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### **REMEDIAL INVESTIGATION WORK PLAN**

**471-483 20<sup>th</sup> Street**  
**Block 888; Lots 50 & 52**  
**Brooklyn, New York**

**NYSDEC BCP Site Number: C224187**

<b>Prepared For:</b>	Ever-Nu Metal Products Co., Inc. 471-483 20 <sup>th</sup> Street Brooklyn, New York 11215
<b>Prepared By:</b>	Hydro Tech Environmental, Corp. 15 Ocean Avenue, 2 <sup>nd</sup> Floor Brooklyn, New York 11225
<b>Prepared On:</b>	September 11, 2015
<b>Revised on :</b>	July 01, 2016
<b>Hydro Tech Job No.</b>	150152

## CERTIFICATIONS

I, Mark E. Robbins, certify that I am a Qualified Environmental Professional (QEP) as defined in 6 NYCRR Part 375 and that this Remedial Investigation Work Plan was prepared for the 471-483 20<sup>th</sup> Street (Site No. C224187) in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Mark E. Robbins

\_\_\_\_\_  
Name

  
\_\_\_\_\_  
Signature

7-1-2016

\_\_\_\_\_  
Date

## LIST OF ACRONYMS

<b>Acronym</b>	<b>Definition</b>
AWQS	Ambient Water Quality Standards
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
BGS	Below Grade Surface
BN	Base Neutral
CAMP	Community Air Monitoring Plan
C&D	Construction & Demolition
CGI	Combustible Gas Indicator
CPP	Citizen Participation Plan
DCE	Dichloroethene
DB	decibels
DUSR	Data Usability Summary Report
ESA	Environmental Site Assessment
ELAP	Environmental Laboratory Accreditation Program
FID	Flame Ionization Detector
EZ	Exclusion Zone
HASP	Health and Safety Plan
MDL	Method Detection Limit
NYC DEP	New York City Department of Environmental Protection
NYS DEC	New York State Department of Environmental Conservation
NYS DOH	New York State Department of Health
PCBs	Polychlorinated Biphenyls
PCE	Tetrachloroethene
PID	Photo Ionization Detector
PM	Particulate Matter
PPE	personal protective equipment (PPE)
QAO	Qualified Assurance Officer

<b>Acronym</b>	<b>Definition</b>
QAPP	Quality Assurance Project Plan
QEP	Qualified Environmental Professional
QHHEA	Qualitative Human Health Exposure Assessment
QEP	Qualified Environmental Professional
REC	Recognized Environmental Condition
QA/QC	Quality Assurance/Quality Control
RIR	Remedial Investigation Report
RIWP	Remedial Investigation Work Plan
SCOs	Soil Cleanup Objectives
SCG	Standards, Criteria and Guidance
SCBA	Self-Contained Breathing Apparatus
SSO	Site Safety Officer
TAL	Full Target Analyte List
TCL	Full Target Compound List
TICs	Tentatively Identified Compounds
TOGS	Technical and Operational Guidance Series
SVOCs	Semi-Volatile Organic Compounds
USCS	Unified Soil Classification System
USGS	United States Geological Survey
VOCs	Volatile Organic Compounds



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## 1.0 EXECUTIVE SUMMARY

This Remedial Investigation Work Plan (RIWP) has been prepared on behalf of Ever Nu Metals (referred to herein as the “Applicant”) to document the details and protocols for the environmental investigation of the property located at 471-483 20<sup>th</sup> street in Brooklyn, New York (the “Site”). The purpose of this RIWP is to characterize the environmental quality of on-site soil. The results of this initial soil investigation will help determine next steps in the remedial investigation process. All investigation work will be performed in accordance with the New York State Department of Environmental Conservation (NYSDEC) requirements under the NYS Brownfield Cleanup Program (BCP) and in compliance with the NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (May 2010) and other acceptable industry standards. A BCP application will be filed by the Applicant to investigate and remediate the Site. The Site has been listed as potential inactive hazardous waste disposal site (P-Site) and was issued a NYSDEC Site number 224187.

The investigation will be conducted through the installation and sampling of soil probes. All portions of the fieldwork will be conducted in accordance with a site-specific Health & Safety Plan.

The following sections provide the details and specific information pertaining to the various components of the RIWP.

## 2.0 INTRODUCTION

Hydro Tech Environmental, Corp. (“Hydro Tech”) has been retained by Ever Nu Metals to prepare this Remedial Investigation Work Plan (RIWP) for the property located at 471-483 20<sup>th</sup> Street, Brooklyn, New York (the “Site”). Specifically, this RIWP provides the protocols and specifications for the proposed subsurface investigation to fully characterize the environmental quality of the soil beneath the Site in anticipation of the Site remediation under the NYSDEC Brownfield Cleanup Program.

### 2.1 Site Description

The Site is located in the Prospect Park West Section in Brooklyn, New York and is identified as Block 888 and Lots 50 and 52 on the New York City Tax Map. The Site is 13,722-square feet and is bounded by 20<sup>th</sup> Street and Greenwood cemetery to the south, a 4-story institutional building (Diocese of Brooklyn) to the east and north, three 2-story residential buildings to the north and a parking lot and adjoining 1-story commercial/industrial building to the west.

Currently, the entire Site is developed with two connected 1-story buildings with slabs on-grade. The Site is occupied by Ever Nu Metal Products, which performs sandblasting and metal coating. The building situated in the southeastern portion of the Site is being utilized for warehousing and storage. The building situated in the northwestern portion includes parts washer area, powder coating and sand blasting areas, and batch ovens. Two floor drains are located in the central portion of this building. The first floor drain is situated in the southeastern section of the building. This drain has a square shape and is approximately 2 feet long and 2 feet wide and is 1 foot deep. This drain is connected to the second drain located in the northwestern section via 4 inch underground pipe. The second drain has rectangular shape and is approximately 2 feet long and, 1 foot wide and is 2 feet deep. This floor drain discharges into the municipal sewer system. Both drains have concrete bottoms and sidewalls and are covered with removable metal plates. **Figure 1** provides a Site Location Map.

## 2.2 Site History

The on-site building was constructed in 1931. Ever-Nu Metal has operated at the site since at least 1953 and generally conducts commercial metal powder coating, finishing and sand blasting. The Site was a Large Quantity Generator (EPA ID # NYD001373471) of ignitable waste (waste code D001), corrosive waste (waste code D002), and spent solvents (waste codes F001, F002 and F003) in the mid-1980s. A February 25, 2014 Hazardous Waste Compliance Inspection alleged violations of the NYSDEC's solid and hazardous waste regulations and issued a Notice of Violation dated March 6, 2014. According to intra-agency correspondence among the NYSDEC dated November 25, 2014, the issues identified in this NOV are close to being resolved. The Site is also listed within the NY Spills database for two closed spills reported in 1992 and 1986. The cause of NYSDEC Spill No. 92-04205 was noted as "housekeeping" and was closed the same day it was opened. NYSDEC Spill No. 86-02236 was related to the release of trichloroethylene (TCE), but was closed on July 6, 1987.

