PLAN

SEAL & SIGNATURE

DATE:	PROJ. ISSUE DATE
PROJECT No:	MEG: 120536
SCALE:	AS SHOWN
DRAWING BY:	-
CHECKED BY:	SLG
DWG No:	C-101
NYC DOB Number:	



NOTE: * DENOTES INVERT ELEVATION AS PER DEP AS-BUILT DRAWING.

ALL DISTURBED AND GRADED AREAS
OUTSIDE PAVEMENT TO RECEIVE
4" TOPSOIL, SEED AND MULCH

FILE NAME: P:\Proj120\120536.03\10_Dwgs\CADD\C-201 DD Grading Plan.dwg PLOT TIME: Thu, 27 Mar 2014 - 7:14pm LAST SAVE: Thu, 27 Mar 2014 - 1:26pm BY: BKelly

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NO.	SUBMISSIONS / REVISIONS	DATE
-	MTA REVIEW COMMENTS 3-11-14	03/28/2014
-	100% CD SUBMISSION	12/20/2013

PROJECT

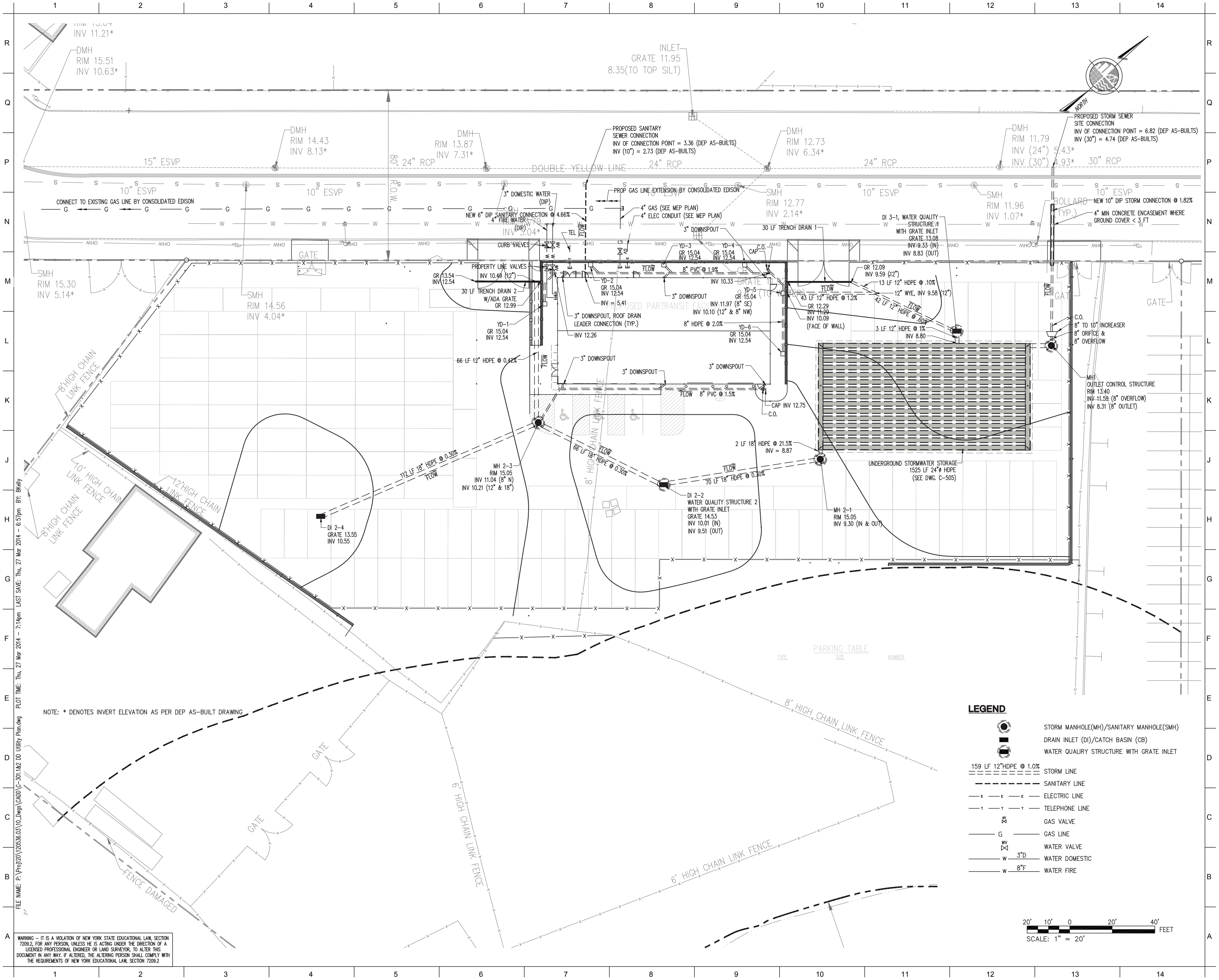
RELOCATED MTA PARATRANSIT FACILITY

COMMERCE AVENUE BRONX, NY 10462

GRADING PLAN

SEAL & SIGNATURE

DATE:	PROJ. ISSUE DATE
PROJECT No:	MEG: 120536
SCALE:	AS SHOWN
DRAWING BY:	-
CHECKED BY:	SLG
DWG No:	C-201
NYC DOB Number:	



NOTE: * DENOTES INVERT ELEVATION AS PER DEP AS-BUILT DRAWING

LEGEND

◉	STORM MANHOLE(MH)/SANITARY MANHOLE(SMH)
▬	DRAIN INLET (DI)/CATCH BASIN (CB)
◉	WATER QUALIRY STRUCTURE WITH GRATE INLET
159 LF 12"HDPE @ 1.0%	STORM LINE
— — —	SANITARY LINE
— E — E — E —	ELECTRIC LINE
— T — T — T —	TELEPHONE LINE
GV ⋈	GAS VALVE
—— G ——	GAS LINE
WV ⋈	WATER VALVE
—— W 3"D ——	WATER DOMESTIC
—— W 8"F ——	WATER FIRE

20' 10' 0 20' 40' FEET
SCALE: 1" = 20'

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FILE NAME: P:\Proj120\120536.03\10_Dwgs\CADD\C-301.1&2 DD Utility Plan.dwg PLOT TIME: Thu, 27 Mar 2014 – 7:14pm LAST SAVE: Thu, 27 Mar 2014 – 6:57pm BY: Bkelly

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PROJECT

RELOCATED MTA
PARATRANSIT FACILITY
COMMERCE AVENUE BRONX, NY 10462

UTILITY PLAN

SEAL & SIGNATURE

DATE:	PROJ. ISSUE DATE
PROJECT No:	MEG: 120536
SCALE:	AS SHOWN
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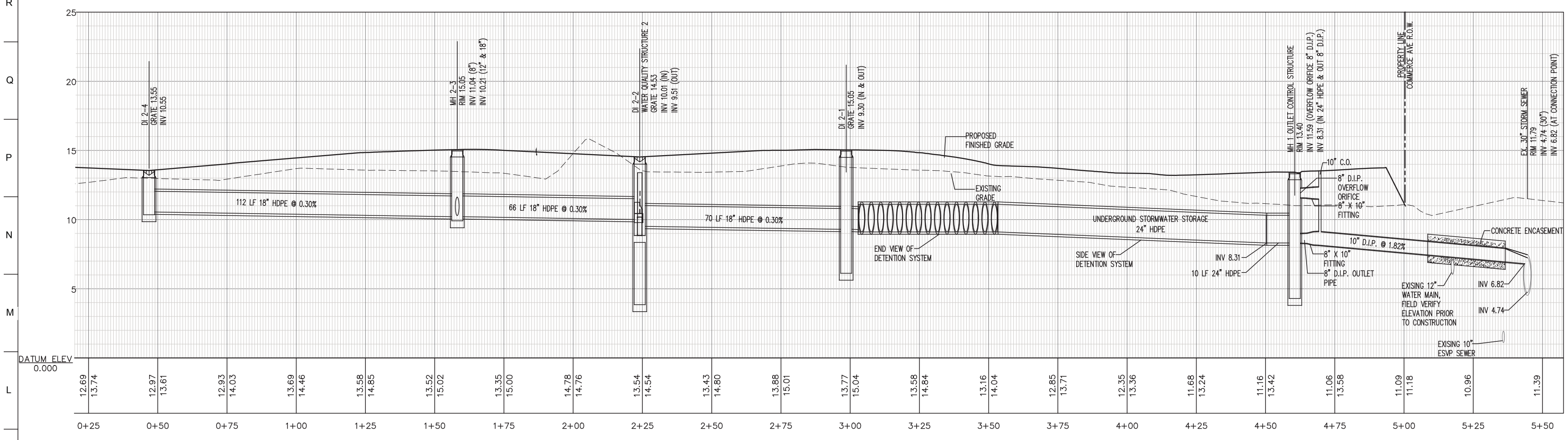
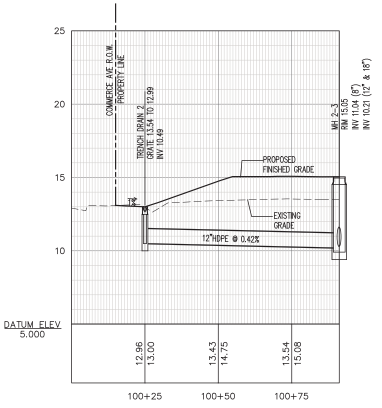
CHECKED BY:	SLG
DWG No:	C-301.1
NYC DOB Number:	



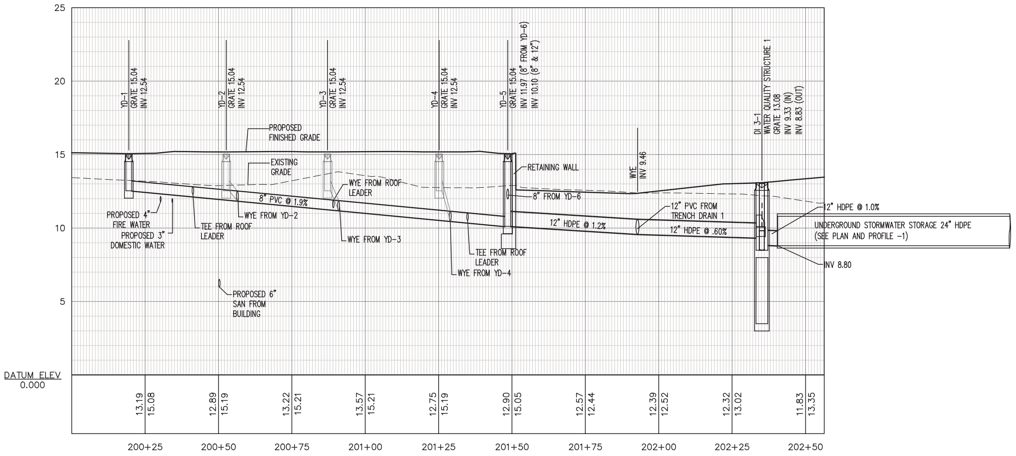
UTILITY PROFILE - 1

HORIZONTAL SCALE 1"=20'
VERTICAL SCALE 1"=4'



UTILITY PROFILE - 2

HORIZONTAL SCALE 1"=20'
VERTICAL SCALE 1"=4'



UTILITY PROFILE - 3

HORIZONTAL SCALE 1"=20'
VERTICAL SCALE 1"=4'

FILE NAME: P:\Proj\120\120536.03\10_Dwgs\CADD\C-301.1&2 DD Utility Plan.dwg PLOT TIME: Thu, 27 Mar 2014 - 7:22pm LAST SAVE: Thu, 27 Mar 2014 - 7:21pm BY: Bkelly

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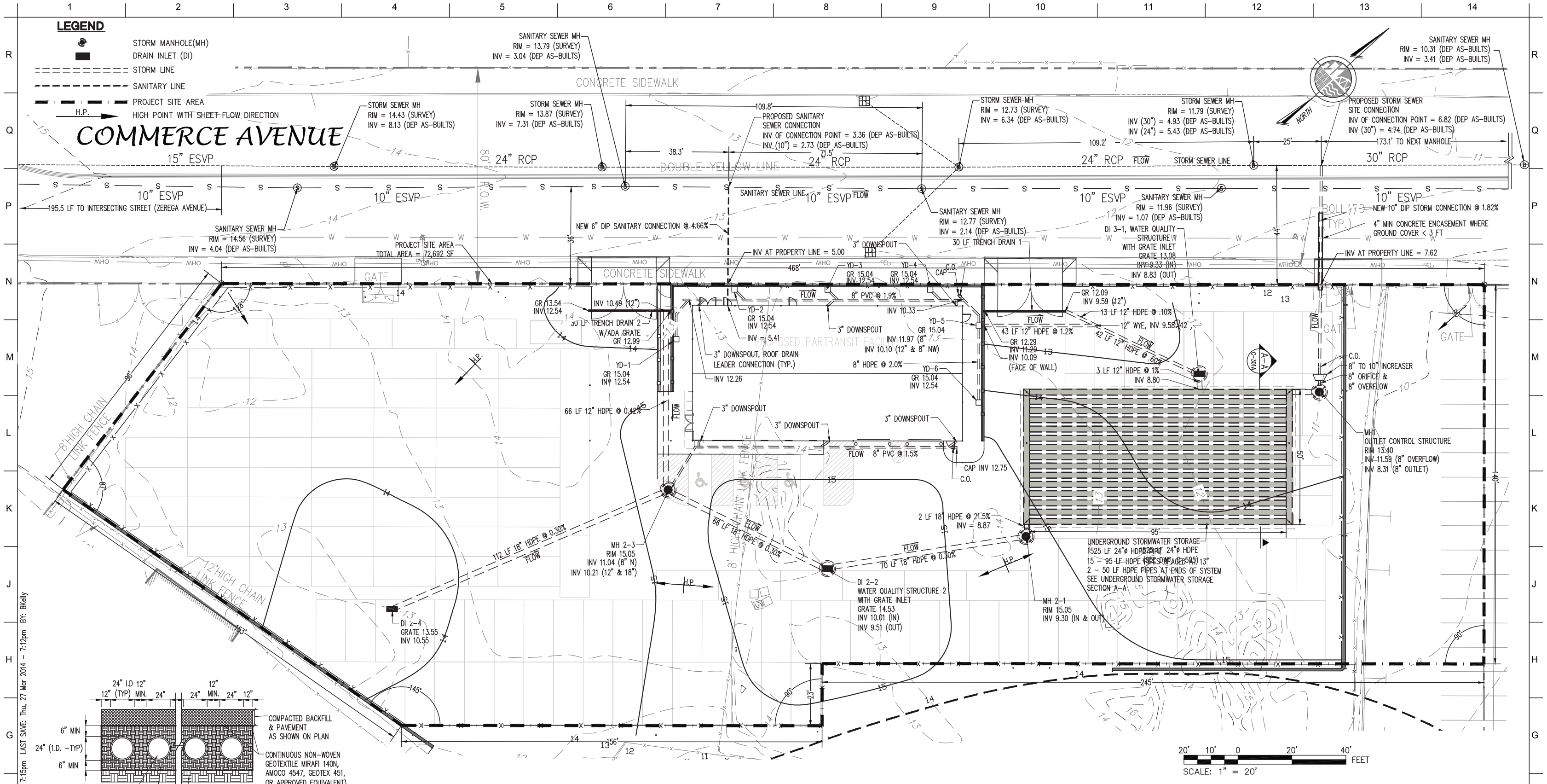
NO.	SUBMISSIONS / REVISIONS	DATE
-	MTA REVIEW COMMENTS 3-11-14	03/28/2014
-	100% CD SUBMISSION	12/20/2013

PROJECT
RELOCATED MTA
PARATRANSIT FACILITY
COMMERCE AVENUE BRONX, NY 10462

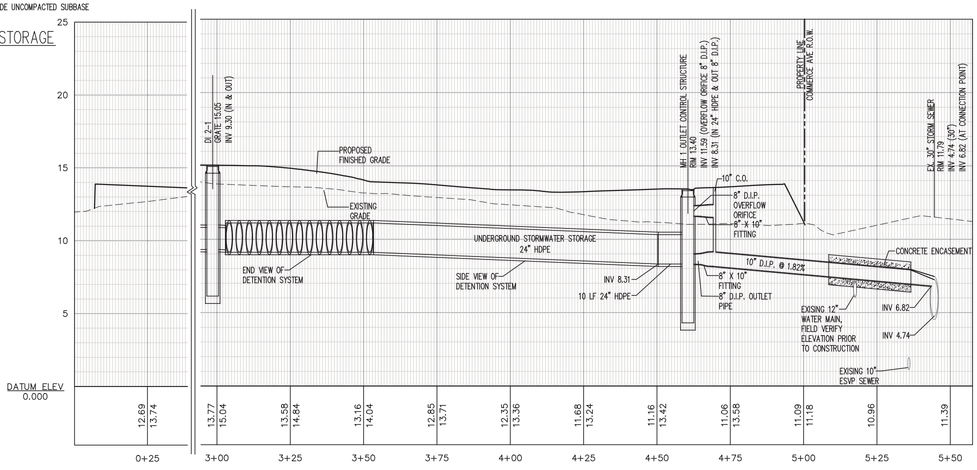
UTILITY PROFILES

SEAL & SIGNATURE

DATE:	PROJ. ISSUE DATE
PROJECT No:	MEG: 120536
SCALE:	AS SHOWN
DRAWING BY:	-
CHECKED BY:	SLG
DWG No:	C-301.2
NYC DOB Number:	



UNDERGROUND STORMWATER STORAGE
SECTION A-A
SCALE: N.T.S.