The following environmental assessments and investigations were previously performed at the Site and were reviewed and evaluated:

- Limited Subsurface Investigation, 471-473 20<sup>th</sup> Street, November 2001, Vertex Engineering Services, Inc.
- Limited Subsurface Investigation, 471-473 20<sup>th</sup> Street, January 8, 2002, Hydro Tech Environmental, Corp.
- Remedial Action Report, 471-473 20<sup>th</sup> Street, February 6, 2002, Hydro Tech Environmental, Corp.
- Phase I Environmental Site Assessment Report, 471 20<sup>th</sup> Street, Brooklyn, NY, May 30, 2013, AEI Consultants.
- Soil Vapor Investigation, 471 20<sup>th</sup> Street, Brooklyn, NY, March 5, 2015, EnviroTrac Ltd.

The following environmental investigation was previously performed at an adjacent property in order to investigate potential soil vapor impacts associated with the Site:

- Air Sampling Report, 429 19<sup>th</sup> Street, Brooklyn, NY, November 29, 2013, Environmental Business Consultants.

Limited Subsurface Investigations were performed by Vertex Engineering Services, Inc. during 2001 and by Hydro Tech Environmental, Corp during 2002 in order to characterize potential impacts associated with the historic use TCE at the Site. The investigation by Vertex involved the installation and sampling of a total of four (4) soil probes designated EN-1 to EN-4. A map showing the specific locations of the four soil probes installed by Vertex was not provided and these locations are presumed to be in the western and central portions of the Site. Soil probes EN-1 was installed at 14 feet below grade surface (bgs) and EN-2 to EN-4 were installed to 20 feet bgs. Field screening of soil samples from grade to final depth of each soil probe with a photoionization detector (PID) indicated the presence of organic vapor with a maximum concentration of 250 ppm detected at unspecified depth in EN-1 and EN-3. Composite samples were collected from 8-12 feet in EN-1 and EN-3 and 16-20 feet in EN-2 and EN-4 and analyzed for volatile organic compounds (VOCs) via EPA Method 8260. TCE was detected in the 8 to 12 foot soil sample from EN-3 at a concentration of 1.92 mg/kg, which exceeded its respective regulatory standard. The investigation by Hydro Tech was performed to further delineate the TCE in subsurface soil and involved the installation and sampling of three soil probes designated SP-1 to SP-3. These soil probes were installed at the presumed locations of the three former soil probes previously installed by Vertex with SP-1 installed in the vicinity of EN-3. In addition, the installation of a ground water probe was attempted during this investigation to 68 feet bgs, at which depth no groundwater was encountered. Grab soil samples from the soil probes were screened at the 2-foot intervals from 16 to 20 feet bgs in SP-1, 26 to 30 feet bgs in SP-2 and 20 to 24 feet bgs in SP-3. Select soil samples were collected from 18-20 feet in SP-1, 28-30 feet in SP-2 and 22-24 feet in SP-3 and were analyzed for VOCs via EPA Method 8260.

Chlorinated VOCs were detected in all three soil samples from the three soil probes at concentrations below their respective regulatory standards. TCE was detected at a concentration of 0.39 mg/kg in the 18 to 20 foot sample from SP-1, and 0.176 mg/kg in the 28 to 30 foot sample from SP-2. No TCE was detected in the 22 to 24 foot sample from SP-3. Other chlorinated compounds included tetrachloroethylene (PCE) detected of in SP-1 (0.016 mg/kg), 1,1,1-trichloroethane (1,1,1-TCA) detected in SP-3 (0.006 mg/kg) and 1,1,2-trichloroethane detected in SP-2 (0.006 mg/kg). The VOC Toluene also occurred in SP-2 at a concentration of 0.03 mg/kg, which did not exceed its respective regulatory standard.

*In-situ* remediation of chlorinated solvent-impacted soil, which was delineated beneath the western and central portions of the Site to the depth of 20 feet, was performed by Hydro Tech and documented in a February 2002 Remedial Action Report. This remediation consisted of the injection of Hydrogen-Releasing Compounds via six (6) injection points to the depth of 20 feet below grade surface. A post-remedial sampling of soil was proposed in the RAP to monitor the effectiveness of injections on a quarterly basis for the duration of 9 months. Monitoring of post-injection levels of chlorinated solvents in soil was not performed.

The May 2013 Phase I ESA report by AEI Consultants identified as Recognized Environmental Conditions (RECs) at the Site the presence of soil impact associated with the historic industrial use of chlorinated solvents, the presence of suspect gasoline underground storage tanks beneath the west central portion, the presence of suspect asbestos containing materials and suspect lead-based paint.

The Soil Vapor Investigation by EnviroTrac, Ltd was performed during November 2014 and was triggered by the sub-slab vapor investigation performed by Environmental Business Consultants during October 2013 at a residential building located in the northeast-adjacent vicinity of the Site at 492 19<sup>th</sup> Street. The investigation by Environmental Business Consultants was conducted utilizing 6-liter Summa Canisters

for the duration of 8 hours, in which TCE concentration of 1,870  $\mu\text{g}/\text{m}^3$  was detected in a sub-slab vapor sample designated SS1 installed in the cellar of this adjacent property.

The investigation by EnviroTrac was coordinated directly by the NYSDEC and consisted of the installation of thirteen (13) soil vapor sampling points including one soil vapor cluster designated as SV-11 and installed in the central portion of the Site at three different depths; shallow (S) at 8 feet, intermediate (I) at 25 feet and deep (D) at 45 feet. The remaining soil vapor points were designated as SV-1 to SV-10 and installed in the surrounding vicinities to the Site at the depth of 8 feet. The off-site soil vapor points included one (1) point in the sidewalk along 20<sup>th</sup> Street, two (2) points in the eastern portion of Brooklyn Diocese to the west, two (2) points in the parking lot to the northwest, four (4) points in the parking lot to the east and one (1) point in the parking lot to the southeast. The vapor sampling during investigation was pursued for the duration of two hours utilizing 6-Liter Summa Canisters. Findings of this investigation indicated chlorinated vapors of PCE, TCE, and 1,1,1-TCA were the most abundant in SV-11 and their maximum concentrations occurred at the shallow depth of 8 feet with PCE detected at 9,200  $\mu\text{g}/\text{m}^3$ , TCE detected at 140,000  $\mu\text{g}/\text{m}^3$  and 1,1,1-TCA detected at 3,300  $\mu\text{g}/\text{m}^3$ . The elevated concentrations of these compounds decreased with depth in SV-11, thus suggesting a surface source of contamination. PCE, TCE, and 1,1,1-TCA also occurred in off-site soil vapors points installed in all directions and their highest concentrations ranged between 150  $\mu\text{g}/\text{m}^3$  for PCE, 3,200 for TCE and 210 for 1,1,1-TCA.

**Figure 2** provides the location of the soil probes and TCE concentrations in soil samples. **Figure 3** provides the soil vapor and sub-slab vapor sampling point.

### 2.3 Environmental Setting

The Site is located in western portion of Brooklyn, New York. The elevation of the Subject Property is approximately 150 feet above mean sea level (USGS 7.5-Minute Brooklyn, New York Quadrangle, 2013).

Brooklyn, New York is located in the western portion of Long Island. Long Island

consists of a wedge-shaped mass of unconsolidated deposits that overlie ancient basement rock. The thickness of these deposits ranges from approximately 100 feet on the Island's north shore to approximately 2,000 feet in some portions of the south shore. These deposits contain ground water that is the sole source of drinking water for the Island's over 3.1 million residents.