SANITARY SEWER FLOW

AREA = 72,692 SF = 1.669 ACRES

$Q_{AVG} = \dfrac{(10{,}000\ GAL/ACRE/DAY) \times (1.0) \times (1.669\ ACRES)}{(7.48 \times 86{,}400)}$

FACTOR FOR M1-1 ZONE = 1.0

$Q_{AVG} = 0.0258$ CFS

$Q_{PEAK} = 0.0258$ CFS * 2 = .0516 CFS

SANITARY PIPE CAPACITY

FLOW FOR 6" DIP @ 5.14%

$Q = (A)x(1.486/n)x(R\verb|^|\tfrac{2}{3})x(S\verb|^|\tfrac{1}{2})$

$Q = 1.38 > .0516$ CFS

STORM FLOW

$Q_{ALL} = A_S/14{,}500$

$A_S = 100\ FT \times 467.7\ FT = 46770$ SF
= 1.074 ACRES

$Q_{ALL} = 3.23$ CFS

ROOF AREA = 5,071 SF
PAVED AREA = 65,140 SF
GRASSED AREA = 2,481 SF

$CA = (5{,}071 \times 0.95) + (65{,}140 \times 0.85) + (2{,}481 \times 0.2) = 60{,}683$

$C_{WT} = 60683 / 72692 = 0.835$

$A_T = 72{,}692$ SF = 1.669 ACRES

$Q_{DEV} = (A_T \times C_{WT} \times 5.95) / 43{,}560$

$Q_{DEV} = 8.29$ CFS

STORMWATER DISCHARGE WILL BE RESTRICTED TO 2.50 CFS

$Q_{DRR} = 2.50$ CFS

STORM PIPE CAPACITY

FLOW FOR 10" DIP @ 1.82%

$Q = (A)x(1.486/n)x(R\verb|^|\tfrac{2}{3})x(S\verb|^|\tfrac{1}{2})$

$Q = 2.96 > 2.50$ CFS

OUTFLOW WILL BE CONTROLLED BY AN ORIFICE TUBE AND WILL VARY WITH DEPTH OF STORAGE

$T_V = 0.27[(C_{WT} \times A_T)/Q_{DRR}]\verb|^|.5 - 15$

$T_V = 27.1$ MIN

$V_V = [0.19(C_{WT} \times A_T)/(T_V+15) - 40Q_{DRR}]T_V$

$V_V = 4{,}712\ FT^3$

VOLUME PROVIDED = $(\pi\ (1\ FT)^2)(1525\ LF)$

VOLUME PROVIDED = $4791\ FT^3$

$4791\ FT^3$ PROVIDED > $4{,}712\ FT^3$ REQUIRED

FOR 8" RE-ENTRANT ORIFICE TUBE

$A_O = 0.35$ SF

$D_O = 8$ IN

$G = 32.2\ FT/S^2$

$C_D = 0.52$

$Q_{DRR} = (C_D)(A_O)(2GH)\verb|^|.5$

$H = ((Q_{DRR})^2)/[((C_D)(A_O))^2 \times 2GH]$

$H = 2.95$ FT

$SDR = 1930(Q_{DRR})\verb|^|2/(D_O)\verb|^|4 + D_O/24$

$SDR = 1930(3.23)\verb|^|2/(8)\verb|^|4 + 8/24$

$SDR = 3.28$ FT

FILE NAME: P:\Proj\20\120536.03\10_Dwgs\CADD\C-301A DEP CONNECTION PLAN.dwg PLOT TIME: Thu, 27 Mar 2014 - 7:15pm LAST SAVE: Thu, 27 Mar 2014 - 7:12pm BY: BKelly

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TAX BLOCK: 3838
TAX LOT: P/O 60
COUNTY: BRONX
DOB NUMBER: NONE

NO.	SUBMISSIONS / REVISIONS	DATE
-	MTA REVIEW COMMENTS 3-11-14	03/28/2014
-	REVISIONS TO NYCDEP COMMENTS	03/12/2014
-	REVISIONS TO NYCDEP COMMENTS	02/07/2014
-	100% CD SUBMISSION	12/20/2013

PROJECT

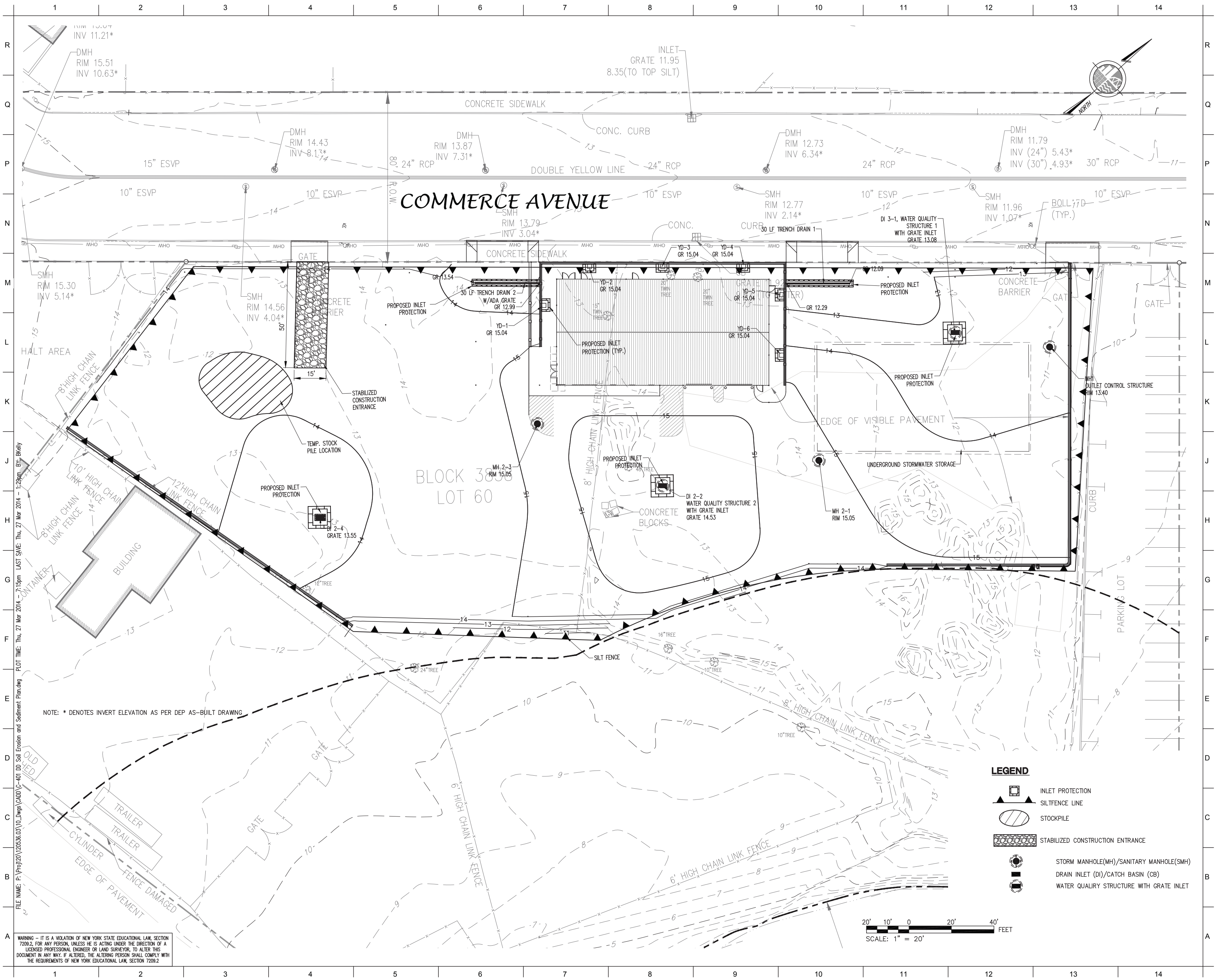
RELOCATED MTA PARATRANSIT FACILITY

COMMERCE AVENUE BRONX, NY 10462

DEP CONNECTION PLAN

SEAL & SIGNATURE

DATE:	PROJ. ISSUE DATE
PROJECT No:	MEG: 120536
SCALE:	AS SHOWN
DRAWING BY:	-
CHECKED BY:	SLG
DWG No:	C-301A
NYC DOB Number:	



NOTE: * DENOTES INVERT ELEVATION AS PER DEP AS-BUILT DRAWING

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FILE NAME: P:\Proj120\120536.03\10_Dwgs\CADD\C-401 DD Soil Erosion and Sediment Plan.dwg PLOT TIME: Thu, 27 Mar 2014 – 7:15pm LAST SAVE: Thu, 27 Mar 2014 – 1:29pm BY: BKelly

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NO.	SUBMISSIONS / REVISIONS	DATE
-	MTA REVIEW COMMENTS 3-11-14	03/28/2014
-	100% CD SUBMISSION	12/20/2013

PROJECT

RELOCATED MTA
PARATRANSIT FACILITY
COMMERCE AVENUE BRONX, NY 10462

SOIL EROSION AND SEDIMENT CONTROL PLAN

SEAL & SIGNATURE

DATE:	PROJ. ISSUE DATE
PROJECT No:	MEG: 120536
SCALE:	AS SHOWN
DRAWING BY:	-
CHECKED BY:	SLG
DWG No:	C-401
NYC DOB Number:	

APPENDIX B

Previous Investigation Results

Legend

- Proposed development boundary
- Boundary of EPM Phase I ESA
- Chain-linked fence
- Soil/groundwater sample
- Soil boring
- Soil vapor sample
- Test pit

Prepared for:
McLaren Engineering Group
100 Snake Hill Road
West Nyack, NY 10994

Prepared by:
ENVIRONMENTAL
PLANNING &
MANAGEMENT, INC.

Figure 2

Sampling Location Diagram
(For Samples Collected June 2013)

Proposed Paratransit
Training Facility
Bronx, New York

EPM Project Number 13033

Table 1.
Summary of Soil Analytical Results Above Regulatory Guidance Values
Proposed MTA Paratransit Training Facility
Bronx, New York 10464

Sample ID:	SP2	B1 (0-4)	B1 (5-9')	B2 (0-4')	B2 (5-9')	B3 (0-4')	B3 (6-10')	B4 (0-4')	B4 (6-10')	B5 (0-4')	B5 (20-25)	T1	T2	Blind Duplicate (from T2)	T3	T4	Part 375 Unrestricted Use SCO	Part 375 Restricted Residential Use SCO	Part 375 Commercial Use SCO
Sample Depth (feet bgs):	0-1	0-4	5-9	0-4	5-9	0-4	6-10	0-4	6-10	0-4	20-25	0-8	0-8	0-8	0-8	0-8			
COMPOUND																	(ppm)		
Volatile Organic Compounds (VOCs)	(ppm)																(ppm)		
Xylene (mixed)												**1.13**					0.26	100	500
1,2,4-Trimethylbenzene												**14**					3.6	52	190
Semi-Volatile Organic Compounds (SVOCs)	(ppm)																(ppm)		
Benzo(a)anthracene	**1.9**				**1.1**			**2.3**	**2.4**					**1.5**		**3.3**	1	1	5.6
Benzo(a)pyrene	**1.8**				**1.2**			**1.8**	**1.8**			**1.2 J**		**1.3**		**2.5**	1	1	1
Benzo(b)fluoranthene	**2.2**				**1.3**			**2.5**	**2.3**			**1.5**		**1.6**		**2.7**	1	1	5.6
Benzo(k)fluoranthene								**0.98**									0.8	3.9	56
Chrysene	**1.8**				**1.1**			**2.2**	**2.5**			**1.1 J**		**1.2**		**3.8**	1	3.9	56
Dibenzo(a,h)anthracene	**0.43 J**			**0.42 J**				**0.34**									0.33	0.33	0.56
Indeno(1,2,3-cd)Pyrene	**1.3**		**0.51 J**	**0.69 J**	**0.85**			**1.3**	**1.1**	**0.7 J**		**1.1 J**		**0.63 J**		**0.88 J**	0.5	0.5	5.6
Metals	(ppm)																(ppm)		
Arsenic, Total															**73**		13	16	16
Barium, Total	**370**		**480**		**410**					**400**		**340**			**720**	**360**	350	400	400
Beryllium, Total	**14**									**49**							7.2	72	590
Cadmium, Total	**6.4**	**2.8**						**2.8**		**5.4**		**5.3**				**2.9**	2.5	4.3	9
Chromium, Total	**100**	**31**			**52**					**130**		**51**	**41**		**34**	**46**	30*	180*	1,500*
Copper, Total	**1,600**	**170**		**360**	**930**	**56**		**220**		**2,600**	**81**	**1,400**	**91**	**150**		**760**	50	270	270
Lead, Total	**1,500**	**520**	**400**	**590**	**9,100**	**140**	**82**	**490**		**2,400**		**2,400**	**320**	**510**	**78**	**490**	63	400	1,000
Mercury, Total	**0.31**	**0.35**	**0.57**	**0.2**		**0.21**		**0.27**		**0.34**		**0.95**	**0.22**	**0.41**	**0.23**		0.18	0.81	2.80
Nickel, Total	**190**			**43**	**89**			**56**		**300**		**47**		**39**		**160**	30	310	310
Zinc, Total	**7,200**	**390**	**290**	**1,000**	**4,800**	**180**		**2,000**	**140**	**18,000**	**370**	**2,000**	**490**	**690**		**3,500**	109	10000	10,000
Polychlorinated Biphenyls (PCBs)	(ppm)																(ppm)		
Aroclor 1254				**0.167**								**0.117**					0.1	1.0	1.0
Aroclor 1260												**0.142**					0.1	1.0	1.0
Total PCBs				**0.3176**				**0.2063**		**0.1573**		**0.3207**	**0.338**	**0.1028**			0.1	1.0	1.0
Pesticides	(ppm)																(ppm)		
Dieldrin		**0.0148**	**0.00762 J**			**0.0511**											0.005	0.2	1.4
4,4'-DDE														**0.00771 J**			0.0033	8.9	62
4,4'-DDD		**0.0226**				**0.0247**		**0.0185**				**0.0191**				**0.00416**	0.0033	13	92
4,4'-DDT	**0.0656 J**	**0.0228 J**	**0.0176 J**		**0.0864**	**0.0561**		**0.0172 J**	**0.00556**	**0.00521**		**0.0374**	**0.0329**	**0.0114 J**	**0.00687**	**0.0136**	0.0033	7.9	47
cis-Chlordane	**0.202**																0.094	4.2	24

Notes:

*	SCOs are for Trivalent Chromium. The reported results are for Total Chromium.
🟩	Concentration above the indicated NYSDEC Part 375 SCO for Unrestricted Use
🟨	Concentration above the indicated NYSDEC Part 375 SCO for Restricted Residential Use
🟧	Concentration above the indicated NYSDEC Part 375 SCO for Commercial Use
BGS	Below ground surface
J	Analyte concentration is an estimate due to detection below the laboratory reporting limit.
NA	No regulatory guidance value established
PPM	Parts per million
SCO	NYSDEC Remedial Program Soil Cleanup Objective; Subpart 375-6(a,b), December, 2006

Table 2.
Summary of Groundwater Analytical Results Above Regulatory Guidance Values
Proposed MTA Paratransit Training Facility
Bronx, New York 10464

Sample ID:	GW1	GW3	GW5	NYSDEC Class GA Standards / Guidance Values*	NYCDEP Sewer Effluent Limitations
COMPOUND					
Semi-Volatile Organic Compounds (SVOCs)		µg/L		µg/L	
Acenaphthene		**40**		20	NA
Naphthalene		**45**		10	47
Benzo(a)anthracene	**0.7**	**3.9**	**0.07 J**	0.002	NA
Benzo(a)pyrene	**0.66**	**3**		ND	NA
Benzo(b)fluoranthene	**0.83**	**4.6**		0.002	NA
Benzo(k)fluoranthene	**0.55**	**1.8**		0.002	NA
Chrysene	**0.89**	**3.4**	**0.06 J**	0.002	NA
Indeno(1,2,3-cd)Pyrene	**0.45**	**2.5**		0.002	NA
Metals (Total)		µg/L		µg/L	
Aluminum, Total	**1,440**	**2,600**	**2,590**	100	NA
Antimony, Total	**3.2**			3.0	NA
Cobalt, Total			**5.72**	5.0	NA
Iron, Total	**7,490**	**6,380**	**4,880**	300	NA
Lead, Total	**577.7**	**265.1**	**34.7**	25	2,000
Magnesium, Total	**44,700**		**221,000**	35,000	NA
Manganese, Total		**451.8**		300	NA
Mercury, Total	**1.81**			0.7	50
Sodium, Total	**234,000**	**199,000**	**1,810,000**	20,000	NA
Vanadium, Total	**70.93**	**65.33**	**78.61**	14	NA
Metals (Dissolved)		µg/L		µg/L	
Aluminum, Dissolved	**410**	**458**		100	NA
Antimony, Dissolved	**4.88**			3.0	NA
Iron, Dissolved	**1,380**	**1,060**		300	NA
Lead, Dissolved	**255.9**	**50.04**		25	2,000
Magnesium, Dissolved	**42,700**		**204,000**	35,000	NA
Manganese, Dissolved		**359.9**		300	NA
Sodium, Dissolved	**230,000**	**200,000**	**1,740,000**	20,000	NA
Vanadium, Dissolved	**43**	**25.08**	**32 J**	14	NA

Notes:

*	NYSDEC Technical & Operational Guidance Series 1.1.1 Ambient Water Quality Standards And Guidance Values And Groundwater Effluent Limitations, June 1998
🟩	Concentration above the indicated Class GA Value
🟨	Concentration also above the indicated Sewer Effluent Limitation
J	Analyte concentration is estimated due to detection below the laboratory reporting limit.
µg/L	Micrograms per liter

TABLE 3 (Page 1 of 2)
VOCs and Methane in Soil Vapor
Proposed MTA Paratransit Training Facility
Bronx, New York 10464

Sample ID:	SV1	SV2	SV3	USEPA National Ambient Air Averages*	NYSDOH Air Guideline Values**
COMPOUND	RESULTS µg/m3			µg/m3	
Propylene	76.4	< 85.7	1.13	NA	NA
Dichlorodifluoromethane	**63.8**	**101**	**2.66**	2.2	NA
Chloromethane	< 0.826	< 41.1	1.29	1.5	NA
Freon-114	< 2.8	< 139	< 1.4	0.31	NA
Vinyl chloride	< 1.02	< 50.9	< 0.511	32	NA
1,3-Butadiene	5.64	< 44	< 0.442	NA	NA
Bromomethane	< 1.55	< 77.3	< 0.777	12	NA
Chloroethane	< 1.06	< 52.5	< 0.528	220	NA
Ethanol	25.4	< 469	35	NA	NA
Vinyl bromide	< 1.75	< 87	< 0.874	NA	NA
Acetone	**154**	< 237	**295**	16	NA
Trichlorofluoromethane	**366**	**382**	**1.69**	1.4	NA
Isopropanol	< 2.46	< 122	3.1	NA	NA
1,1-Dichloroethene	< 1.59	< 78.9	< 0.793	18	NA
Methylene chloride	< 6.95	< 346	< 3.47	5.6	NA
3-Chloropropene	< 1.25	< 62.3	< 0.626	NA	NA
Carbon disulfide	**11.6**	< 62	< 0.623	0.3	NA
Freon-113	< 3.07	< 153	< 1.53	2.7	NA
trans-1,2-Dichloroethene	< 1.59	< 78.9	< 0.793	3	NA
1,1-Dichloroethane	< 1.62	< 80.5	< 0.809	0.16	NA
Methyl tert butyl ether	< 1.44	< 71.7	< 0.721	NA	NA
Vinyl acetate	< 1.41	< 70.1	< 0.704	NA	NA
2-Butanone	**14.4**	< 58.7	**14.5**	1.9	NA
cis-1,2-Dichloroethene	< 1.59	< 78.9	< 0.793	1.3	NA
Ethyl Acetate	< 3.6	< 179	< 1.8	NA	NA
Chloroform	2.58	< 97.2	< 0.977	3.1	NA
Tetrahydrofuran	< 1.18	< 58.7	< 0.59	NA	NA
1,2-Dichloroethane	< 1.62	< 80.5	< 0.809	1.6	NA
n-Hexane	**125**	< 70.1	< 0.705	13	NA
1,1,1-Trichloroethane	**16.4**	< 109	< 1.09	5	100
Benzene	**22.2**	< 63.6	< 0.639	8.9	NA
Carbon tetrachloride	< 2.52	< 125	< 1.26	1	5
Cyclohexane	4.72	< 68.5	< 0.688	NA	NA
1,2-Dichloropropane	< 1.85	< 92	< 0.924	0.74	NA
Bromodichloromethane	< 2.68	< 133	< 1.34	0.01	NA
1,4-Dioxane	< 1.44	< 71.7	< 0.721	NA	NA
Trichloroethene	< 2.15	**240**	< 1.07	2.7	5
2,2,4-Trimethylpentane	< 1.87	< 92.9	0.943	9.3	NA
Heptane	**79.1**	< 81.6	< 0.82	6.6	NA
cis-1,3-Dichloropropene	< 1.82	< 90.3	< 0.908	110	NA
4-Methyl-2-pentanone	3.09	< 81.6	3.64	NA	NA
trans-1,3-Dichloropropene	< 1.82	< 90.3	< 0.908	NA	NA
1,1,2-Trichloroethane	< 2.18	< 109	< 1.09	6	NA
Toluene	**121**	< 75	1.69	32	NA
2-Hexanone	< 1.64	< 81.6	1.84	NA	NA
Dibromochloromethane	< 3.41	< 170	< 1.7	0.27	NA

TABLE 3 (Page 2 of 2)
VOCs and Methane in Soil Vapor
Proposed MTA Paratransit Training Facility
Bronx, New York 10464

Sample ID:	SV1	SV2	SV3	USEPA National Ambient Air Averages*	NYSDOH Air Guideline Values**
COMPOUND	RESULTS µg/m3			µg/m3	
1,2-Dibromoethane	< 3.07	< 153	< 1.54	2.5	NA
Tetrachloroethene	**239**	**28,000**	< 1.36	5.8	100
Chlorobenzene	< 1.84	< 91.6	< 0.921	1.5	NA
Ethylbenzene	**53.9**	< 86.4	< 0.869	20	NA
p/m-Xylene	**223**	< 173	< 1.74	96	NA
Bromoform	< 4.14	< 206	< 2.07	0	NA
Styrene	**3.22**	< 84.7	< 0.852	1.5	NA
1,1,2,2-Tetrachloroethane	< 2.75	< 137	< 1.37	0.7	NA
o-Xylene	**83**	< 86.4	< 0.869	33	NA
4-Ethyltoluene	35.2	< 97.8	1.92	NA	NA
1,3,5-Trimethylbenzene	**32.7**	< 97.8	1.98	4	NA
1,2,4-Trimethylbenzene	**132**	< 97.8	5.85	6.7	NA
Benzyl chloride	< 2.07	< 103	< 1.04	0.07	NA
1,3-Dichlorobenzene	< 2.4	< 120	< 1.2	5.3	NA
1,4-Dichlorobenzene	< 2.4	< 120	< 1.2	6	NA
1,2-Dichlorobenzene	< 2.4	< 120	< 1.2	7.8	NA
1,2,4-Trichlorobenzene	< 2.97	< 148	< 1.48	1.3	NA
Hexachlorobutadiene	< 4.27	< 212	< 2.13	0.38	NA

Sample ID:	SV1	SV2	SV3	Lower Explosive Limit (LEL)
COMPOUND	%			%
Methane	< 0.204	< 0.174	< 0.182	5

Notes:

<	Analyte value is less than the laboratory detection limit for the listed compound
*	US Environmental Protection Agency: Average National Ambient Outdoor Air VOCs, NYS Department of Health - Guidance For Evaluating Soil Vapor Intrusion in the State of New York, October 2006.
**	Air guideline values contained in NYS Department of Health - Guidance For Evaluating Soil Vapor Intrusion in the State of New York, October 2006.
Bold	Concentration above the indicated USEPA National Ambient Air Average value
🟩	Concentration above the indicated NYSDOH Air Guideline value
µg/m3	Micrograms per cubic meter
NA	No regulatory guidance value established

APPENDIX C

Sample and Analysis Project Plan

SAMPLING AND ANALYSIS PROJECT PLAN

SITE CHARACTERIZATION WORK PLAN

PROPOSED MTA PARATRANSIT FACILITY
COMMERCE AVENUE
BRONX, NY

May 21, 2015

EPM, Inc.

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FIGURES

Figure 1. Site Location

Figure 2. Proposed Sample Location Plan

APPENDICES

Appendix C-A: Field Log Sheets

1.0 INTRODUCTION

This Sampling and Analysis Project Plan (SAPP) is prepared as part of the Site Characterization Work Plan to investigate the property proposed for the new Metropolitan Transportation Authority (MTA) Paratransit Facility, located on Commerce Avenue, Bronx, New York (Figure 1 – Project Site Location). The SAPP outlines the specific sample collection and analysis procedures that will achieve the objectives of the investigation. The quality assurance/quality control methods to be used to ensure reliable accurate data are detailed in the Quality Assurance Project Plan (QAPP) provide as Appendix D. All field activities will be conducted in accordance with the Health and Safety Plan provided as Appendix E.

The objectives of this investigation are to further characterize onsite soil, groundwater, and soil vapor conditions; to investigate soil vapor and groundwater conditions offsite along Commerce Avenue; and, to determine surface aquifer flow patterns.

The results of the investigation will be used to identify appropriate mitigation measures to protect future users of the new Paratransit Facility from exposure to hazardous materials. The results will also be used to evaluate the likelihood that the project site could be a source of soil vapor or groundwater contamination.

The data collected during the investigation will be utilized to provide information to satisfy the following Data Quality Objectives (DQOs):

- Further delineate soil, groundwater, and soil vapor conditions within the boundaries of the project site;
- Identify conditions in offsite soil vapor and offsite groundwater along Commerce Avenue; and,
- Determine groundwater flow patterns in the immediate vicinity of the site.

The data will be evaluated as follows:

- Onsite data will be used to determine if the mitigation measures contained in the existing RAP are sufficient for construction of the proposed Paratransit Facility;
- Offsite and onsite data will be evaluated in the context of groundwater flow patterns to determine the likelihood of any onsite or offsite contaminant sources.

Once the field investigation activities have been performed, a determination of the adequacy of the investigation will be made relative to the data quality objectives. Additional investigation may be required if all data quality objectives have not been met.

2.0 SITE MANAGEMENT PLAN

2.1 Site Access, Security, and Permits

The project site is currently vacant and owned by the City of New York. A locked security fence surrounds the entire site. No permits are considered necessary for work within the property line of the site. New York City Department of Transportation (NYCDOT) Sidewalk Opening Permits will be obtained in order to install the monitoring wells and temporary soil vapor implants within the sidewalk along Commerce Avenue. Access to the onsite sampling locations will be through a secured gate. During sampling activities, the Field Geologist and/or the Site Safety Officer (SSO) will be responsible for recording the names, company represented, and the arrival and departure times of all persons who enter the site. Visitors to the site during field activities must comply with all aspects of the Health and Safety Plan provided as Appendix E. If the visitors have not received the proper OSHA 40-hour hazardous waste site training, they must be accompanied by trained personnel when they are in the work areas.

2.2 Traffic Control and Parking

Only those vehicles directly involved with the field investigation activities (i.e., drill rig and support vehicles) will have access to work areas. All other vehicles will park in an area designated by the Field Geologist or SSO. It is expected that the borings within the public sidewalk can be performed without traffic interruption to Commerce Avenue since a compact track mount drill rig will be used that will not encroach into the roadway. Safety cones and caution tape will be established around the work area, and all work within the sidewalk will be conducted in accordance with the NYSDOT Permit stipulations.

2.3 Waste Disposal

Drill cuttings and well development water generated during installation of the offsite wells, along with all decontamination liquids/solids, and contaminated personal protective equipment will be collected in USDOT-approved 55-gallon drums and temporarily stored onsite pending waste classification testing and transport to a permitted disposal facility. Excess drill cuttings from the onsite borings will be returned to the borings they originated from unless gross signs of contamination are observed, in which case the cuttings will be drummed for offsite disposal. Likewise, well development water from the onsite wells will be discharged to the unpaved land surface of the site unless contamination is observed, in which case the liquids will be drummed for offsite disposal.

The specific waste transport firm and disposal facility(s) have not yet been determined. Only properly permitted transporters and disposal sites will be used. The fully executed waste disposal manifests for any wastes disposed offsite will be included in the Site Characterization Findings Report.

3.0 SAMPLING AND ANALYSIS METHODS

3.1 Soil Sampling and Analysis

Soil samples from the ten Geoprobe borings will be continuously field screened from ground surface to the boring termination depth. The cores will be collected in 5-foot long dedicated acetate liners. The soil will be field screened with a freshly calibrated photo-ionization detector (PID) for indications of organic vapors, and for visual or odor evidence of contamination. Three soil samples will be collected for laboratory analysis from each boring. A soil sample will be collected from each boring for lab analysis from the 0 to 2-foot depth, a second soil sample will be collected from each boring from the 2-foot interval at the boring terminus, and a third sample will be collected from a location with the greatest field evidence of contamination from between the top 2 feet of soil and the bottom of the boring.

Soil samples will be prepared for the laboratory by placing the selected interval into a stainless steel mixing bowl, separating it into quarters, and placing an equal portion of each quarter into the proper laboratory provided containers. To minimize volatilization, soil samples collected for VOC analysis will not be composited in this manner, but rather will consist of discreet samples collected from locations with the greatest PID readings or other evidence of VOC impacts. The initial 24 inches of soil will be field screened for indications of VOCs at each boring. A discreet sample will be collected for VOC analysis from each boring from the location with the greatest evidence of impact from the upper 24 inches of soil, or from the upper 6 inches if no evidence of impacts are observed. The soil samples will be analyzed for Target Compound List (TCL) Volatile Organic Compounds+10 TICs (VOCs by Method 8260); TCL Semi-Volatile Organic Compounds+20 TICs (TCL SVOCs by Method 8270); PCBs by Method 8082, Pesticides by Method 8081, and Target Analyte List (TAL) metals by methods 6010/7000. The samples will be collected, stored, shipped, and analyzed according to the procedures detailed in the attached SAPP and QAPP. The QAPP contains a summary of the types of samples, analytical methods, and quality assurance samples that will be collected and analyzed.

3.2 Groundwater Sampling and Analysis

The wells will be measured for depth to water and free product with an electronic interface probe. After these measurements are recorded, the wells will be purged and sampled with a low flow method bladder pump utilizing USEPA low-flow sampling procedures. Field measurements will be recorded during purging for pH, temperature, specific conductance, turbidity, reduction-oxidation potential, and dissolved oxygen until these parameters stabilize indicating that the well contains a representative groundwater sample. The purge volumes and chemistry measurements will be recorded on Low Flow Purge and Sampling Logs, an example of which is included in Appendix C-A.

One round of groundwater samples will be collected from the eight wells for laboratory analysis of VOCs+10, SVOCs+20, PCBs, Pesticides, and TAL Metals (total unfiltered).

3.3 Soil Vapor Sampling and Analysis

A Geoprobe will be used to advance 1.5-inch outer diameter rods with expendable vapor sampling points to a sampling depth of six feet below grade. If groundwater is encountered at deeper than expected depths, a field decision will be made regarding placing the vapor probe deeper if possible. Current soil data for the site does not indicate a significant onsite source of VOCs in soil; however, the Geoprobe soil sampling will be performed prior to the soil vapor sampling so that the soil vapor locations can be adjusted to suspected source locations if identified.

A 12-inch long stainless steel vapor sampling implant will be inserted through the rod such that it is positioned at the bottom of the borehole. Dedicated Teflon tubing will be attached to the disposable implant. The annular space around the screen implant will be backfilled with clean #1 sand to two feet above the implant screen. A bentonite seal will be placed above the sand extending to ground surface. The sample tubing will then be connected to a T connector 3-way valve apparatus with one end of the T connector attached to a vacuum pump and the other end attached to a batch certified summa canister with calibrated flow controller. The tubing will be purged at least approximately two volumes with a Gillian vacuum pump set at a flow rate of 0.2 liters per minute.

A tracer gas (helium) will be used to verify that ambient air does not dilute the soil gas sample being collected. The gas will be used to enrich the atmosphere where the sample tubing meets the ground surface to test the borehole seal and confirm that ambient air is not entering the sample. A 5-gallon bucket will be placed over the borehole and the tracer gas pumped into the bucket. A tedlar bag will be connected to the Gillian pump and filled with the purge gas as the helium is added to the bucket. Both the purge gas from the sample tubing and the helium enriched air in the bucket will be measured for helium with a Gas Check 3000 meter. If the tracer gas screening indicates the rate of helium detected in the sample tubing is greater than 20 percent of the helium detected in the bucket, the seals around the sampling apparatus will be reset and purged again until the tracer gas is no longer present at levels greater than 20 percent of the enriched air within the bucket.

After the purge and tracer gas verification procedures, the valve leading to the pump will be shut, the pump shut off, and the soil vapor then directed to the summa canister for collection of the sample. The flow controller on the summa canister will be set to a flow rate of 0.2 liters per minute or lower, and the soil vapor sample collected for 2 hours. After the sample is collected, the borehole will be backfilled with clean sand, a bentonite seal, and grouted to the land surface. The summa canisters will then be shipped to the laboratory for analysis of VOCs by EPA Method TO-15 and methane by EPA Method TO-3. The purge data for each sample location will be recorded on Soil Vapor Sampling Field Logs, an example if which is provided in Appendix C-A.

3.4 Qualitative Human Health Exposure Assessment

A qualitative human health exposure assessment will be conducted in accordance with the requirements of the New York State Department of Health and NYSDEC. The exposure assessment will identify the potential routes of human exposure to contaminants at the site or migrating from the site, and any potential exposure pathways that may exist. Potential exposure pathways will be evaluated by identifying 1) contaminant sources, 2) contaminant release and transport mechanisms, 3) points of exposure, 4) routes of exposure, and 5) receptor populations. Additional data requirements will be identified where appropriate.

3.5 Site Survey

Upon completion of the sampling program, the vertical and horizontal locations of the soil borings and monitoring wells will be surveyed by a New York State Licensed Surveyor. The surveyed Site Plan will be provided in the Findings Report.

4.0 DECONTAMINATION PROCEDURES

Designated decontamination areas will be established by the field Geologist. All non-disposable sampling equipment (augers, stainless steel mixing bowls, trowels, spoons, etc.) will be decontaminated prior to initial use, between sample locations, and prior to leaving the site) as follows:

1. Use a bristle brush and nonphosphate detergent (such as Alconox) in potable water to scrub equipment.
2. Rinse with potable water.
3. Rinse with distilled water.
4. Air dry the equipment and place on clean plastic for next use.