The major landforms of Long Island of importance to the hydrologic system are the moraines and outwash plains, which originated from glacial activity. The moraines represent the farthest extent of the glacial advances. The moraines consist of till, which is a poorly sorted mixture of sand, silt, clay, gravel and boulders. The till is poor to moderately permeable in most areas. Outwash plains are located to the south of the moraines. The outwash plains were formed by the action of glacial melt water streams, which eroded the headland material of the moraines and laid down deposits of well-sorted sands, silts and gravels. These outwash deposits have a moderate to high permeability.

The **Upper Glacial Aquifer** is the uppermost hydrogeologic unit. This aquifer encompasses the moraine and outwash deposits, in addition to some localized lacustrine, marine and reworked materials. A relatively high horizontal hydraulic conductivity and a low vertical hydraulic conductivity characterize the outwash plain portion of this unit. Since the water table is situated in the Upper Glacial Aquifer.

The **Magothy Formation** directly underlies the Upper Glacial Aquifer in the vicinity of the site. This formation is a Cretaceous coastal-shelf deposit, which consists principally of layers of sand and gravel with some interbedded clay. This formation ranges from moderate to highly permeable. A clay layer in some parts of Long Island confines the uppermost portion of the aquifer. The Magothy is Long Island's principal aquifer for public water supply. The United States Environmental Protection Agency (USEPA) has classified the Long Island aquifer system as a sole source aquifer.



The **Raritan Formation** is the deepest unit and rests directly above the bedrock units. This formation is comprised of a sand member (**Lloyd Aquifer**) and a clay member (**Raritan Clay**). The Lloyd sand extends southward from Flushing Bay to the Atlantic Ocean. The thickness of the sand member ranges in depth from 200 to 800 feet below sea level and increases in thickness to the southeast. The clay member acts as an aquitard confining the lower Lloyd aquifer between the clay and the underlying bedrock.

Long Island has a humid, temperate climate that is strongly influenced by the Long Island Sound and the Atlantic Ocean. These bodies of water temper extremes of heat in summer and cold in winters. Climate affects the formation of soil through its influence on chemical, biological and physical processes. The amount and content of rainwater, as it percolates through the soil, chemically alters the composition of the soils. Chemical and biological processes are also affected by temperature changes. The physical weathering of the soil and rocks is affected by freezing.

According to USGS Long Island Depth To Water Viewer (2010) the depth to groundwater beneath the Site is estimated to be between 151 feet to 157 feet. In addition, the topographic relief of the site vicinity as presented by the USGS Condition on Long Island, NY (2010) suggests the groundwater flow in the site vicinity is toward the northwest.

## 2.4 Objective & Project Goals

The objective of the RIWP is to set forth the details and protocols for the characterization of the environmental quality beneath the Site by delineating the vertical and horizontal extent of soil contamination identified beneath the property.

All of the fieldwork will be performed in accordance with the NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (May 2010) and other acceptable industry standards.

### 3.0 INVESTIGATION SPECIFICATIONS

#### 3.1 Introduction

The purpose of this section is to document the details and protocols intended to be utilized in the delineation of the soil contamination beneath the Site. To accomplish this, Hydro Tech will install and sample a series of on-site soil probes utilizing direct-push technology. Select soil samples will be analyzed via approved analytical methods, and all laboratory results will be evaluated and documented in a Remedial Investigation Report. Due to the excessive depth of the water table beneath the Site, no groundwater samples will be collected during this investigation. According to USGS Long Island Depth To Water Viewer (March-April 2006) the depth to groundwater beneath the Site is estimated to be between 151 feet to 157 feet. In addition, since chlorinated solvents have been characterized in on-Site and off-site soil vapors, no further soil vapor investigation is proposed at this time until results of the soil investigation have been reviewed. All these activities will be implemented consistent with a Citizen Participation Plan (CPP) and in accordance to a site-specific Health and Safety Plan (HASP) and a Community Air Monitoring Plan (CAMP). No waste characterization samples will be collected from the Site as part of this investigation. **Appendix A** provides a Site-specific HASP.

**Appendix B** provides a Site-specific CAMP.

Prior to the performance of the fieldwork, a public utility mark-out will be requested from the New York City-Long Island One-Call Center. During the fieldwork, underground utilities clearance survey will be performed on-Site utilizing a magnetometer. All work will be coordinated with representatives of the NYSDEC.

#### 3.2 Soil Probes

A total of seven (7) soil probes designated SP-4 to SP-10 will be installed during the investigation. **Table 1** below provides the specific location of each soil probe. The purpose of these soil probes is to characterize the soil environmental quality in the

vicinity of the two floor drains at the Site and in areas not investigated previously at the Site. The two proposed soil probes in the immediate vicinity of floor drains will be drilled to below the depth of 20 feet and as far down as no organic vapors would be detected utilizing a Photoionization Detector or PID or refusal. The remaining five soil probes will be drilled as far down as no organic vapors would be detected with the PID to the depth of 20 feet or they will continue to be drilled as far as organic vapors are detected until no PID response or refusal. All soil probes shall be terminated 5 feet below the depth of no PID response or refusal.

**Table 1** - Summary of Proposed Soil Sampling Locations and Analyses

Soil Probe (SP)	Location	Soil Characterization Depth	Analytical Methods
SP-4	Northeastern portion	Grade surface to 20 feet below grade if no PID response; if PID response to depth of 20 feet, continue 5 feet below the point of no PID response or refusal	*TCL VOCs via EPA Method 8260 *TCL SVOCs via EPA Method 8270 * Pesticides via EPA Method 8081 * Herbicides via EPA Method 8151 * Polychlorinated biphenyls via EPA Method 8082
SP-5	Eastern portion		
SP-6	Southeastern portion		
SP-7	Southern portion		
SP-8	Southwestern portion		
SP-9	Vicinity of floor drain in central portion	Grade surface to 5 feet below the point of no PID response past the depth of 20 feet or refusal	*TAL Metals via EPA Method 6010 & EPA Method 7471 for Mercury
SP-10	Vicinity of floor drain in northern portion		

All soil probes will be installed utilizing Hydro Tech's probe machine units fitted with Geoprobe® tooling and sampling equipment. The probing machine will install the soil probes utilizing direct-push (hydraulic percussion) technology. **Figure 4** provides the proposed locations of the soil probes.

Soil samples will be collected in all probes at 2-foot intervals utilizing a 4-foot long Macro Core sampler fitted with dedicated acetate liners. The Macro sampler allows for

the collection of both continuous and discrete soil samples. Each sampler will be installed with 1½-inch diameter drill rods.

The four soil probes SP-4 to SP-8 will be extended to the depth of refusal. The remaining soil probes SP-9 and SP-10 will extend to the depth of 45 feet. No groundwater is expected to be encountered at this depth. Separate aliquots of each soil sample will be placed into clean zip-lock storage bags and laboratory supplied soil jars. The soil samples placed in airtight zip-lock bags will be characterized in the field by a Hydro Tech geologist. The characterization will consist of field screening for evidence of organic vapors utilizing a Photoionization Detector or PID and soil classification.

Headspace analyses will be conducted on each soil sample by partially filling a zip lock bag and sealing it, thereby creating a void. This void is referred to as the sample headspace. To facilitate the detection of any hydrocarbons contained within the headspace, the container will be agitated for a period of thirty (30) seconds. The probe of the PID will then be placed within the headspace to measure the hydrocarbon concentrations present.

The soil classification will be based upon the Unified Soil Classification System (USCS). The USCS identifies common soil details such as grain size, shape, sorting and color. In addition, any visual or olfactory evidence of hydrocarbons will be identified. Soil probe logs will be generated based upon the soil characterization, along with the PID field screening. **Appendix C** provides a sample boring log.

Soil samples collected from each of the seven soil probes for lab analysis will include the deepest soil sample obtained at the bottom sampling interval and another soil sample will be biased toward locations exhibiting the highest PID field screenings, areas expected to be contaminated or potential source areas, as the case may be.

All soil samples will be containerized in laboratory supplied soil jars and appropriately labeled.

### **3.4 Field Management of Investigation Derived Waste**

#### Soil Sampling

- Soil cuttings generated during soil probe installation and sampling will be placed in one DOT-approved 55-gallon drum and properly labeled with content and generator information for disposal as hazardous waste.
  
- Fluids generated during equipment decontamination will be contained in the 55-gallons drums and properly disposed of as hazardous waste.
  
- Fine grade sand and/or absorbent pads will be applied to direct any runoff water away from the boreholes in order to avoid any discharges of unknown surface contaminants into the subsurface soil. The sand and absorbent pads will be disposed of into the 55-gallons drum along the soil cuttings.
  
- All boreholes will be back-filled with fine grade sand and properly sealed in surface with a layer of slurry.

### **3.5 Laboratory Analytical Methods**

As indicated in **Table 1** all soil samples will be analyzed for volatile organic compounds (VOCs) via EPA Method 8260, semi-volatile organic compounds (SVOCs) via EPA Method 8270, Pesticides via EPA Method 8081, Herbicides via EPA Method 8151, Polychlorinated biphenyls via EPA Method 8082 and TAL Metals via EPA Method 6010 and EPA Method 7471 for Mercury.

### **3.6 Quality Assurance/Quality Control**

A Hydro Tech Quality Assurance Officer (QAO) (Mark Robbins) will adopt a Quality Assurance Project Plan (QAPP) during the collection of soil samples in order to ensure that proper procedures are performed and subsequently followed during sample collection and analysis. The QAPP for this investigation is provided in **Appendix E**.

## **4.0 REPORT OF FINDINGS**

A Remedial Investigation Report (RIR) will be prepared following the completion of the fieldwork and the laboratory analyses. This report will be certified by a QEP as per DER-10 Table 1.5 and will contain the findings and conclusions of the investigation and will include appropriate maps and diagrams, tabulations of all analytical data, written narratives, boring logs and appendices.

The soil quality results will be compared to the 6 NYCRR Part 375 Unrestricted Residential Use and Commercial Use (SCOs). All soil samples that exceed their respective soil cleanup objectives (SCOs) will be highlighted in tables and shown on spider diagrams. The RIR will include a Data Usability Summary Report.

All data will also be submitted electronically to NYSDEC through the Environmental Information Management System, using the standardized electronic data deliverable (EDD) format.

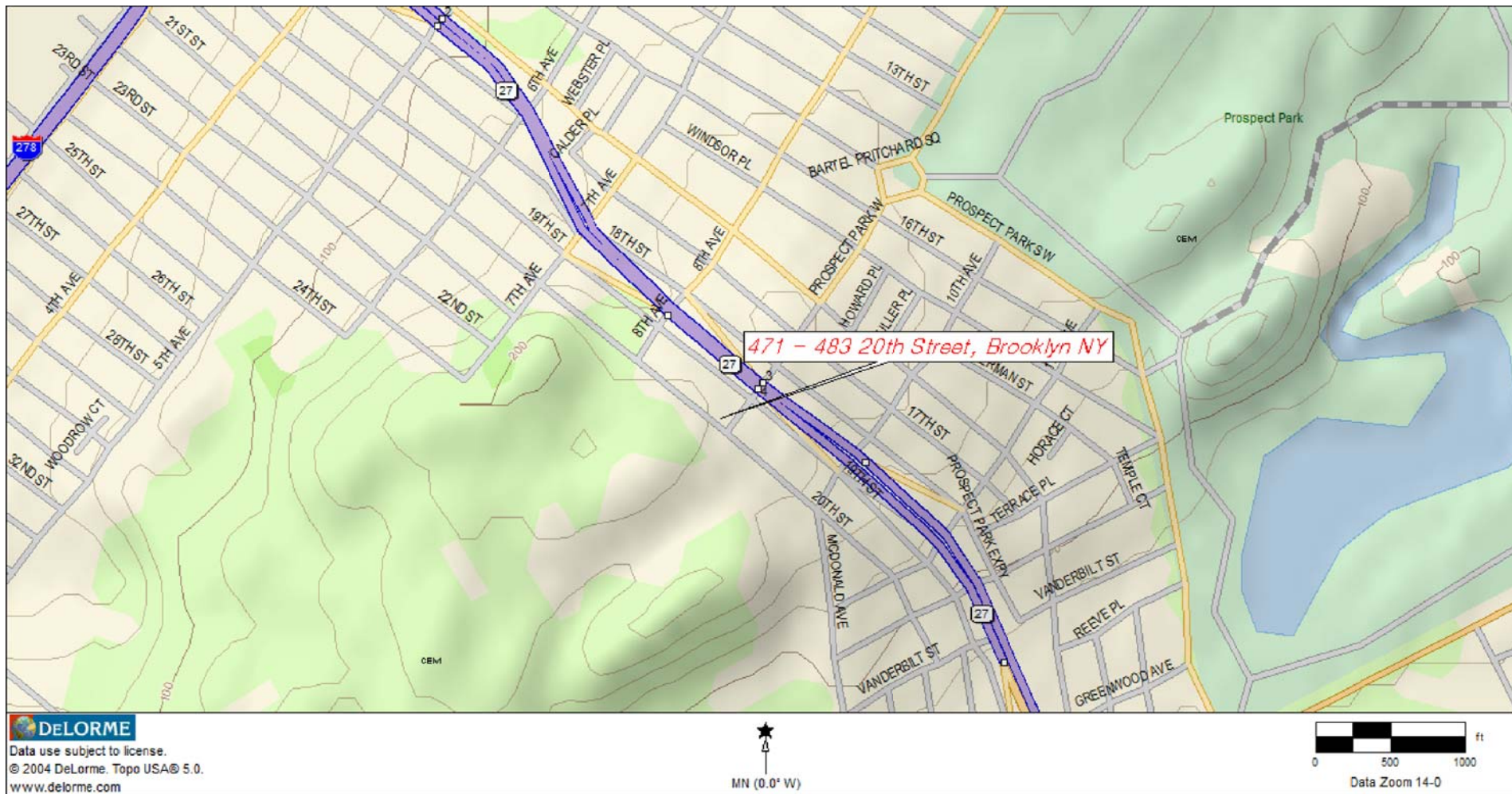
### **4.1 Anticipated Project Schedule**

The table below provides a tentative schedule for the performance of the remedial investigation and other major task leading to the date of issuance of a Certificate of Complete (COC). This schedule is tentative based upon the approvals of documents by the NYSDEC.