5.0 DATA MANAGEMENT PLAN

Proper management and documentation of field activities is essential to ensure that all field work is conducted efficiently and in accordance with the Field Sampling Plan and QAPP. Presented below are procedures for field documentation, sample handling, packaging and shipping, QA/QC, and implementing field changes and corrective actions.

5.1 Field Documentation

Field log sheets for collecting data during purging and sampling of the wells and during soil vapor sampling are provided in Appendix C-A. Bound field notebooks will be used to document daily field activities. Entries will be made in as much detail as possible so conditions may be reconstructed with minimal reliance on memory. Daily entries made in the log books may include the following:

- Description and Sketch of Sample Locations,
- Number(s) and volume(s) of sample(s) taken,
- Description of sampling methodology,
- Date and time of sample collection,
- Sample Identification,
- Split samples (with another party),
- Field observations, including the results of field analysis,
- A record of subcontractors and visitors at the site, and,
- Signature or initials of personnel responsible for log entries.

Incoming documents will be date-stamped and filed. If necessary, the documents will be distributed to the appropriate project personnel. In addition, all notes from project meetings and telephone conversations will be filed, along with other project documents.

5.2 Sample Identification

All samples will be given a unique designation that will be recorded in the field log book, on the label affixed to the sample container, and on the Chain-of-Custody form. Blind field replicate samples will be given numbers that will not indicate the location being replicated. The replicate location will be recorded in the field notes. Trip blank and field blank samples will be labeled as “TB” and “FB”, respectively, followed by a number and the date of shipment to the laboratory. Each sample bottle will be labeled with the sample designation as well as the date and time of collection, type of laboratory analysis, and initials of person(s) collecting the sample.

5.3 Sample Handling, Packaging, and Shipping

All analytical samples will be placed in the appropriate sample containers as specified in the current NYSDEC Analytical Services Protocol (ASP). Sample volume requirements, sample container requirements, holding times, and preservation requirements are specified in the attached QAPP. All samples requiring chemical analysis will be shipped from the site to arrive at the laboratory within 48 hours of collection. The laboratory will be notified by the Project Manager in a timely manner of the impending arrival of the samples. The laboratory will be prepared to receive the sample and perform preliminary extractions or analyses within the analytical method recommended holding times.

Prior to packaging any sample for shipment, the sample containers will be checked for proper identification and compared to the Sampling Log and to the Chain-of-Custody Form for accuracy. The samples will then be wrapped with a cushioning material and placed in a cooler. Sufficient amounts of bagged ice or ice packs will be placed in the cooler to maintain the samples at 4° Celsius during shipment to the laboratory.

All necessary documentation required to accompany the samples during shipment, including the Chain-of-Custody Record, will be placed in a sealed plastic bag and taped to the underside of the cooler lid. When the cooler is ready, it will be sealed with tape, and custody seals will be placed in such a manner that any opening of the cooler prior to arrival at the laboratory can be detected.

6.0 QUALITY ASSURANCE/QUALITY CONTROL

To identify the precision, accuracy, representativeness, comparability, and completeness of data collected, quality control checks and quality assurance audits will be performed as described in the attached QAPP. Specific procedures that will be followed in the field include the collection or preparation of QA/QC samples and the performance of field audits.

6.1 QA/QC Samples

Blank and duplicate samples will be prepared during the field investigation. The purpose of these samples is to:

1. Check sample bottle preparation;
2. Evaluate the effectiveness of the field decontamination procedures and;
3. Evaluate the “reproducibility” and accuracy of laboratory analytical procedures.

Equipment/field blanks will be performed for the type of sampling apparatus used (i.e. drill rig rods, sample compositing bowls, etc.). The equipment / field blank will be prepared by pouring analyte free water through the particular sampling device that has been decontaminated according to the procedure specified in the equipment decontamination section.

6.2 Performance of Field Audits

During field activities, the Project Manager will periodically accompany sampling personnel into the field to verify that the field sampling plan is being implemented properly. All findings will be documented and filed.

6.3 Field Changes and Corrective Actions

Frequently, unanticipated conditions necessitate modification to the proposed field activities. If it becomes necessary to modify the field program, the EPM Project Manager will notify the NYSDEC of the necessary changes. All changes made in the field during the investigation program will be documented and signed by the EPM Site Geologist. The EPM Project Manager is responsible for controlling, tracking, and implementing program changes. Documentation of the changes will be included in the findings report that will be submitted to NYSDEC.

FIGURES

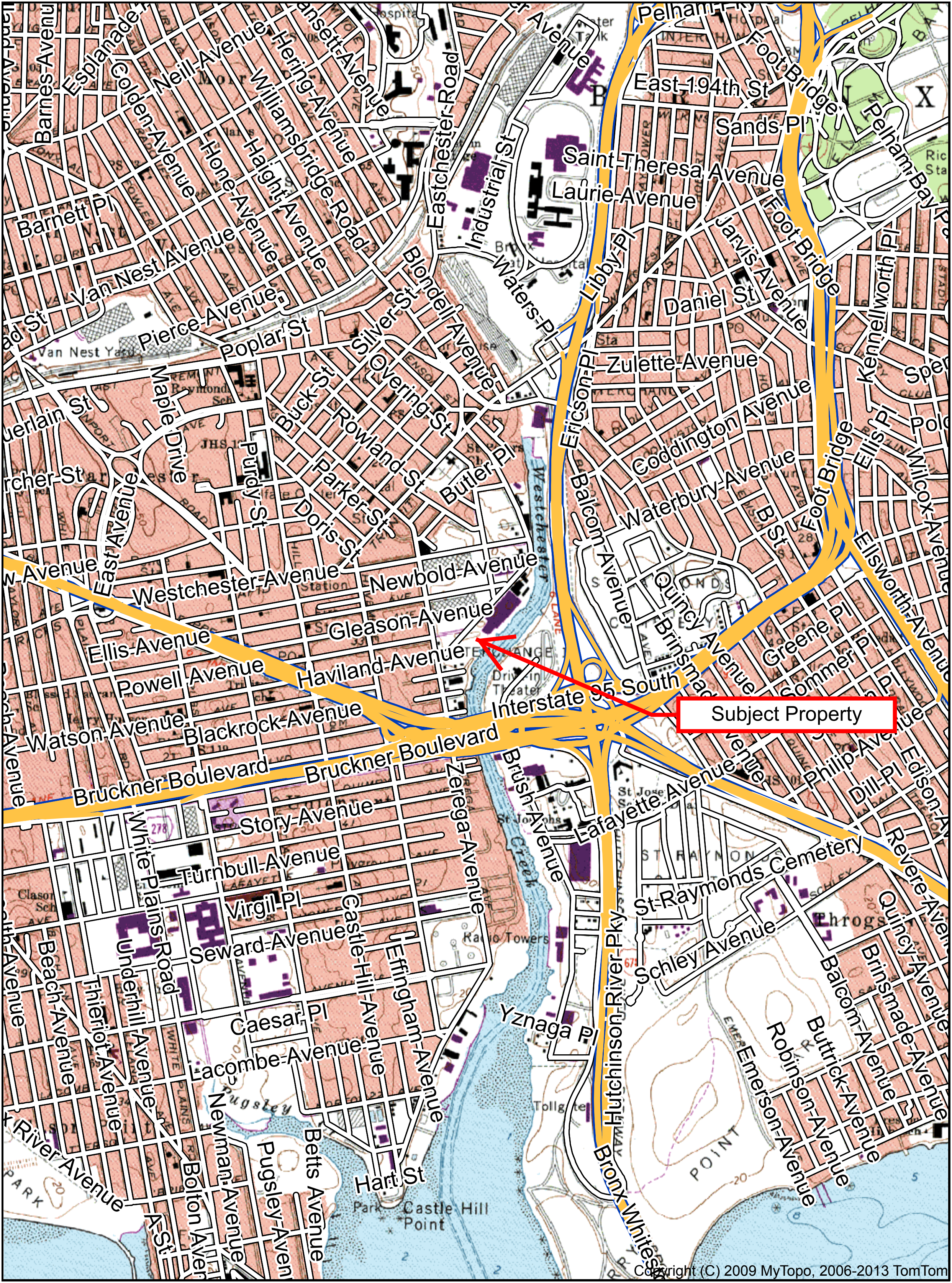

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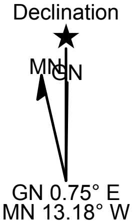
Figure 1 - Site Location Map

Map Name: FLUSHING
Horizontal Datum: NAD27
Scale: 1 inch = 2,000 ft.
Map Center: 040° 49' 54.39" N 073° 50'



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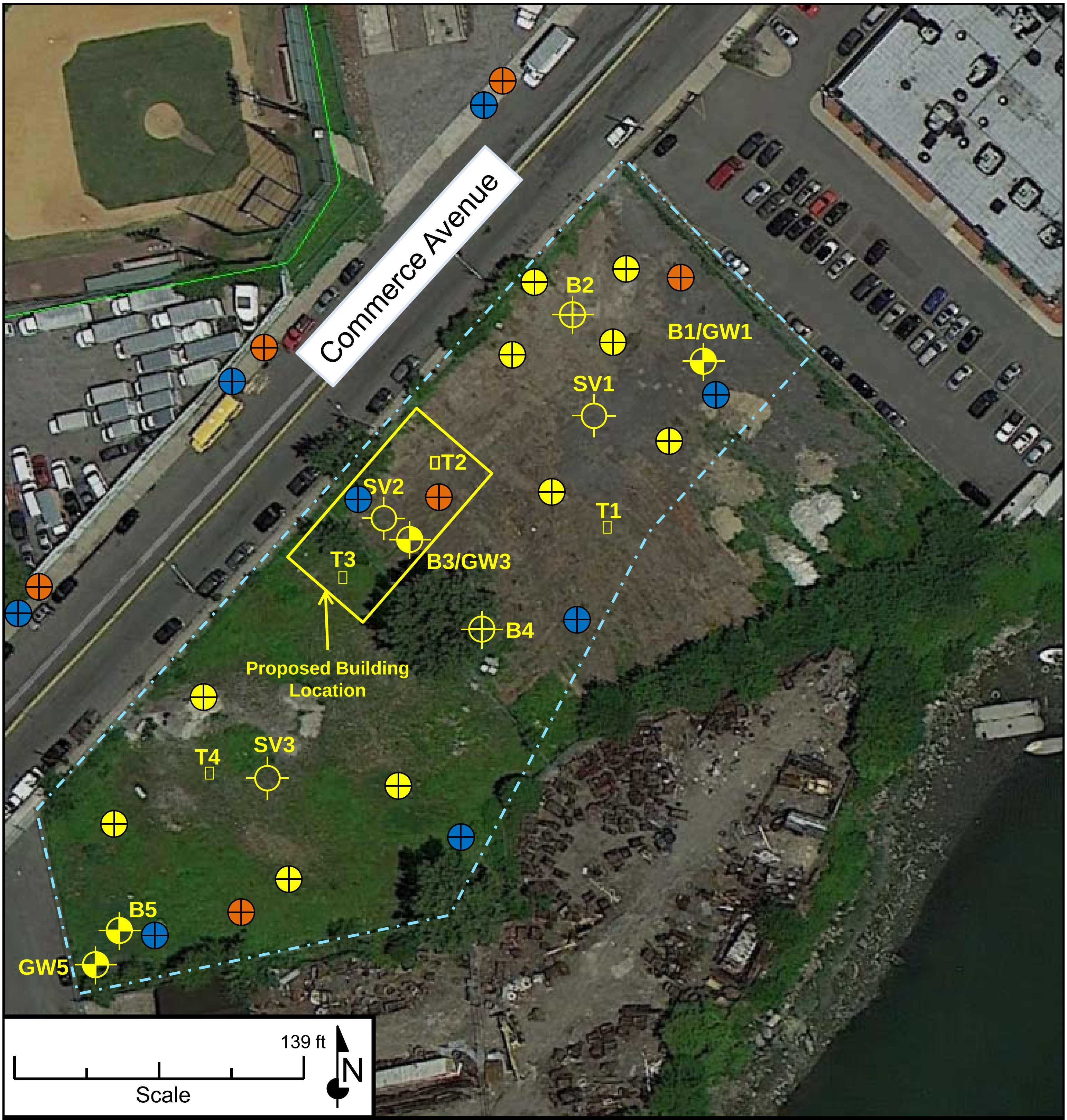

Legend

- Site boundary
- Proposed soil boring
- Proposed monitoring well
- Proposed soil vapor sample
- Prior soil/groundwater sample
- Prior soil boring location
- Prior soil vapor sample
- Prior test pit

Prepared for:

NYCEDC
110 William Street
New York, NY 10038

Prepared by:

ENVIRONMENTAL PLANNING & MANAGEMENT, INC.

Figure 2:

Proposed Sample Location Plan

Site Characterization
Proposed Paratransit Facility
Commerce Avenue
Bronx, NY 10462
April 20, 2015

Appendix C-A

Field Data Log Sheets

SUMMA CANISTER FIELD SAMPLING LOG

Site Name / Location: ____________________

Name of Sampler: ____________________

Company: ____________________

Date of Sampling: ____________________

Sample ID:							
Summa Canister ID:							
Flow Controller ID:							
Summa Canister Volume:							
Purge Start Time:							
Purge Stop time:							
Purge Duration (min.):							
Purge Volume:							
Tracer Gas Results:							
Pressure Gauge before Sampling							
Sample Start Time:							
Sample Stop time:							
Total Sample Time (min):							
Final Pressure Gauge:							

Comments:

LOW FLOW GROUNDWATER PURGING AND SAMPLING LOG

Project / Site: ______________________________ Well ID: ______________________

Date: __________________ Sampling Technician: _________________________________

Company: _________________________________

Purge/Sampling Instrument: ______________________________

Type of Tubing: ____________________

Pump Tubing Inlet Depth: ____________________

Measuring Point: ____________________

Initial Depth to Water: ____________________

Depth to Well Bottom: ____________________

Well Diameter: ____________________ (inches)

Screen Length: ____________________

Volume of 1 well casing: ____________________ (liters)

Estimated Purge Volume: ____________________ (liters)

Sample ID: __________________ Sample Time: ______________________

Sample Analysis Parameters: ____

____

PURGE ANALYSIS

Time	pH	Temp (^{0}C)	Cond. (mS/cm)	Diss. O_2 (mg/l)	Turbidity (NTUs)	Flow Rate (ml/min.)	Depth to Water (ft)

Comments:

APPENDIX D

Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN

SITE CHARACTERIZATION WORK PLAN

PROPOSED MTA PARATRANSIT FACILITY
COMMERCE AVENUE
BRONX, NY

May 21, 2015

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QUALITY ASSURANCE PROJECT PLAN

1.0 Introduction

This Quality Assurance Project Plan (QAPP) is prepared as part of the Site Characterization Work Plan to investigate the property proposed for the new Metropolitan Transportation Authority (MTA) Paratransit Facility, located on Commerce Avenue, Bronx, New York. Refer to Figure 1 and Figure 2 in the Work Plan for the project site location and proposed sampling locations, respectively.

This QAPP presents the project organization, data quality objectives, and data management procedures for implementing the investigation. The QAPP identifies the specific quality control (QC) checks and quality assurance (QA) auditing processes to be undertaken for the project.

2.0 Project Description

The site is bounded by Commerce Avenue to the west/northwest and Westchester Creek to the east/southeast, and is located in the Unionport neighborhood of the Bronx. The site is currently vacant and occupies an approximate 94,958 square-foot portion of Block 3838, Lot 60. The Department of Housing, Preservation and Development currently has jurisdiction over the site.

The proposed Paratransit Facility will include parking for approximately 150 Paratransit vehicles and an approximate 5,000 square-foot building that will include a training room, administrative office areas, and other back of house areas. The remainder of the site will be completed as paved parking, with small landscaped areas possible within the sidewalk area along Commerce Avenue. It is expected that the new facility will serve to receive new vehicles from manufacturers and retired vehicles from private operators for temporary storage onsite until disbursed to new operators/owners; perform asset recovery of selected vehicle equipment; and, train drivers and maintainers in the operation and maintenance of the vehicles.

2.1 Data Quality Objectives

The objectives of this investigation are to further characterize onsite soil, groundwater, and soil vapor conditions; to investigate soil vapor and groundwater conditions offsite along Commerce Avenue; and, to determine surface aquifer flow patterns. The data collected during the investigation will be utilized to provide information to satisfy the following Data Quality Objectives (DQOs):

- Further delineate soil, groundwater, and soil vapor conditions within the boundaries of the project site;
- Identify conditions in offsite soil vapor and offsite groundwater along Commerce Avenue;
- Determine groundwater flow patterns in the immediate vicinity of the site;

The data will be evaluated as follows:

- Onsite data will be used to determine if the mitigation measures contained in the existing RAP are sufficient for construction of the proposed Paratransit Facility;
- Offsite and onsite data will be evaluated in the context of groundwater flow patterns to determine the likelihood of any onsite or offsite contaminant sources.

3.0 Project Organization and Responsibilities

3.1 EPM Personnel

The following EPM personnel have designated responsibilities on this project:

Glenn Umstetter, P.E., Quality Assurance Manager.
The Quality Assurance Manager is responsible for performance of quality control checks and quality assurance audits during field operations and review of project documents and reports.

Richard Hart, Project Manager.
The Project Manager is responsible for overseeing the implementation of the investigation. All documents including the work plan, reports, approvals and other correspondence will be routed through and approved by the Project Manager. The Project Manager is responsible for the technical adequacy of the investigation and all associated activities, including conformance to the work plan. The Project Manager is responsible for reporting the progress of the investigation to NYSDEC.