Schedule Milestone	Anticipated Date
Submit Revised RIWP	7-1-2016
Submit SVE Pilot Test Work Plan	7-1-2016
Fact Sheet Announcing the 30-day Public Comment Period for RI Activities	7-11-2016
NYSDEC Approval of RIWP	8-25-2016
NYSDEC Approval of SVE Pilot test	8-25-2016
Submit IRM-SVE Design Report	10-13-2016
Implementation of IRM	11-25-2016
Submit Draft RIR	9-28-2016
Submit IRM Construction Completion Report	12-30-2016
Submit and Interim Site Management Plan for the SVE System	2-28-2017
Submit Draft RAWP	3-23-2017
Fact Sheet Announcing the 45-day Public Comment Period for RAWP Activities	3-27-2017
NYSDEC Approval of RAWP	5-8-2017
Submit draft Easement package	6-1-2017
Submit Draft Site Management Plan	8-1-2017
Submit Draft Engineering Report	10-2-2017
Submit Final Engineering Report	11-15-2017

## Figures



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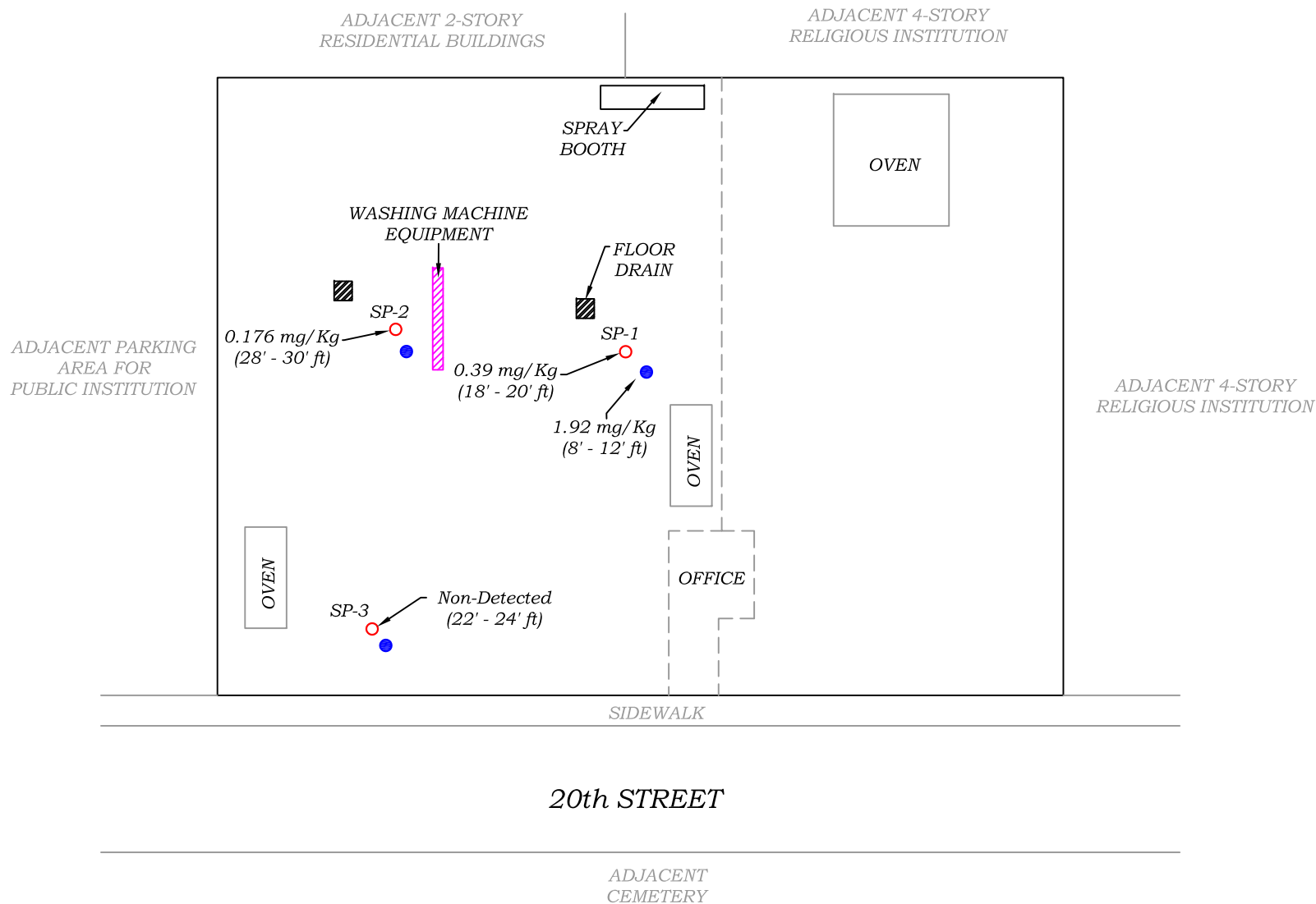
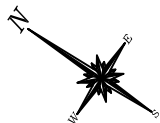
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Scale: AS NOTED

TITLE:

FIGURE 1: SITE LOCATION MAP



LEGEND:

- SOIL PROBE LOCATIONS (SP) - INSTALLED BY HYDROTECH DURING 2002
- PRESUMED SOIL PROBE LOCATIONS - INSTALLED BY VERTEX DURING 2001

0' 10' 20'  
SCALE IN FEET (FT.)



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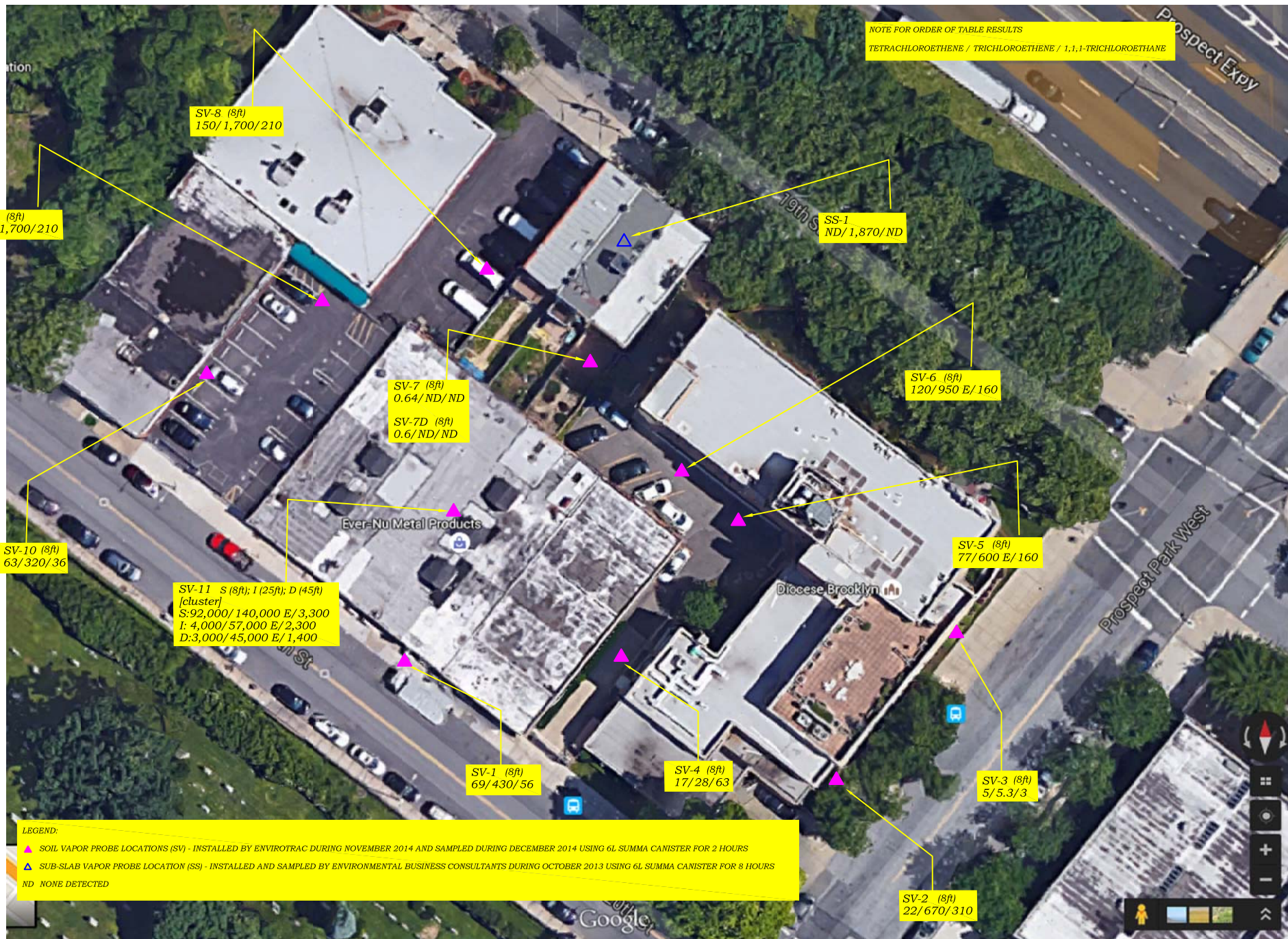
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TITLE:

FIGURE 2: MAP OF TCE CONCENTRATE IN SOIL SAMPLE





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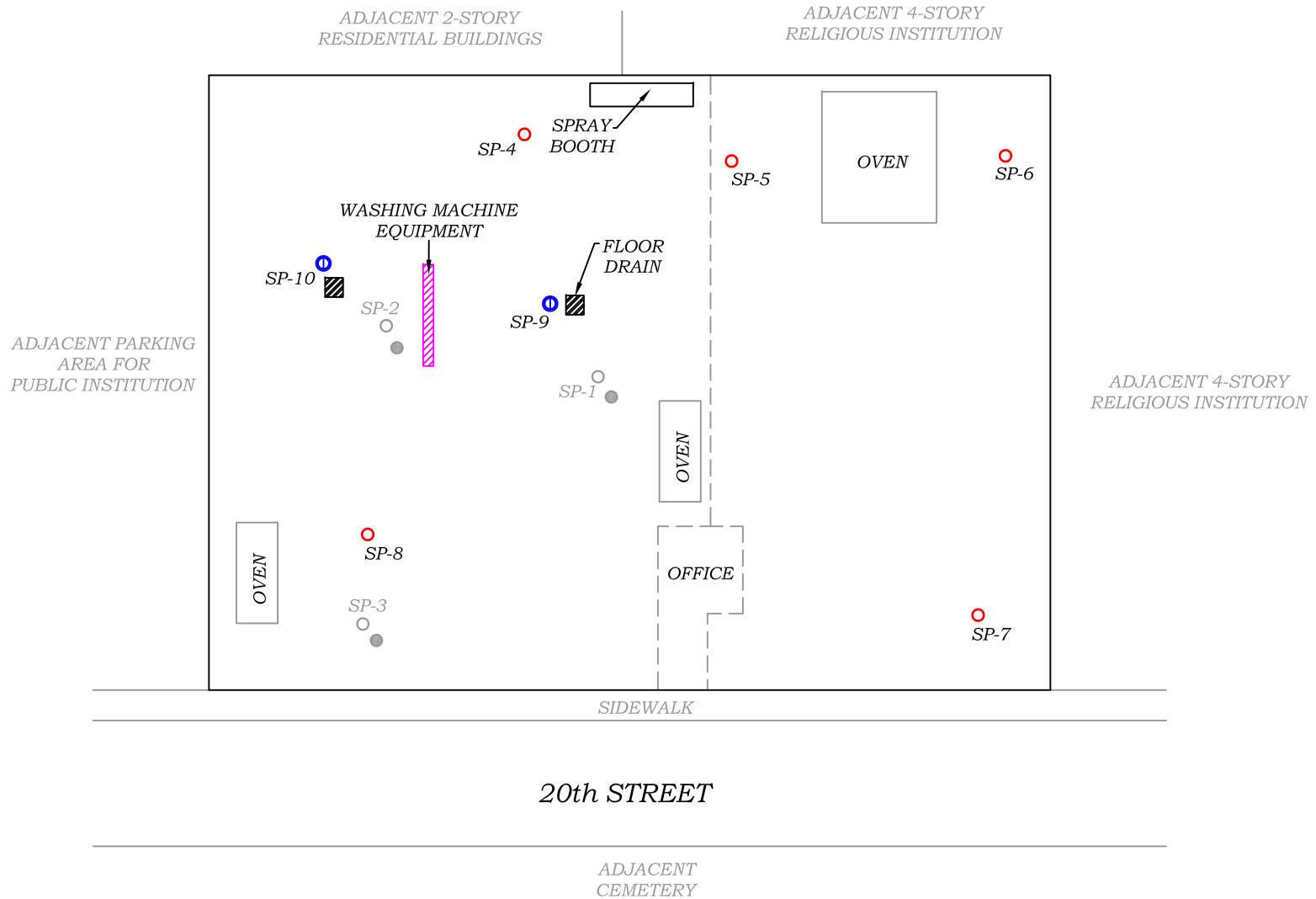
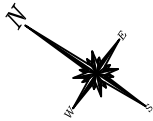
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471-483 20th Street  
Brooklyn, NY.  
HTE Job # 150152

Drawn By: C.Q.  
Reviewed By: P.M.  
Approved By: M.R.  
Date: 06/23/16  
Scale: AS NOTED

TITLE:

FIGURE 3: CHLORINATED COMPOUNDS IN SOIL VAPOR



**LEGEND:**

- SOIL PROBE LOCATIONS (SP) - INSTALLED BY HYDROTECH DURING 2002
- PRESUMED SOIL PROBE LOCATIONS - INSTALLED BY VERTEX DURING 2001
- PROPOSED SOIL PROBE LOCATIONS (SP) - TO BE ADVANCED TO DEPTH OF 20 FEET IF NO P.I.D. RESPONSE
- Ⓢ REVISED SOIL PROBE LOCATIONS (SP) - TO BE ADVANCED PAST 20 FEET AND DOWN 5 FEET BELOW THE POINT OF LOW P.I.D. RESPONSE

0' 10' 20'  
SCALE IN FEET (FT.)