Judah Lebow, Field Geologist / Site Safety Officer.
Darren Frank, Field Geologist / Alternate Site Safety Officer.
The Field Geologist responsibilities include overall project coordination, meeting the project schedule, sample collection, supervision of subcontractors in the field, reviewing and assessing data, and preparation of project reports. The Site Safety Officer is responsible for implementation of the health and safety requirements and emergency response as presented in the Health and Safety Plan (HASP). The EPM personnel identified above have been trained and certified in the Occupational Safety and Health Administration Hazardous Waste Operations Procedures.

3.2 Subcontractors

EPM anticipates that the following types of subcontractors will be working on the investigation, although the specific firms have not yet been selected pending a bidding process:

- Geoprobe and Hollow Stem Auger Drill Rig Services;
- Analytical Laboratory Services;
- Independent Data Validation;
- NY State Licensed Surveyor; and,
- Waste Transport and Disposal Firms.

4.0 Quality Assurance Objectives for Data Measurement

The QA objective is to develop and implement procedures for field measurements and sampling and analytical testing that will provide data of known quality that is consistent with the intended use of the information. This section identifies the objectives by describing the use of the data, specifying the applicable field checks, and defining the acceptable criteria for data quality.

4.1 Data Usage and Requirements

The intended use of the data is as follows:

- Onsite data will be used to determine if the mitigation measures contained in the existing RAP are sufficient for construction of the proposed Paratransit Facility;

- Offsite and onsite data will be evaluated in the context of groundwater flow patterns to determine the likelihood of any onsite or offsite contaminant sources.

4.2 Level of Quality Control Effort

The field sampling team will use different types of QA/QC samples to ensure and document the integrity of the sampling procedures, laboratory handling procedures, and validate the measured data. A summary of the Quality Control samples is provided in Table Q-1.

The targeted laboratory reporting limits (RLs) will be in accordance with NYSDEC ASP protocols, and are provided in the attached Table Q-2. The laboratory makes every effort to achieve the RLs unless high concentrations of the target analyte, or an interfering compound are present, necessitating sample dilution, or often, resulting in an interference that requires an elevated limit. The laboratory flags such data with footnotes.

In order to achieve the project DQOs, specific data quality requirements such as Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC) are required.

4.2.1 Precision

Sampling precision will be measured to demonstrate reproducible analytical data by the collection of at least one duplicate for every 20 soil samples taken in the field. All field sample duplicates will be collected in the same manner (split portion from) as all other samples as follows: collected at the same time, utilizing the same sampling methods, sampling equipment, sample containers and preservatives.

4.2.2 Accuracy

Accuracy is defined as a measurement of bias that exists in a measurement system. Systems of bias that may be introduced either in the collection or analysis of the samples may be external contamination, incorrect handling, or equipment malfunction.

4.2.2a Analytical Accuracy

Analytical accuracy will be measured in the laboratory as the recovery of a known analyte that has been added to a sample prior to analysis. Accuracy is checked as part of the laboratory's QA/QC as the matrix spikes and surrogate spike.

4.2.2b Sampling Accuracy

Sampling accuracy will be assessed by the use of field blanks. Blanks help in quantifying the possibility of the introduction of a contaminant by either problems in the collection or handling of the samples. Under ideal conditions, the blanks should show no contamination. One field blank will be collected for every 20 samples per type of media sampled. While blanks can assess the introduction of external contaminants into a sample, they cannot define a loss of contaminant concentration, if any, from the samples. Any loss in concentration can only be limited by the strict adherence to established Standard Operating Procedures (SOPs) as per the New York State Department of Environmental Conservation (NYSDEC) protocols.

4.2.3 Representativeness

Representativeness is the degree to which sampling data accurately and precisely represents selected characteristics. All sampling will be conducted in accordance with NYSDEC protocols.

4.2.4 Completeness

The data quality objective for the completeness of the data with respect to sampling is 100%. In the event that 100% data completeness is not obtained, due to inaccessibility of sampling points or other field conditions, the effect of the uncollected data will be evaluated by the Quality Assurance Manager. Corrective actions will be implemented to resolve any data gaps found as a result of less than 100% data completeness.

4.2.5 Comparability

The methods used for collection and analysis of samples as documented in the QAPP are expected to provide comparable data. EPM will use standardized methods per NYSDEC protocols of field analysis, sample collection, holding times, and preservation (refer to Table Q-1). In addition, field conditions will be documented and considered when evaluating data to determine the effects of sample characteristics or analytical results. Whenever possible, the same sampling team will obtain all samples on consecutive days to reduce inconsistencies which may be caused by technique and time variables.

4.3 Quality Control Objective

The QC objective is to provide data of known and acceptable quality. QC check samples will be analyzed and results evaluated. The QC check samples include:

Field blank samples
Surrogate spikes
Matrix spikes
Duplicate samples

5.0 Sampling Procedures

Quality control procedures to be adopted in the field include the collection of a field blank for testing decontamination procedures on sampling equipment. One field blank per 20 samples will be prepared and submitted for each type of sampling equipment utilized.

The field blank will be prepared using laboratory supplied deionized water to fill the appropriate sample containers. Standard sampling equipment and procedures will be used for the field blank preparation. The field blank will be treated as a separate sample for identification, logging and shipping.

The laboratory targets will meet the specific QA/QC conditions stipulated in the current "Statement of Work of the Contract Lab Program." All QA/QC documentation following ASP Exhibit B procedures will be provided in the laboratory report.

Quality Control for the laboratory equipment and procedures will be achieved by collecting blind duplicate samples and matrix spike/matrix spike duplicate samples. Blind Duplicate samples will be collected at a frequency of one per 20 samples of each media being sampled. The duplicate sample will be labeled "Duplicate" so that its identification is not known to the laboratory and its identification will be recorded in the field log. A Matrix Spike sample and a Matrix Spike Duplicate sample will be collected at a frequency of one per 20 samples of each media. The recovery data for the spiked samples will be included in the laboratory deliverables package.

6.0 Sample Custody

Sampling team personnel will perform all sampling and will be responsible for proper chain of custody documentation. This documentation begins upon release of the empty sample containers from the laboratory to sampling personnel. This initial transfer is marked on a chain of custody form. Examples of the chain-of-custody forms to be used are provided as Appendix D-A.

Sampling personnel will retain custody of the sample containers until shipment of the samples to the laboratory. When the containers are filled, the sampling personnel shall record the appropriate information on the chain of custody document. The samples will then be packed in ice and delivered to the laboratory.

At the laboratory, an authorized representative from the lab will accept custody of the samples and annotate such on the chain of custody document. The laboratory will be informed that they are responsible for completion of the correct information on a chain of custody document each time the responsibility for the sample changes from one individual to another. Upon completion of the sample analysis, the chain of custody documentation will be attached to the data report.

7.0 Calibration Procedures

The calibration procedures for the laboratory instruments used for sample analysis will be performed according to those specific to the analytical method.

8.0 Analytical Procedures

All laboratory analysis will be performed in accordance with NYSDEC ASP methods and provided in an Appendix B Data Deliverable Package with a Data Usability Summary Report prepared by an independent party.

The soil samples will be analyzed for Target Compound List (TCL) Volatile Organic Compounds + 10 TICs (VOCs by Method 8260b); TCL Semi-Volatile Organic Compounds + 20 TICs (TCL SVOCs by Method 8270c); PCBs by Method 8082, Pesticides by Method 8081, and Target Analyte List (TAL) metals by methods 6010/7000. The groundwater samples will be analyzed for TCL VOCs+10, TCL SVOCs+20, PCBs, Pesticides, and TAL Metals (total unfiltered). The soil vapor samples will be analyzed for VOCs by EPA Method TO-15.

9.0 Data Reduction, Validation, and Reporting

The laboratory data package will be evaluated following its completion by an independent third party data validation consultant. Currently, Julie Smith is expected to perform this task, with Ms. Smith’s qualifications provided as Appendix D-B. Should an alternative data validator be proposed, the person’s qualifications will be provided to NYSDEC for approval.

10.0 Internal Quality Control

Field personnel will utilize duplicate samples and field blanks. To reduce the possibility of cross-contamination of the samples, all equipment that comes in contact with the sample that are not single-use disposable items will be decontaminated between each use. The decontamination procedure includes a wash with Alconox detergent, potable water rinse, followed by a rinse with distilled water.

11.0 Performance and System Audits

Performance and system audits will be performed on a periodic basis to ensure that the site investigation field activities are implemented in accordance with the approved Work Plan and in accordance with good work practices. The Quality Assurance Manager will oversee field personnel and check that the data is being obtained in an appropriate and organized manner. The data packages submitted by the laboratory will be checked to see that sample holding times were met, analysis were performed as requested, appropriate QC samples were reported and conform to requirements, etc.

12.0 Preventive Maintenance

EPM personnel will check all field equipment to make sure that it is in good working order prior to field sampling activities (cleaned, charged, calibrating correctly).

13.0 Data Assessment Procedures

The field and laboratory data will be assessed for precision, accuracy, representativeness, comparability and completeness using the field and lab QC check samples.

14.0 Corrective Actions

The QA/QC program enables problems with the data to be identified, controlled, and corrected. Any person identifying an unacceptable condition will bring such to the attention of the Project Director and documented in the field log as well as any corrective action taken. Deviations identified by the laboratory will be documented in the data package as well as any corrective action taken. Corrective actions may include re-sampling, reanalysis of samples, or modifying the project procedures.

15.0 Quality Assurance Reports

Data collection activities will be documented in field log books for review. The data packages prepared by the laboratory will include analytical data, results of QC samples, and a summary of any deviations or problems encountered with the samples and corrective actions taken.

TABLES

TABLE Q-1.
ANALYTICAL METHODS / QUALITY ASSURANCE SAMPLE SUMMARY

Matrix	Number of Samples	Field Blanks	Trip Blanks (VOCs only)	Matrix Spike	Matrix Spike Duplicate	Blind Duplicates	Analytical Paramater and Method	Sample Preservartion / Holding Time	Sample Container Type and Volume
SOIL	30	2	2	2	2	2	TCL VOCs / EPA 8260b	Ice / 14 days	Encores
							TCL SVOCs / EPA 8270c	Ice / 14 days	4 oz. glass
							PCBs / EPA 8082	Ice / 14 days	4 oz. glass
							Pesticides / EPA 8081	Ice / 14 days	4 oz. glass
							TAL Metals / EPA 6000/7000	Ice / 6 months (Hg: 28 days)	4 oz. glass
GROUNDWATER	8	1	1	1	1	1	TCL VOCs / EPA 8260b	HCL / 7 days	40 ml. glass vial, teflon cap
							TCL SVOCs / EPA 8270c	Ice / 7 days	1 liter amber glass, teflon cap
							PCBs / EPA 8082	Ice / 7 days	1 liter amber glass, teflon cap
							Pesticides / EPA 8081	Ice / 14 days	1 liter amber glass, teflon cap
							TAL Metals / EPA 6000/7000	HNO3 / 6 months (Hg: 28 days)	500 ml. polyethylene
SOIL VAPOR	6					1	VOCs / EPA TO-15	none	6-liter Summa Canister
Background Samples	2						VOCs / EPA TO-15	none	6-liter Summa Canister

Table Q-2
Soil Samples
Target Compound List/Target Analyte List
Chemical Parameters, Quantitation Limits and Data Quality Levels

Parameter	QL	DQL
Volatile Organic Compounds (µg/kg) - TCL		
1,1,1-Trichloroethane		680
1,1,2,2-Tetrachloroethane		600
1,1,2-Trichloroethane		NC
1,1,2-Trichlorotrifluoroethane		600
1,1-Dichloroethane		270
1,1-Dichloroethene		330
1,2,3-Trichlorobenzene		NC
1,2,3-Trichloropropane		340
1,2,4-Trichlorobenzene		3,400
1,2,4-Trimethylbenzene		3.600
1,2-Dibromo-3-chloropropane		NC
1,2-Dibromoethane		NC
1,2-Dichlorobenzene		1,100
1,2-Dichloroethane		20
1,2-Dichloropropane		NC
1,3,5-Trimethylbenzene		8,400
1,3-Dichlorobenzene		2,400
1,3-Dichloropropane		300
1,4-Dichlorobenzene		1,800
1,4-Dioxane		100
2-Butanone		300
2-Hexanone		NC
4-Isopropyltoluene		NC
4-Methyl-2-pentanone		1,000
Acetone		50
Benzene		60
Bromochloromethane		NC
Bromodichloromethane		NC
Bromoform		NC
Bromomethane		NC
c-1,2-Dichloroethene		250
c-1,3-Dichloropropene		NC
Carbon disulfide		2,700
Carbon Tetrachloride		760
Chlorobenzene		1,100
Chloroethane		NC
Chloroform		370
Chloromethane		NC

Table Q-2
Soil Samples
Target Compound List/Target Analyte List
Chemical Parameters, Quantitation Limits and Data Quality Levels

Parameter	QL	DQL
Cyclohexane		NC
Dibromochloromethane		NC
Dichlorodifluoromethane		NC
Ethylbenzene		1,000
Hexachlorobutadiene		NC
Isopropylbenzene		2,300
m,p-xylene		260^{A}
Methyl t-butyl ether		930
Methylene Chloride		50
Methyl Cyclohexane		NC
n-Butylbenzene		12,000^{B}
n-Propylbenzene		3,900
Naphthalene		12,000
o-xylene		260^{A}
sec-Butylbenzene		11,000
Styrene		NC
t-1,2-Dichloroethene		190
t-1,3-Dichloropropene		NC
tert-Butylbenzene		12,000^{B}
Tetrachloroethene		1,300
Toluene		700
Trichloroethene		470
Trichlorofluoromethane		NC
Vinyl Chloride		20
Semivolatile Organic Compounds (µg/kg) - TCL		
1,2,4-Trichlorobenzene		3,400
1,2-Dichlorobenzene		NC
1,3-Dichlorobenzene		NC
1,4-Dichlorobenzene		NC
1,1-Biphenyl		NC
1,2,4,5-Tetrachlorbenzene		NC
2,3,4,6-Tetrachlorophenol		NC
2,4,5-Trichlorophenol		100
2,4,6-Trichlorophenol		NC
2,4-Dichlorophenol		400
2,4-Dimethylphenol		NC
2,4-Dinitrophenol		200
2,4-Dinitrotoluene		NC

Table Q-2
Soil Samples
Target Compound List/Target Analyte List
Chemical Parameters, Quantitation Limits and Data Quality Levels

Parameter	QL	DQL
2,6-Dinitrotoluene		170
2-Chloronaphthalene		NC
2-Chlorophenol		100,000
2-Methylnaphthalene		410
2-Nitroaniline		400
2-Nitrophenol		300
2-Methylphenol		NC
3+4-Methylphenol		NC
3,3'-Dichlorobenzidine		NC
3-Nitroaniline		500
4,6-Dinitro-2-methylphenol		NC
4-Bromophenyl phenyl ether		NC
4-Chloro-3-methylphenol		NC
4-Chloroaniline		220
4-Chlorophenyl phenyl ether		NC
4-Nitroaniline		NC
4-Nitrophenol		100
Acenaphthene		98,000
Acenaphthylene		100,000
Acetophenone		NC
Aniline		330
Anthracene		100,000
Atrazine		NC
Benzidine		NC
Benzo(a)anthracene		1,000
Benzo(a)pyrene		1,000
Benzo(b)fluoranthene		1,000
Benzo(g,h,i)perylene		100,000
Benzo(k)fluoranthene		1,000
Benzaldehyde		NC
Benzoic acid		2,700
bis(2-Chloroethoxy)methane		NC
bis(2-Chloroethyl)ether		NC
bis(2-Chloroisopropyl)ether		NC
bis(2-Ethylhexyl)phthalate		50,000
Butyl benzyl phthalate		100,000
Caprolactam		NC
Carbazole		NC
Chrysene		1,000
Di-n-butyl phthalate		8,100

Table Q-2
Soil Samples
Target Compound List/Target Analyte List
Chemical Parameters, Quantitation Limits and Data Quality Levels

Parameter	QL	DQL
Di-n-octyl phthalate		100,000
Dibenz(a,h)anthracene		330
Dibenzofuran		NC
Diethyl phthalate		7,100
Dimethyl phthalate		27,000
Fluoranthene		100,000
Fluorene		100,000
Hexachlorobenzene		410
Hexachlorobutadiene		NC
Hexachlorocyclopentadiene		NC
Hexachloroethane		NC
Indeno(1,2,3-cd)pyrene		500
Isophorone		4,400
N-Nitrosodi-n-propylamine		NC
N-Nitrosodimethylamine		NC
N-Nitrosodiphenylamine		NC
Naphthalene		12,000
Nitrobenzene		170
Pentachlorophenol		800
Phenanthrene		100,000
Phenol		330
Pyrene		100,000
Pesticides (µg/kg) - TCL		
4,4’-DDD		3.3
4,4’-DDE		3.3
4,4’-DDT		3.3
Aldrin		5
alpha–BHC		20
alpha-Chlordane		94
beta-BHC		36
delta-BHC		40
Dieldrin		5
Endosulfan I		2,400
Endosulfan II		2,400
Endosulfan Sulfate		2,400
Endrin		14
Endrin Aldehyde		42
Endrin Ketone		NC
gamma-BHC (Lindane)		100

Table Q-2 **Soil Samples** **Target Compound List/Target Analyte List** **Chemical Parameters, Quantitation Limits and Data Quality Levels**		
Parameter	**QL**	**DQL**
gamma-Chlordane		540
Heptachlor		42
Heptachlor Epoxide		77
Methoxychlor		100,000
Toxaphene		
Polychlorinated Biphenyls (PCBs) (µg/kg) - TCL		
Aroclor-1016		100
Aroclor-1221		100
Aroclor-1232		100
Aroclor-1242		100
Aroclor-1248		100
Aroclor-1254		100
Aroclor-1260		100
Aroclor-1262		100
Aroclor-1268		100
Metals (mg/kg) - TAL		
Aluminum		NC
Antimony		NC
Arsenic		13
Barium		350
Beryllium		7.2
Cadmium		2.5
Calcium		NC
Chromium (total)		1 [C]
Cobalt		30
Copper		50
Iron		2,000
Lead		63
Magnesium		NC
Manganese		1,600
Mercury		0.18
Nickel		30
Potassium		NC
Selenium		3.9
Silver		2
Sodium		NC
Thallium		NC

Table Q-2
Soil Samples
Target Compound List/Target Analyte List
Chemical Parameters, Quantitation Limits and Data Quality Levels

Parameter	QL	DQL
Vanadium		100
Zinc		109

QL = Quantitation Limit is the Laboratory Reporting Limit.
DQL = Data Quality Level is the most stringent of the 6NYCRR Part 375-6.8 and CP-51 Unrestricted Use Soil Cleanup Objectives and Restricted Use for the Protection of Groundwater.