**HYDRO TECH ENVIRONMENTAL CORP.**

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TITLE:

FIGURE 4: MAP OF PROPOSED SOIL PROBE LOCATIONS

## **Appendices**

A.HASP



## HEALTH & SAFETY PLAN

471-483 20<sup>th</sup> Street  
Block 888; Lots 50 & 52  
Brooklyn, New York

NYSDEC Site Number: C224187

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1. Directions to Hospital

### Attachments

- A. Health and Safety Fact Sheets

## 1.0 Introduction

The HASP has been prepared in conformance with applicable regulations, safe work practices and the project's requirements. It addresses those activities associated with the installation and sampling of soil probes and the in-field characterization of soil samples. The Project Manager (PM), Site Safety Officer (SSO) and Hydro Tech field staff will implement the Plan during site work. Compliance with this HASP is required of all persons and third parties who perform fieldwork for this project. Assistance in implementing this HASP can be obtained from the Hydro Tech's SSO. The content of this HASP may change or undergo revision based upon additional information that is made available to health and safety personnel, monitoring results or changes in the technical scope of work. Any changes proposed must be reviewed by the SSO.

## SCOPE OF WORK

The Scope of Work activities will include the following:

- Installation of soil probes
- Characterization and collection of soil samples

## EMERGENCY NUMBERS

<u>Contact</u>	<u>Phone Number</u>
Lutheran Medical Center	718-630-7000
New York City EMS	911
NYPD	911
NYFD	911
National Response Center	800-424-8802
Poison Information Center	800-562-8816
Chemtree	800-424-9555

### *Project Management/Health and Safety Personnel*

<u>Title</u>	<u>Contact</u>	<u>Phone Number</u>	<u>Cell Phone</u>
QEP	Mark E. Robbins	(631) 462-5866	(631) 457-0032
PM/SSO	Paul I. Matli	(718) 636-0800	(631) 457-0523

### *Directions to Lutheran Medical Center (See Figure 1)*

Upon leaving the Site, start going north northeast on 20<sup>th</sup> Street toward 8<sup>th</sup> Avenue. Turn left onto 3<sup>rd</sup> Avenue and then right onto 51<sup>st</sup> Street. Turn left at the 2<sup>nd</sup> cross street onto 1<sup>st</sup> Avenue and then left onto 55<sup>th</sup> Street. The hospital will be on the right side.

## **2.0 Health and Safety Staff**

This section briefly describes the personnel and their health and safety responsibilities for the:

### **PROJECT Manager (PM)**

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

Resumes for Hydro Tech Project Staff involved in this project are provided in the QAPP (Appendix E) of the Supplemental Remedial Investigation Work Plan (Supplemental RIWP).

### **SITE SAFETY OFFICER (SSO)**

- Directs and coordinates health and safety monitoring activities.
- Ensures that field teams utilize proper personal protective equipment (PPE).
- Conducts initial onsite, specific training prior to personnel and/or subcontractors proceeding to work.
- Conducts and documents periodic safety briefings; ensures that field team members comply with this HASP.
- Completes and maintains Accident/Incident Report Forms.
- Notifies Hydro Tech corporate administration of all accidents/incidents.
- Determines upgrade or downgrade of PPE based on site conditions and/or downgrade of PPE based on site conditions and/or real-time monitoring results.
- Ensures that monitoring instruments are calibrated daily or as determined by manufacturer suggested instructions.
- Maintains health and safety field log books.
- Develops and ensures implementation of the HASP.
- Approves revised or new safety protocols for field operations.
- Coordinates revisions of this HASP with field personnel and the SSO Division Contracting Officer.
- Responsible for the development of new company safety protocols and procedures and resolution of any outstanding safety issues which may arise during the conduction of site work.
- Reviews personnel and subcontractors current and up-to-date medical examination and acceptability of health and safety training.

### **FIELD PERSONNEL AND SUBCONTRACTORS (IF ANY)**

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

### 3.0 Chemical & Waste Description/Characterization

The following list of chemicals is based on the materials either once stored onsite or believed to be formerly stored onsite:

- Unknown Contaminant(s) including VOCs, SVOCs, TAL metals, pesticides, PCBs

**Attachment A** contains information regarding assessing health risks from contaminants of concern.

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

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

### 4.0 Hazard Assessment

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

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

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

#### CHEMICAL HAZARDS

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

- Installation of soil probes
- Removal of any contaminated materials during sampling

#### *Exposure Pathways*

Exposure to these compounds during ongoing activities may occur through inhalation of contaminated dust particles, inhalation of volatile (VOC) and semi-volatile (SVOC) vapor fume compounds, by way of dermal absorption, and accidental ingestion of the contaminant by either direct or indirect cross contamination activities (eating, smoking, poor hygiene). Indirectly, inhalation of contaminated dust particles (VOCs, SVOCs) can occur during adverse weather conditions (high or changing wind directions) or during operations that may generate airborne dust such as excavation, and sampling activities. Dust control measures such as applying water to roadways and work sites will be implemented, where visible dust is generated from non-contaminated and contaminated soils. Where dust control measures are not feasible or effective, respiratory protection will be used.

#### *Additional Precautions*

Dermal absorption or skin contact with chemical compounds is possible during invasive activities at the Site, including removal of product, excavation of tanks, and handling of contaminated soils. The use of PPE in accordance with Section 9.2 and strict adherence to proper decontamination procedures should significantly reduce the risk of skin contact.

The potential for accidental ingestion of potentially hazardous chemicals is expected to be remote, when good hygiene practices are used.

### **PHYSICAL HAZARDS**

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

#### *Noise*

Noise is a potential hazard associated with operation of heavy equipment, power tools, pumps and generators. High noise operators will be evaluated at the discretion of the SSO. Employees with an 8-hour time weighted average exposure exceeding 85 decibels (db) will be included in the hearing conservation program in accordance with 29 CFR 1910.85.

It is mandated that employees working around heavy equipment or using power tools that dispense noise levels exceeding 95 db are to wear hearing protection that shall consist of earplugs and earphones. This is particularly relevant as the jet engines of modern airplanes can give sound level readings of greater than 110 db.

#### *Heat/Cold Stress*

Extremes in temperature and the effects of hard work in impervious clothing can result in heat stress and/or hypothermia. The human body is designed to function at a certain internal temperature. When metabolism or external sources (fire, hot summer day, winter weather, etc.) cause the body temperature to rise or fall excessively, the body seeks to protect itself by triggering cooling/warming mechanisms. Profuse sweating is an example of a cooling mechanism, while uncontrollable shivering is an example of a warming mechanism. The SSO monitor the temperature to determine potential adverse affects the weather can cause on site personnel.

Protective clothing worn to guard against chemical contact effectively stops the evaporation of perspiration. Thus the use of protective clothing increases heat stress problems. Cold stress can easily occur in winter with sub-freezing ambient temperatures. Workers in protective garments may heat-up and sweat, only to rapidly cool once out of the tank and the PPE. The major disorders due to heat stress are heat cramps, heat exhaustion and heat stroke.