NC = No Criterion
NA = Not Applicable

[A] = The Unrestricted Use SCO for Total Xylenes is used
[B] = The Unrestricted Use SCO for Butylbenzene is used.
[C] = The Unrestricted Use SCO for Hexavalent Chromium is used.

Table Q-2
Groundwater Samples
Chemical Parameters, Quantitation Limits and Data Quality Levels

Parameter	QL	DQL
Volatile Organic Compounds (µg/L)		
1,1,1-Trichloroethane		5
1,1,2,2-Tetrachloroethane		5
1,1,2-Trichloroethane		1
1,1,2-Trichlorotrifluoroethane		5
1,1-Dichloroethane		5
1,1-Dichloroethene		5
1,2,3-Trichlorobenzene		10
1,2,3-Trichloropropane		0.04
1,2,4-Trichlorobenzene		10
1,2,4-Trimethylbenzene		5
1,2-Dibromo-3-chloropropane		0.04
1,2-Dibromoethane		0.0006
1,2-Dichlorobenzene		3
1,2-Dichloroethane		0.6
1,2-Dichloropropane		1
1,3,5-Trimethylbenzene		5
1,3-Dichlorobenzene		3
1,3-Dichloropropane		5
1,4-Dichlorobenzene		3
1,4-Dioxane		NC
2-Butanone		50
2-Hexanone		50
4-Isopropyltoluene		5
4-Methyl-2-pentanone		NC
Acetone		50
Benzene		1
Bromochloromethane		5
Bromodichloromethane		50
Bromoform		50
Bromomethane		5
c-1,2-Dichloroethene		5
c-1,3-Dichloropropene		0.4[a]
Carbon disulfide		60
Carbon Tetrachloride		5
Chlorobenzene		5
Chloroethane		5
Chloroform		7
Chloromethane		5

Table Q-2

Groundwater Samples

Chemical Parameters, Quantitation Limits and Data Quality Levels

Parameter	QL	DQL
Cyclohexane		NC
Dibromochloromethane		50
Dibromomethane		5
Dichlorodifluoromethane		5
Ethylbenzene		5
Hexachlorobutadiene		0.5
Isopropylbenzene		5
m,p-xylene		5
Methyl acetate		NC
Methyl t-butyl ether		10
Methylene Chloride		5
Methyl Cyclohexane		NC
n-Butylbenzene		5
n-Propylbenzene		5
Naphthalene		10
o-xylene		5
sec-Butylbenzene		5
Styrene		5
t-1,2-Dichloroethene		5
t-1,3-Dichloropropene		0.4[a]
tert-Butylbenzene		5
Tetrachloroethene		5
Toluene		5
Trichloroethene		5
Trichlorofluoromethane		5
Vinyl Chloride		2

Table Q-2
Groundwater Samples
Chemical Parameters, Quantitation Limits and Data Quality Levels

Parameter	QL	DQL
Semivolatile Organic Compounds (µg/L) - TCL		
1,1-Biphenyl		5
1,2,4,5-Tetrachlorobenzene		5
1,2,4-Trichlorobenzene		5
1,2-Dichlorobenzene		3
1,3-Dichlorobenzene		3
1,4-Dichlorobenzene		3
2,3,4,6-Tetrachlorophenol		1
2,4,5-Trichlorophenol		1
2,4,6-Trichlorophenol		1
2,4-Dichlorophenol		5
2,4-Dimethylphenol		50
2,4-Dinitrophenol		10
2,4-Dinitrotoluene		5
2,6-Dinitrotoluene		5
2-Chloronaphthalene		10
2-Chlorophenol		1
2-Methylnaphthalene		NC
2-Methylphenol		1
2-Nitroaniline		5
2-Nitrophenol		1
3+4-Methylphenol		1
3,3'-Dichlorobenzidine		5
3-Nitroaniline		5
4,6-Dinitro-2-methylphenol		1
4-Bromophenyl phenyl ether		NC
4-Chloro-3-methylphenol		1
4-Chloroaniline		5
4-Chlorophenyl phenyl ether		NC
4-Nitroaniline		5
4-Nitrophenol		1
Acenaphthene		20
Acenaphthylene		NC
Acetophenone		NC
Aniline		5
Anthracene		50
Atrazine		7.5
Benzaldehyde		NC
Benzo(a)anthracene		0.002
Benzo(a)pyrene		ND
Benzo(b)fluoranthene		0.002

Table Q-2
Groundwater Samples
Chemical Parameters, Quantitation Limits and Data Quality Levels

Parameter	QL	DQL
Benzo(g,h,i)perylene		NC
Benzo(k)fluoranthene		0.002
Benzoic acid		NC
bis(2-Chloroethoxy)methane		5
bis(2-Chloroethyl)ether		1
bis(2-Chloroisopropyl)ether		5
bis(2-Ethylhexyl)phthalate		5
Butyl benzyl phthalate		50
Caprolactum		NC
Carbazole		NC
Chrysene		0.002
Di-n-butyl phthalate		50
Di-n-octyl phthalate		50
Dibenz(a,h)anthracene		NC
Dibenzofuran		NC
Diethyl phthalate		50
Dimethyl phthalate		50
Fluoranthene		50
Fluorene		50
Hexachlorobenzene		0.04
Hexachlorobutadiene		0.5
Hexachlorocyclopentadiene		5
Hexachloroethane		5
Indeno(1,2,3-cd)pyrene		0.002
Isophorone		50
N-Nitrosodi-n-propylamine		NC
N-Nitrosodimethylamine		NC
N-Nitrosodiphenylamine		50
Naphthalene		10
Nitrobenzene		0.4
Pentachlorophenol		1
Phenanthrene		50
Phenol		1
Pyrene		50
Pesticides (µg/L) - TCL		
alpha-BHC		0.01
Beta-BHC		0.04
Delta-BHC		0.04
gamma-BHC (Lindane)		0.05
Heptachlor		0.04

Table Q-2
Groundwater Samples
Chemical Parameters, Quantitation Limits and Data Quality Levels

Parameter	QL	DQL
Aldrin		ND
Heptachlor epoxide		0.03
Endosulfan I		NC
Dieldrin		0.004
4,4'-DDE		0.2
Endrin		ND
Endosulfan II		NC
4,4'-DDD		0.3
Endosulfan sulfate		NC
4,4'-DDT		0.2
Methoxychlor		35
Endrin ketone		5
Endrin aldehyde		5
alpha-Chlordane		NC
gamma-Chlordane		NC
Toxaphene		0.06
PCBs (µg/L) - TCL		
Aroclor 1016		5
Aroclor 1221		5
Aroclor 1232		5
Aroclor 1242		5
Aroclor 1248		5
Aroclor 1254		5
Aroclor 1260		5
Metals (µg/L) - TAL		
Aluminum		NC
Antimony		3
Arsenic		25
Barium		1,000
Beryllium		3
Cadmium		5
Calcium		NS
Chromium		50
Cobalt		NC
Copper		200
Iron		300
Lead		25
Magnesium		35,000
Manganese		300

Table Q-2
Groundwater Samples
Chemical Parameters, Quantitation Limits and Data Quality Levels

Parameter	QL	DQL
Mercury		0.7
Nickel		100
Potassium		NC
Selenium		10
Silver		50
Sodium		20,000
Thallium		0.5
Vanadium		NC
Zinc		2,000

QL = Quantitation Limit is the Laboratory Reporting Limit.
DQL = Data Quality Level based on TOGS Ambient Water Quality Class GA Standards and Guidance Values.

NC = No Criterion
(a) = 0.4 µg/L applies to the sum of cis- and trans-1,3-dichloropropene.
ND = Class GA Value is any detected concentration.

Shading indicates QL is higher than DQL.

APPENDIX D-A

Laboratory Chain of Custody Documentation

CHAIN OF CUSTODY

PAGE_______ OF _______

Date Rec'd in Lab:

ALPHA Job #:

WESTBORO, MA
TEL: 508-898-9220
FAX: 508-898-9193

MANSFIELD, MA
TEL: 508-822-9300
FAX: 508-822-3288

Client Information

Client:

Address:

Phone:

Fax:

Email:

☐ These samples have been previously analyzed by Alpha

Project Information

Project Name:

Project Location:

Project #:

Project Manager:

ALPHA Quote #:

Turn-Around Time

☐ Standard ☐ RUSH *(only confirmed if pre-approved!)*

Date Due: **Time:**

Report Information - Data Deliverables

☐ FAX ☐ EMAIL
☐ ADEx ☐ Add'l Deliverables

Billing Information

☐ Same as Client info PO #:

Regulatory Requirements/Report Limits

State /Fed Program	*Criteria*

Other Project Specific Requirements/Comments/Detection Limits:

ANALYSIS

SAMPLE HANDLING

*Filtration*_________
☐ Done
☐ Not needed
☐ Lab to do
Preservation
☐ Lab to do
(Please specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection		Sample Matrix	Sampler's Initials													Sample Specific Comments	TOTAL # BOTTLES
		Date	Time																

Container Type												
Preservative												

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions.
See reverse side.

FORM NO: 01-01 (rev. 14-OCT-07)

ALPHA ANALYTICAL

AIR ANALYSIS

CHAIN OF CUSTODY

PAGE_______ OF _______

320 Forbes Blvd, Mansfield, MA 02048
TEL: 508-822-9300 FAX: 508-822-3288

Date Rec'd in Lab:

ALPHA Job #:

Client Information

Client:
Address:

Phone:
Fax:
Email:
❑ These samples have been previously analyzed by Alpha

Project Information

Project Name:
Project Location:
Project #:
Project Manager:
ALPHA Quote #:

Turn-Around Time

❑ Standard ❑ RUSH *(only confirmed if pre-approved!)*

Date Due: **Time:**

Report Information - Data Deliverables

❑ FAX
❑ ADEx
Criteria Checker: ____________
(Default based on Regulatory Criteria Indicated)
Other Formats: ____________
❑ EMAIL (standard pdf report)
❑ Additional Deliverables:
____
Report to: (if different than Project Manager)
____
____

Billing Information

❑ Same as Client info PO #:

Regulatory Requirements/Report Limits

State/Fed	*Program*	*Criteria*

Other Project Specific Requirements/Comments:

ANALYSIS

All Columns Below Must Be Filled Out

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection					Sample Matrix*	Sampler's Initials	Can Size	I D Can	I D - Flow Controller	TO-14A by TO-15	TO-15	TO-15 SIM	APH	FIXED GASES	TO-13A	TO-4 / TO-10	Sample Comments (i.e. PID)
		Date	Start Time	End Time	Initial Vacuum	Final Vacuum													

**SAMPLE MATRIX CODES*

AA = Ambient Air (Indoor/Outdoor)
SV = Soil Vapor/Landfill Gas/SVE
Other = Please Specify

Container Type								

Relinquished By:	Date/Time	Received By:	Date/Time:

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. All samples submitted are subject to Alpha's Terms and Conditions.
See reverse side.

Form No: 101-02 (19-Jun-09)

APPENDIX D-B

Data Validation Specialist Qualifications

NANCY WEAVER
Project Manager/Senior Chemist

OVERALL EXPERIENCE

Ms. Weaver has over twenty years combined laboratory, data validation and project management experience. She is the President and co-founder of EDS and is responsible for the technical data review and validation of laboratory data. Ms. Weaver has performed data validation on hundreds of data validation projects. She has extensive knowledge in applying the various regional and project specific data validation guidelines and QAPPs. Her experience also includes writing Quality Assurance Project Plans (QAPPs), managing subcontracted analytical laboratories, performing laboratory audits, participating in field sampling activities and analyzing samples in a laboratory.

PROFESSIONAL EXPERIENCE

Environmental Data Services, Inc., Williamsburg, Virginia
August 1994 - Present
Principal/Senior Chemist

- Responsible for the supervision and direction of the data validation department including the day-to-day assignment of tasks.
- Senior technical review of all data validation reports including specific review of all qualified data. Performance of data validation including organic, inorganic, wet chemistry, and radiological data. Perform laboratory audits and prepare reports.

City & County of Denver, Denver, Colorado
June 1992 - August 1994
Chemist-Analyst Specialist

- Supervised performance and compliance sampling for O & M requirements at groundwater treatment facility. Provided assessment of analytical data for quarterly reports to local regulatory agencies. Acted as liaison between technical group and laboratory to coordinate sampling events and resolve problems with analyses. Performed data validation for organic, inorganic and radiological analyses. Managed database for groundwater and treatment plant sampling events.
- Performed environmental site assessments for commercial and residential properties. Provided technical review and recommendations of Phase I and Phase II site investigations performed by outside consultants. Analyzed policy and interpreted city, state and federal environmental regulations.

C.C. Johnson & Malhotra, Lakewood, Colorado
January 1990 to June 1992
Contractor/Data Validation Specialist

- Performed data validation and interpretation of organic analytical data generated from the EPA Contract Laboratory Program (CLP). Data analysis included volatiles, semivolatiles, pesticides, and polychlorinated biphenyls.
- Interpreted gas chromatograms, gas chromatography/mass spectral data and verified mathematical calculations. Provided written assessment of data quality. Researched and authored technical reports for specific sites.

The Anschutz Corporation - SP Environmental Systems, Inc., Denver, Colorado
July 1990 to January 1992
Environmental Chemist
Assisted in the management of site investigations and remediation for Southern Pacific Transportation Company properties. Experience with the following activities:

- Performed environmental audits and site assessments;
- Conducted site investigations at potential Superfund sites with state and federal agencies;
- Researched and prepared responses to regulatory agencies for non-compliant sites;
- Defined the needs for hazardous waste disposal including the analysis required and disposal;
- Supervised the removal of underground storage tanks and remediation;
- Prepared closure reports for UST removals;
- Prepared annual waste summary forms for TSD facilities throughout the state of Texas;
- Constructed, developed, and sampled groundwater monitoring wells.

Martin Marietta Astronautics Group, Denver, Colorado
January 1988 to January 1990
Environmental Specialist

- Performed organic analysis and sampling of wastewater, groundwater, and drinking water in support of NPDES permit. Operated and maintained laboratory instrumentation including GC and GC/MS for volatile, semi-volatile, and pesticide/PCB analysis. Coordinated sample collection and preparation activities, developed and authored standard operating procedures for laboratory analysis, and followed EPA protocol for QA/QC requirements for analysis. Calculated and interpreted data and reported results.

Camp, Dresser, & McKee, Boston, Massachusetts
April 1986 to October 1987
Environmental Chemist

- Analyzed water/wastewater for organic compounds. Operated and maintained laboratory instrumentation including GC and infrared spectrophotometer for volatile, pesticide/PCB, and petroleum hydrocarbon analysis. Calculated and interpreted data and reported results.

EDUCATION/CREDENTIALS

B.S., Chemistry, University of Colorado
State of New York Department of Environmental Conservation certified Asbestos Inspector
40-Hour OSHA Hazardous Waste Training
8-Hour Health and Safety Supervisor Training for Hazardous Waste Operations
Professional Member - American Chemical Society

APPENDIX E

Site Specific Health and Safety Plan

SITE SPECIFIC HEALTH AND SAFETY PLAN

SITE CHARACTERIZATION INVESTIGATION

PROPOSED MTA PARATRANSIT FACILITY
COMMERCE AVENUE
BRONX, NEW YORK

November 7, 2014

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II Profiles of Chemicals of Concern
III Heat Stress/Cold Stress and Related Illness
IV OSHA Certificates

1.0 INTRODUCTION

Environmental Planning and Management, Inc. (EPM) has developed this Site Specific Health and Safety Plan (HASP) in connection with the Site Characterization Work Plan for the proposed Metropolitan Transportation Authority (MTA) Paratransit Facility, located at Commerce Avenue in Unionport, Bronx County, New York (Figure 1 – Project Site Location). The purpose of this HASP is to identify the potential hazards associated with the subsurface environmental investigation for the project, and to stipulate appropriate health and safety procedures to mitigate these hazards. The procedures and guidelines of this document are intended to minimize exposure to chemical substances, physical hazards, and other anticipated hazards that may be present in the soil, groundwater, or air at the project site. This HASP focuses on the hazards associated with working in contact with potentially contaminated soil and groundwater, as well as the physical hazards associated with drilling equipment. The drilling contractor will be required to sign-off on and adhere to this HASP. The HASP Acceptance Form is provided in **Attachment I.**

The procedures described in this document were developed in accordance with the provision of Occupational Safety and Health Administration (OSHA) rule 29 CFR 1910.120, and EPM’s experience with similar projects. All field personnel performing duties on the environmental investigation must read this HASP before entering the project site. EPM’s Site Health and Safety Officer (SHSO) will ensure that personnel have reviewed the HASP. All site personnel will be briefed on the contents of the HASP at daily safety briefings to be held prior to the start of each day’s work. New employees will be briefed at that start of their first day and will be required to sign the New Employee Orientation Form provided in **Attachment I.** All field personnel will also sign the acknowledgement form also provided in Attachment I. Daily tailgate safety meetings will be held at the start of each work day to review the contents of the HASP and general safety procedures for that day’s scope of work. The recommended health and safety guidelines in this document may be modified, if warranted, by additional information obtained prior to or during field activities.

2.0 Planned Field Activities

The detailed investigation procedures are described in the associated Site Characterization Work Plan, Sampling and Analysis Project Plan, and Quality Assurance Project Plan. The proposed soil, groundwater, and soil vapor sample locations are shown on Figure 2. A Geoprobe® soil coring machine will be used to advance soil borings and soil vapor implants. A hallow stem auger drill rig will be used to install permanent groundwater monitoring wells. Groundwater samples will be collected from the monitoring wells using low flow sampling procedures. Soil vapor samples will be collected in Summa Canisters. Soil samples will be collected from the Geoprobe borings. The soil and groundwater samples will be analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, and metals. The soil gas samples will be analyzed for VOCs.

3.0 POTENTIAL CHEMICAL AND PHYSICAL HAZARDS

3.1 Potential Chemical Hazards

This HASP focuses on the following chemicals of concern:

- Volatile Organic Compounds (VOCs);
- Semi-Volatile Organic Compounds (SVOCs);
- Heavy Metals; and,
- Polychlorinated Biphenyls (PCBs).

Attachment II lists the exposure limits, physical and chemical properties, recommended protection levels and symptoms of exposure to the chemical compounds of concern. The chemical hazards will be minimized by limiting exposure of personnel to hazardous conditions and by the use of personal protective equipment (PPE). Dust suppression controls may also be used to limit exposure if warranted.

3.2 Physical Hazards

Physical hazards present at the site include the following:

- Slip, trip and fall hazards;
- Environmental (heat/cold) stress (refer to **Attachment III**);
- Noise Hazards;
- Use of heavy equipment; and,
- Moving vehicle hazards.

Site personnel will be briefed at each day's tailgate safety meeting on the hazards of and safety protocols for heat and cold stress that are contained in **Attachment III**. Public street closures and maintenance and protection of traffic plans are not considered necessary. Entrances to the project site location will be secured prohibiting pedestrians from entering the work zone.

3.3 Biological Hazards

Based on the vegetated conditions of the project site, there is a potential for exposure to biological hazards such as snakes and insects, including ticks. Basic protective Level D clothing, including work boots and long pants and tick spray if warranted is considered sufficient for protection. The following NIOSH recommended procedures will be followed to prevent exposure to tick bites if warranted. Refer to **Attachment II** for additional information about avoiding tick bites, recognizing the symptoms of Lyme Disease, and appropriate medical responses.

To avoid tick bites:

- 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
- Swollen lymph nodes

4.0 HEALTH AND SAFETY PROTOCOL

4.1 Project Team Organization

4.1.1 Health and Safety Team

EPM personnel responsible for implementation of this Health and Safety Plan are:

Personnel	Responsibilities
Bob Vasiliades, CIH	Corporate Health and Safety Officer
Richard Hart	Project Health and Safety Officer/Project Manager
Judah Lebow	Site Health and Safety Officer (SHSO)
Darren Frank	Alternate SHSO

Judah Lebow is the designated Competent Person / SHSO for EPM's field activity. When Mr. Lebow is not onsite during EPM's field work, the Project Health and Safety

Officer or the Alternate SHSO will serve as the Competent Person / SHSO. OSHA 40-hour Training Certificates for personnel likely to be onsite are provided as **Attachment IV**.

4.1.2 The Site Health and Safety Officer

The Site Health and Safety Officer (SHSO) and the Project Health and Safety Officer or there 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 Form (Attachment II).
9. Conducting daily briefings as necessary.
10. Halting work if necessary.
11. Ensuring strict adherence to the Site HASP.
12. Reviewing personnel medical monitoring participation and health and safety training.

The minimum qualifications for each individual participating in field activities are:

- OSHA specific medicals including, but not limited to, audiometric testing under the hearing conservation program.
- Participation in an Occupational Health Monitoring Program.
- Successful completion of the 40-hour OSHA health and safety training for hazardous material sites (29 CFR 1910.120(e)(3)(i)) and valid/up-to-date 8-hour refresher training (29 CFR 1910.120(e)(4)). Copies of each site worker's training certifications will be available onsite.
- 8-hour OSHA Supervisor Training (if the SHSO determines potentially hazardous conditions exist).
- Additionally, it is recommended that key field personnel be trained in first aid and cardio-pulmonary resuscitation (CPR).

Project personnel will be under the direct supervision of a trained and experienced supervisor for a minimum of one day. The anticipated site activities do not include the need for specific operations, such as lock-out/tag-out, scaffolds or confined spaces. Therefore, these items are not addressed in the HASP. If a change in work scope occurs that requires these operations, an addendum to the HASP will be prepared and properly trained and experienced personnel shall be utilized.

4.2 General Safety Rules

The following general safety rules apply to the project.

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 SHSO 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, including the Geoprobe soil coring machine.

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.

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

8. For personal safety, 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.

4.3 Personal Hygiene

Eating, drinking and the use of tobacco products in the work area are prohibited. The use of alcohol or other non-prescription drugs that could impair the ability to function at the job-site by personnel is prohibited. The use of some prescription drugs may impair the ability to function and can create safety problems on the job. Site personnel taking prescription medication should alert the SHSO in case of an emergency. Beards or facial hair that could interfere with the use of a respirator are not allowed. 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.

4.4 Levels of Personal Protection

The level of personal protection shall be re-evaluated on an ongoing basis. The SHSO may decide to upgrade the level of personal protection based on results of the air quality assessment and periodic air monitoring of the breathing zone with a photo ionization detector (PID) or specific site conditions observed during Site work. Personnel are always given the option to upgrade PPE. Downgrading of PPE is permissible only under the expressed direction of the SHSO. The SHSO is responsible for ensuring that adequate PPE and safety equipment supplies are maintained at the Site. Levels B or C protective equipment are not yet applicable to this project and are therefore not described herein. Should field observations require an upgrade to Level C or higher, work activities will stop and the HASP re-written to address the proper PPE needs in full accordance with OHSA 1910.120.

4.4.1 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
- Reflective vest
- Disposable latex gloves
- First aid kit
- Eye wash station
- Potable drinking water or equivalent

4.4.2 Modified Level D

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

- Tyvek® QC coveralls
- Outer Chemical resistant nitrile or required gloves and inner disposable latex gloves
- Safety work boots
- Hard hat
- Safety glasses
- Reflective vest
- First aid kit
- Eye wash station or bottles
- Potable drinking water or equivalent
- Joints between gloves, boots and suit must be taped

4.4.3 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 (neoprene) outer boots.

5.0 AIR MONITORING EQUIPMENT AND ACTION LEVELS

Air quality monitoring equipment will be used during soil boring and sampling activities to detect the presence of organic vapors. A PID will be calibrated daily following the manufacturer's procedures. Significant generation of airborne dust is not expected when advancing the borings. Water misting will be instituted as necessary to prohibit airborne particulates at the boreholes.

Background ambient VOC levels will be established on a daily basis. If the air concentration of total VOCs in the breathing zone of the work area exceeds 5 parts per million (ppm) above background for a 15 minute average, work activities will be halted temporarily and monitoring continued. If the total VOC level readily decreases (per instantaneous reading) below 5 ppm over background, work activities can resume with continued monitoring.

If the air concentration of total VOCs in the breathing zone of the work area persists at levels above 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 can resume provided that the total organic vapor levels remain below 5 ppm with institution of the abatement steps. Such abatement would include forced air ventilation.

If VOC levels are sustained at 25 ppm or greater within the breathing zone of the work area, activities will be shutdown and the need to upgrade to Level C PPE evaluated.

6.0 DECONTAMINATION

6.1 Site/Work Area Organization

The organization of the Site/Work area shall consist of the following basic elements:

- Exclusion zone – where the activity will take place and where contamination is either known or suspected to be present, or, because of the nature of the activity (use of mechanical equipment), it may potentially harm personnel. Entry into the exclusion zone requires the use of the level of PPE determined necessary by the SHSO. The exclusion zone will be the immediate work area surrounding a particular boring and will be delineated by safety cones and reflective caution tape.
- Decontamination zone, located between the exclusion zone and support zone, where site workers will remove and containerize their contaminated PPE.
- Support zone, located outside the exclusion zone, where the potential of encountering site hazards are minimal; therefore, PPE is not required.

6.2 Personnel Decontamination

Decontamination of personnel consists of physically removing potentially contaminated soil particles from boots and the removal of PPE. A wire brush will be used to remove soil from boots, and disposable PPE will be containerized for offsite disposal. Should field observations indicate the need for an upgrade of PPE to Level C (refer to section 4.4), work shall stop and the HASP re-written to incorporate the applicable personnel decontamination procedures per OHSA 1910.120.

7.0 EMERGENCY RESPONSE AND CONTINGENCY PLAN

7.1 Personal Injury

Emergency communications are to be maintained during all on-site field activities. During the safety briefing conducted prior to each day’s work, all personnel will be instructed on the emergency evacuation route and gathering location. The nearest hospital to the project site with emergency room service is Calvary Hospital, located at 1740 Eastchester Road, Bronx County, NY. The telephone number for the hospital is (718) 518-2000. The route to the hospital from the work area is provided as Figure 3.

A first-aid kit will be available on-site at all times to administer basic first aid. Emergency medical response will be sought should the injury require additional attention. On-site verbal communications should not be a problem since all tasks will be performed in Level D protection. If personnel are upgraded to Level C protection, or verbal communications become difficult for any reason, a universal set of hand signals will then be used. They are as follows:

- 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.

Communications from the site will be through a cellular telephone which will be brought to the site.

All job-related injuries and illnesses will be reported to the SSO. If medical attention is needed, the injured worker will be decontaminated, if possible, prior to leaving the site. The SSO will investigate the cause of the accident and corrective measures will be taken before the work can resume. If there is a fatality, or if three or more workers are hospitalized as a result of a single incident, the SSO will contact the office health and safety manager immediately for OSHA reporting purposes.

7.2 Fires and Spills

Since the project site consists of undeveloped, grassed areas, the potential for onsite fires is considered low, with the possible exception of malfunctioning drilling equipment. A fire extinguisher will be provided onsite at all times by the drilling contractor. On-site personnel will be instructed in the proper use of the fire extinguisher. A fire extinguisher should be used only for small fires in the early stages of development. Where the fire cannot be controlled through extinguisher use, the area will be evacuated immediately and the local fire department called to fight the fire. The phone number of the local fire department is provided in Table 1.

The most likely source of spills or leaks of potentially hazardous material would be from the Geoprobe machine and support vehicles. These vehicles could potentially release fuel or other automotive fluids onto the site. In the event of such an occurrence, emergency spill response materials will be available on-site to immediately contain such spills should they occur. The spill response materials will include a “spill bucket,” with oil absorbent pads, plastic bags, additional PPE, plastic sheeting, and bags of clean sand.

7.3 Incident / Accident Investigation Process

The three primary tasks of the incident/accident investigation process are to gather useful information, analyze the facts surrounding the occurrence, and write the investigation report. The intent of the investigation process is not to assign personal blame for the occurrence, but to determine the root cause of the occurrence and how it can be prevented in the future.

In the event of an incident or accident, the SHSO and Project Health and Safety Officer will follow the following basic steps:

Step 1 - Secure the incident/accident scene;

Step 2 – Collect facts about what happened / develop sequence of events;

Step 3 - Determine cause(s);

Step 4 – Recommend improvements; and,

Step 5 – Write a report summarizing above findings and recommendations.

Copies of the incident/accident investigation forms to be completed by the SHSO or Project Health and Safety Officer in the event of such an occurrence are included in Attachment I.

TABLES

TABLE 1
Emergency Contacts and Phone Numbers
1000 Commerce Avenue Phase II Investigation

CONTACT	PHONE
AMBULANCE / EMS	911
Calvary Hospital 1740 Eastchester Road Bronx, NY 10461	(718) 518-2000
POISON CONTROL CENTER	(800) 222-1222
POLICE:	911
FIRE RESPONSE:	911
EPM CONTACTS:	
Main Office	(516) 328-1194
EPM Principal-in-Charge, Stacey Gogos	(516) 328-1194
EPM Project Manager, Richard Hart	(201) 232-7049 (Cell)
EPM Corporate H&S Officer, Bob Vasiliades	(917) 488-0507 (Cell)
EPM SHSO, Judah Lebow	(808) 635-6111 (Cell)
EPM SHSO, Darren Frank	(516) 297-9829
EMERGENCY SPILL RESPONSE:	
NYSDEC:	
Spill Hotline (24 Hour response)	(800) 457-7362

FIGURES

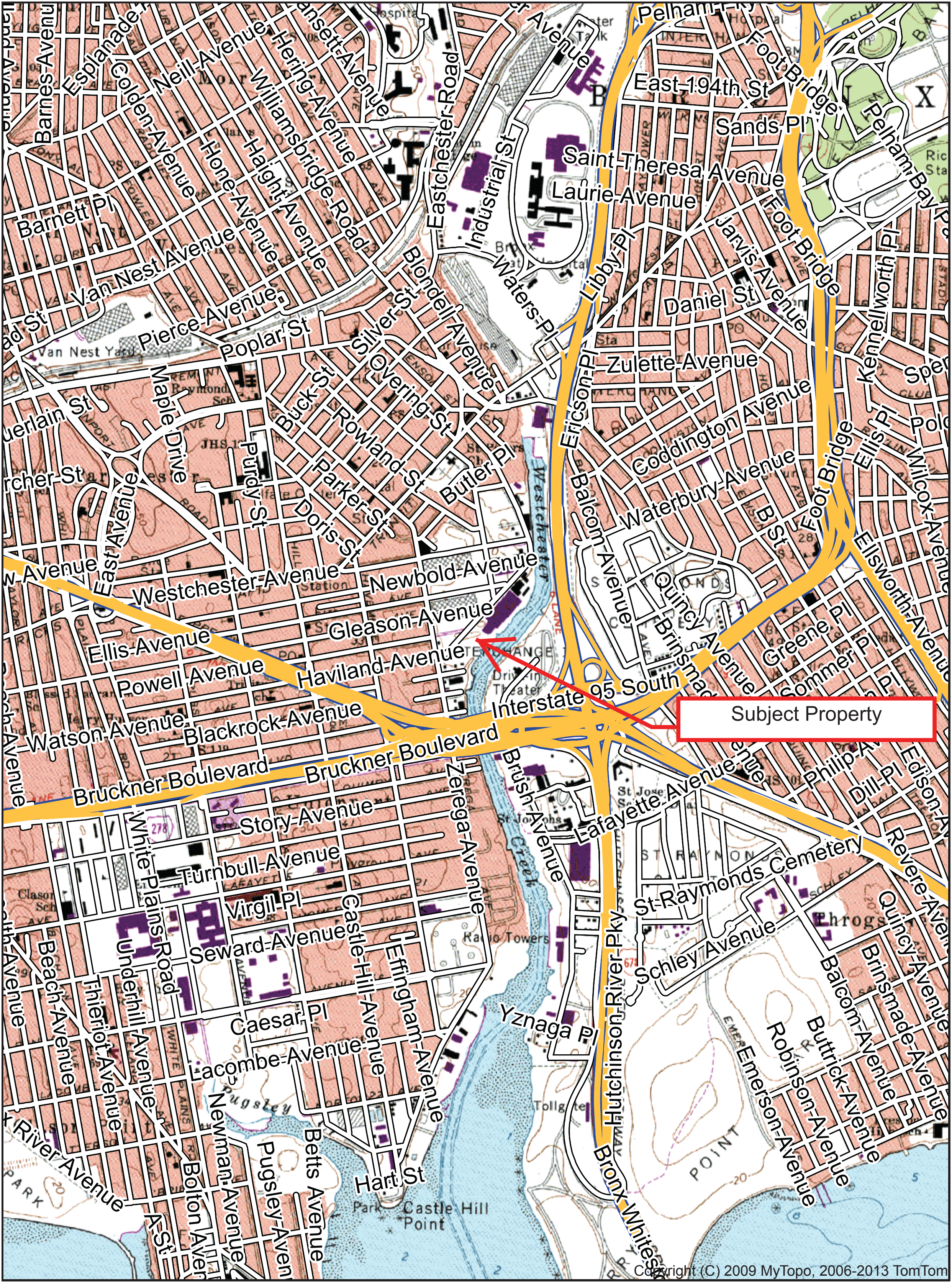

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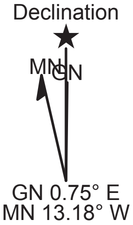
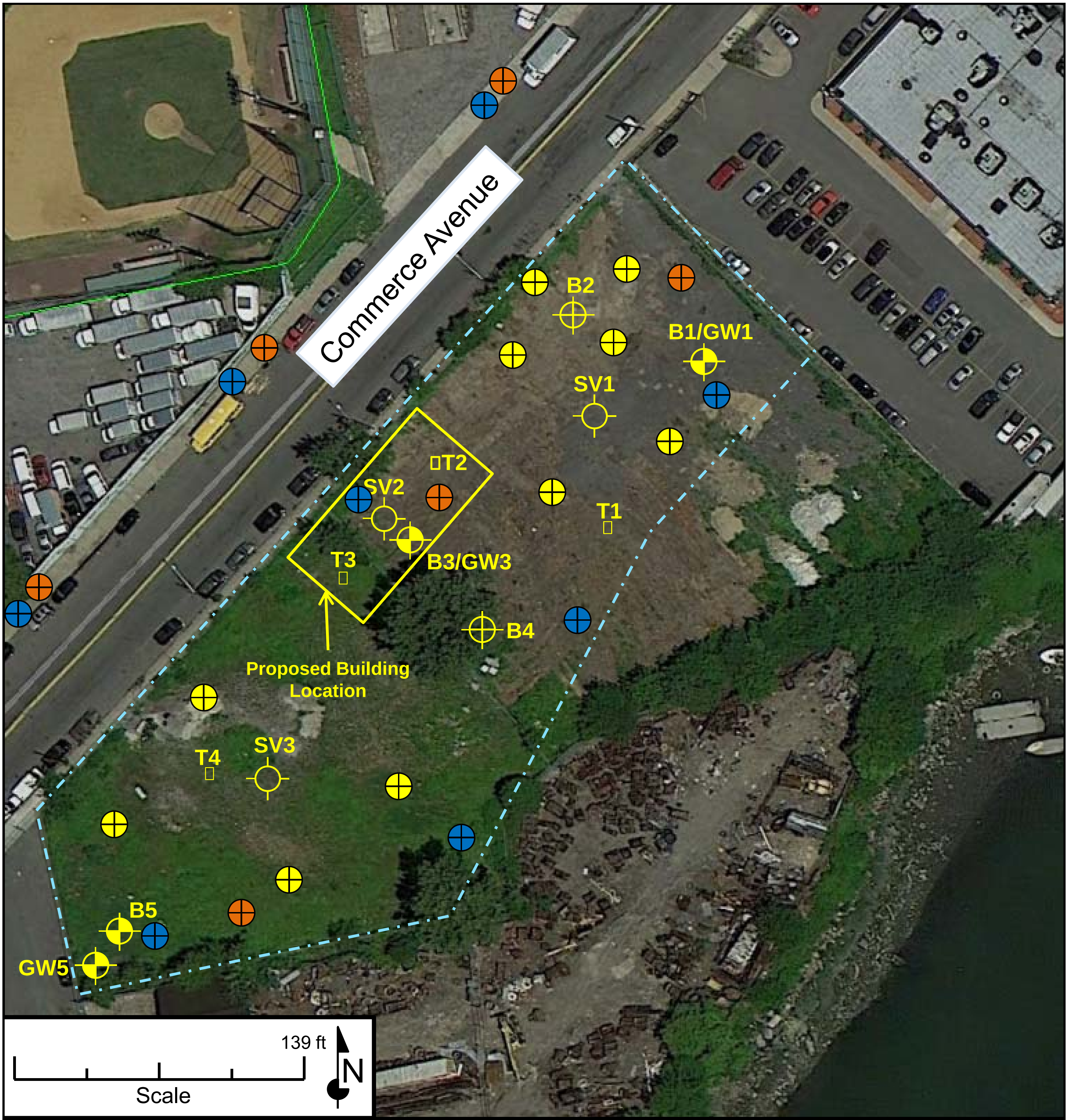
Figure 1 - Site Location Map

Map Name: FLUSHING
Horizontal Datum: NAD27
Scale: 1 inch = 2,000 ft.
Map Center: 040° 49' 54.39" N 073° 50'



SCALE 1:24000



Legend

- -·- Site boundary
- ⊕ Proposed soil boring
- ⊕ Proposed monitoring well
- ⊕ Proposed soil vapor sample
- ◐ Prior soil/groundwater sample
- ⊕ Prior soil boring location
- ○ Prior soil vapor sample
- ▯ Prior test pit

Prepared for:
NYCEDC
110 William Street
New York, NY 10038

Prepared by:

ENVIRONMENTAL
PLANNING &
MANAGEMENT, INC.

Figure 2:

Proposed Sample Location Plan

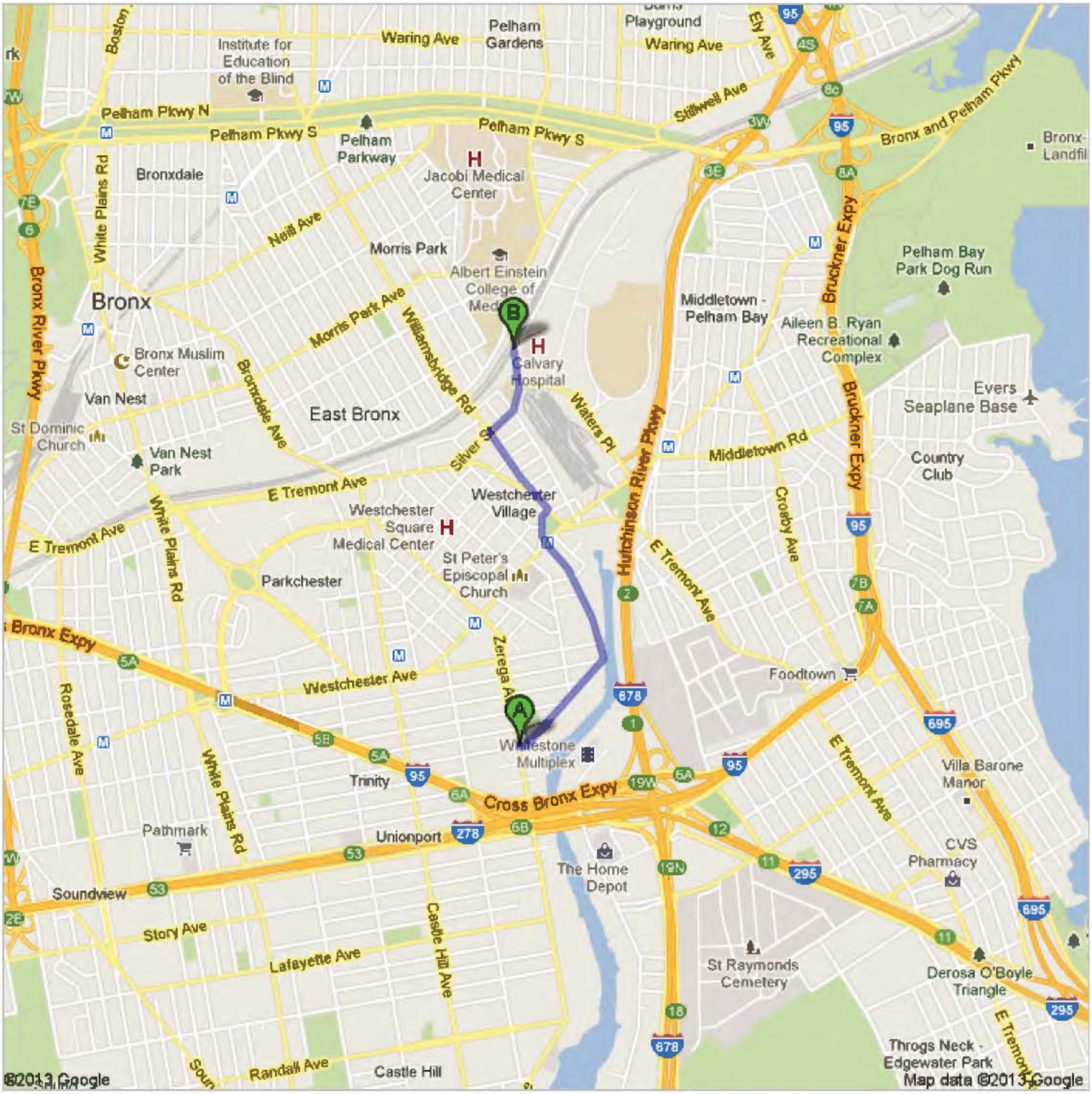
Site Characterization
Proposed Paratransit Facility
Commerce Avenue
Bronx, NY 10462
April 20, 2015

FIGURE 3

Hospital Route Map and Directions

Directions to Calvary Hospital

1740 Eastchester Rd, New York, NY 10461
1.4 mi – about 5 mins



1000 Commerce Ave, Bronx, NY 10462

1. Head east on Commerce Ave/Haviland Ave toward Gleason Ave Continue to follow Commerce Ave About 2 mins	go 0.7 mi total 0.7 mi
2. Continue onto Lane Ave About 1 min	go 0.1 mi total 0.8 mi
↰ 3. Turn left onto E Tremont Ave	go 295 ft total 0.9 mi
4. Continue onto Williamsbridge Rd	go 0.2 mi total 1.1 mi
↱ 5. Turn right onto Eastchester Rd About 59 secs	go 0.3 mi total 1.4 mi

Calvary Hospital
1740 Eastchester Rd, New York, NY 10461

ATTACHMENTS

ATTACHMENT I

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: _______________________________

SAMPLE ACCIDENT INVESTIGATION REPORT

Number _________ Date _________

Prepared by ________________________ ____________________________

SECTION I. BACKGROUND

WHO Victim: ____

Witnesses (1) ___________ Address ________________ Phone (H) _________ (W) ____________
Job Title ______________ Length of Service ______

Witnesses (2) ___________ Address ________________ Phone (H) _________ (W) ____________
Job Title ______________ Length of Service ______

WHEN Date _____________ Time of day _____________ Work shift __________________
Date Accident Reported ____________

WHERE Department ________________ Location ____________________ Equipment _________

SECTION II. DESCRIPTION OF THE ACCIDENT PROCESS.

(Describe the sequence of relevant events prior to, during, and immediately after the accident. Attach separate page if necessary)

Events prior to: ____
Injury event: ____
Events after: ____

SECTION III. FINDINGS AND JUSTIFICATIONS.

(Attach separate page if necessary)

Surface Cause(s) (Unsafe conditions and/or behaviors at any level of the organization)

____

Justification: (Describe evidence or proof that substantiates your finding.)

____

Root Cause(s) (Missing/inadequate Programs, Plans, Policies, Processes, Procedures)

____

Justification: (Describe evidence or proof that substantiates your finding.)

____

SECTION IV. RECOMMENDATIONS AND RESULTS (Attach separate page if necessary)

Corrective actions. (To eliminate or reduce the hazardous conditions/unsafe behaviors that directly caused the accident)

____

Results. (Describe the intended results and positive impact of the change.)

____

System improvements. (To revise and improve the programs, plans, policies, processes, and procedures that indirectly caused/allowed the hazardous conditions/unsafe behaviors.)

____

Results. (Describe the intended results and positive impact of the change.)

____

SECTION V: SUMMARY (Estimate costs of accident. Required investment and future benefits of corrective actions)

____

SECTION VI: REVIEW AND FOLLOW-UP ACTIONS: (Describe equipment/machinery repaired, training conducted, etc. Describe system components developed/revised. Indicate persons responsible for monitoring quality of the change. Indicate review official.)

Corrective Actions Taken:	**Responsible Individual:**	**Date Closed:**
____________________	____________________	__________
____________________	____________________	__________

System improvements made:	**Responsible Individual:**	**Date Closed:**
____________________	____________________	__________
____________________	____________________	__________

Person(s) monitoring status of follow-up actions: ______________________________

Reviewed by __________________ Title __________________
Date ____________ Department ___________

SECTION VII: ATTACHMENTS: (Photos, sketches, interview notes, etc.)

Accident Investigation Checklist

Notification

________ Time and date of accident
________ Time and date of notification
________ Time and date of arrival on site

Documenting the Accident Scene

________ Observation notes
________ Sketches/diagrams
________ Measurements
________ Photos/videotape
________ Records/review

Worker Identification

________ Name
________ Age
________ Home address and phone
________ Occupation
________ Experience
________ Training in this job
________ Familiarity with equipment
________ How supervised
________ PPE used
________ Mental/physical disabilities
________ Nature of injuries

Supervision

________ Name
________ Age
________ Experience as supervisor
________ Experience in job worker was doing
________ Personal knowledge of worker
________ Method of supervision
________ Knowledge of rules
________ How accident happened
________ How accident could have been prevented
________ Supervisors direction from management

First Aid

________ Were services available?
________ Was treatment given?
________ Name of first aid attendent

Other Party

________ Instructions
________ Experience in industry
________ Experience in job
________ Supervision
________ Training
________ Knowledge of rules
________ Familiarity with equip

Worksite Equipment/Machinery

________ General condition
________ Make and model number
________ Manufacturers information
________ Maintenance information
________ Suitability of equipment
________ Layout of operation

Worksite Environment

________ General condition
________ Lighting
________ Ventilation
________ Wind
________ Temperature
________ Weather conditions
________ Terrain
________ Noise

Persons With Information

________ Name
________ Work and residence address
________ Recollection of accident
________ Hearsay

Employer

________ Name and address of office
________ Condition of company safety Program

ATTACHMENT II

Profiles of 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.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES, Public Health Service
Agency for Toxic Substances and Disease Registry

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 $\mu g/m^3$) 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

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 he 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
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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-byōō′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.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
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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 μg/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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AGENCY FOR TOXIC SUBSTANCES
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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. Phoue: 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.

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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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.

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.

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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 mŭr′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-sĭ′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.

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: TE□ACO INC.

Box: 509
City: BEACON **State:** NY **Zip:** 12508−0509

Country: US
Info Phone Number: 914−831−3400 E□T 204
Emergency Phone Number: 914−831−3400 E□T 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:**TE□ACO INC
Address:UN□NOWN **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 E□pression□
UI Container Qty□□ Type of Container□BUL□

Ingredients

TOP

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

Name: **BENZENE (SARA III)**

□ Te□t□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 □□□S5250000 Code□M

Name: **TOLUENE (SARA III)**

□ Te□t□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)**

□ Te□t□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)**

□ Te□t□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)**

□ Te□t□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 □□□N5250000 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□E□TREMELY FLAMMABLE. HARMFUL OR FATAL IF SWALLOWED. MAY BE FATAL IF INHALED□ MAY CAUSE IRRITATION. MAY BE HARMFUL IF ABSORBED THROUGH THE S□IN. □EEP AWAY FROM HEAT□ SPAR□S 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 Te□t□−40F□−40C

Autoignition Temp□

Autoignition Temp Te□t□N/A

Lower Limits□1.4 □

Upper Limits□7.6 □

E□tinguishing Media

DRY CHEMICAL□FOAM□CARBON DIO□IDE.

Fire Fighting Procedures

WATER MAY BE INEFFECTIVE ON FLAMES□BUT SHOULD BE USED TO COOL FIRE−E□POSED CONTAINERS. IF A SPILL OR LEA□ HAS NOT IGNITED□USE WATER SPRAY TO DISPERSE VAPORS.

Unusual Fire/E□plosion Hazard

FLOWING GASOLINE CAN BE IGNITED BY SELF−GENERATED STATIC ELECTRICITY□USE ADEQUATE GROUNDING. CARBON MONO□IDE □ CARBON DIO□IDE MAY BE FORMED ON BURNING IN AIR.

== Control Measures ==

TOP

Respiratory Protection

SCBA OR SUPPLIED AIR RESPIRATORY PROTECTION REQUIRED FOR ENTRY INTO TAN□S□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 E□uipment

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□E□TREMELY 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

□□□
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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.□.
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 MIXTURE. 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 Assocition 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, SPART(S) 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□mixture 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□U□ 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.

===================== 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	
NP - Not Pertinent: U - Unknown:		Shipping Name:	Arsenic
		UN Number:	UN 1558
		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: Corrosive: Other:	No No Yes	Acid: Yes Alkali: No	Oxidizers: Reducers:	Yes No
Hazardous Decomposition Products:	Highly toxic fumes when in contact with acids.				
Hazardous Polymerization:	May Occur - May not Occur -	NO X	Conditions to Avoid:	NP	

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

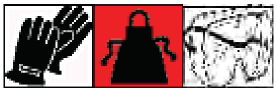
Storage:

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 e□posure 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.)*

*reporting not required when diameter of the pieces of solid metal released is equal to or exceeds 100 micrometers (0.004 inches).

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%

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***

MSDS *Material Safety Data Sheet*

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

National Response in Canada
CANUTEC: 613-996-6666

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

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

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

Mallinckrodt CHEMICALS J.T.Baker

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

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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
```

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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.

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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:
□□
Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.
□□
Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

ATTACHMENT III

Heat Stress/Cold Stress and Related Illness

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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 IV

OSHA Certificates

RAPID

INTERVENTION

Certificate of Completion

Richard R. Hart

Has Successfully Completed The Requirements Of Training For

Permit-Required Confined Space Entry

HAZWOPER 8 Hour Refresher

29 CFR/OSHA Parts 1910.146 & .120

Dated this 13th Day of March, 2013

Director of Training

RAPID

INTERVENTION

Certificate of Completion

Judah Lebow

Has Successfully Completed The Requirements Of Training For

Permit-Required Confined Space Entry

HAZWOPER 8 Hour Refresher

29 CFR/OSHA Parts 1910.146 & .120

Dated this 13th Day of March, 2013

Director of Training

RAPID
INTERVENTION

Certificate of Completion

Darren Frank

Has Successfully Completed The Requirements Of Training For

Permit-Required Confined Space Entry

HAZWOPER 8 Hour Refresher

29 CFR/OSHA Parts 1910.146 & .120

Dated this 13th Day of March, 2013

Director of Training