HEAT CRAMPS are painful spasms that occur in the skeletal muscles of workers who sweat profusely in the heat and drink large quantities of water, but fail to replace the body's lost salts or electrolytes. Drinking water while continuing to lose salt tends to dilute the body's extra cellular fluids. Soon water seeps by osmosis into active muscles and causes pain. Muscles fatigued from work as usually most susceptible to cramps.

HEAT EXHAUSTION is characterized by extreme weakness or fatigue, dizziness, nausea, and headache. In serious cases, a person may vomit or lose consciousness. The skin is clammy and moist, complexion pale or flushed, and body temperature normal or slightly higher than normal. Treatment is rest in a cool place and

replacement of body water lost by perspiration. Mild cases may recover spontaneously with this treatment; severe cases may require care for several days. There are no permanent effects.

HEAT STROKE is a very serious condition caused by the breakdown of the body's heat regulating mechanisms. The skin is very dry and hot with red mottled or bluish appearance. Unconsciousness, mental confusion or convulsions may occur. Without quick and adequate treatment, the result can be death or permanent brain damage. Get medical assistance quickly! As first aid treatment, the person should be moved to a cool place. Soaking the person's clothes with water and fanning them should reduce body heat artificially, but not too rapidly.

Steps that can be taken to reduce heat stress are:

- Acclimatize the body. Allow a period of adjustment to make further heat exposure endurable.
- Drink more liquids to replace body water lost during sweating.
- Rest is necessary and should be conducted under the monitoring condition from the SSO and the effect personnel physiological state.
- Wearing personal cooling devices. There are two basic designs; units with pockets for holding frozen packets and units that circulate a cooling fluid from a reservoir through tubes to different parts of the body. Both designs can be in the form of a vest, jacket or coverall. Some circulating units also have a copy for cooling the head.

Cold temperatures can cause problems. The severe effects are FROSTBITE and HYPOTHERMIA.

FROSTBITE is the most common injury resulting from exposure to cold. The extremities of the body are often affected. The signs of frostbite are:

- The skin turns white or grayish-yellow
- Pain is sometimes felt early but subsides later. Often there is no pain
- The affected part feels intensely cold and numb

Shivering, numbness, drowsiness, muscular weakness and a low internal body temperature characterize the condition known as HYPOTHERMIA. This can lead to unconsciousness and death. With both frostbite and hypothermia, the affected areas need to be warmed quickly. Immersing in warm, not hot, water best does this. In such cases medical assistance will be sought.

To prevent these effects from occurring, persons working in the cold should wear adequate clothing and reduce the time spent in the cold area. The field SSO, to determine appropriate time personnel may spend in adverse weather conditions, will monitor this.

#### *Lockout/Tagout*

PURPOSE -- This program establishes procedures for de-energizing, isolating and ensuring the energy isolation of equipment and machinery. The program will be used to ensure that equipment and machinery is de-energizing and isolated from unexpected energization by physically locking (Lockout) energy isolation devices or, in the absence of locking capabilities, tagout (Tagout) the device to warn against energization. These procedures will provide the means of achieving the purpose of this program, prevention of injury to Hydro Tech employees from the unexpected energization or start-up of equipment and machinery, or from the release of stored energy.

APPLICATION -- This program applies to the control of energy during the servicing and/or maintenance of equipment and machinery. This program covers normal operations only if a guard or other safety device is removed or bypassed, or any part of the body is placed into an area of the equipment or machinery where work is performed on the material, or a danger zone exists during the operating cycle. Minor tool changes, adjustments, and other minor servicing activities which take place during normal production operations do not require isolation and lockout/tagout if they are routine and integral to the use of the equipment.

SCOPE -- This program will include all employees whose duties require them to service, install, repair, adjust, lubricate, inspect or perform work on powered equipment or machinery that may also have the potential for stored energy.

PROGRAM RESPONSIBILITIES -- The SSO will have the overall responsibility of the program to ensure that; authorized and affected employees receive adequate training and information, the program is evaluated annually, and the lockout/tagout equipment is properly used and the procedures of this program are followed.

The program evaluation will be conducted to ensure that the procedures and requirements of the program are being followed and will be utilized to correct any deviations or inadequacies that may be discovered. The evaluation will consist of one or more inspections or audits of actual lockout/tagout procedures being used to isolate equipment. A review of the authorized and affected employee's responsibilities will be conducted at the time of the inspection /audit. Any authorized employee, except the one(s) utilizing the energy isolation procedure being inspected, may perform the inspection/audit. A record will be maintained of program evaluation inspections and will include:

1. The identity of the equipment or machine on which energy control procedures were being utilized.
2. The date(s) of the inspection(s).
3. The employee(s) included in the inspection(s).
4. The person performing the inspection.

Authorized employees (persons who implement lockout/tagout procedures) will be responsible for following the procedures established by this program.

Affected employees are responsible for understanding the significance of a lockout/tagout device and the prohibition relating to attempts to restart or re-energize equipment or machinery that is locked out or tagged out.

TRAINING - Where applicable, Hydro Tech employees will be provided instruction in the purpose and functions of the energy control program to ensure that they understand the significance of locked or tagged out equipment and also have the knowledge and skill to correctly apply and remove energy controls. Training will include:

The recognition of applicable hazardous energy source(s), the type and magnitude of energy available, and the policies and procedures of the Hydro Tech energy control program.

1. Affected employees will be made aware of the purpose and use of energy control procedures and the prohibition relating to attempts to remove lockout or tagout devices.
3. Instruction in the limitations of tagout as a sole means of energy control.
  - a. Tags are warning devices and do not provide the physical restraint that a lock would.
  - b. Tags may provide a false sense of security.
  - c. Tags may become detached during use.

Initial training will be provided during to energy control program implementation, when new employees are hired or when job responsibilities change to include utilization of energy control procedures.

Retraining will be conducted whenever there is a change in job assignments that require the employee to utilize energy control procedures, a change in equipment that presents a new hazard, a change in the energy control procedures or when the program evaluation identifies inadequacies in the energy control program procedures.

Records of employee training will be maintained and will include the employee's name and date(s) of training.

STANDARD OPERATING PROCEDURES –where necessary, Hydro Tech will provide the necessary devices to effectively lockout or tagout energy isolating devices. Lockout/tagout devices will be the only devices used for controlling energy and shall not be used for other purposes. Any device used for lockout/tagout will be capable of withstanding the environment to which they are exposed for the maximum period they are to be exposed. The devices will be substantial enough to prevent removal without excessive force. Excessive force for a locking device would be bolt cutters or other metal cuttings tools. Tagout devices will be attached by a non-reusable method, attachable by hand, and very difficult to remove by hand. A nylon cable tie or equivalent will be used.

Lockout/tagout devices will indicate the identity of the employee who applied the device, and the tagout device will warn against the hazards if the equipment is energized.

Lockout is the preferred method of energy isolation. When physical lockout is not possible, the energy isolation will be tagged out of service with a warning tag attached at the power source. In the case of plug-in power source, the tag will be attached at the male plug. To ensure full employee protection using tagout instead of lockout, additional steps should be taken to guard against accidental or inadvertent energization. These steps may include, where applicable: removal of fuses, blocking switches, removal of a valve handle.

## **STANDARD OPERATING PROCEDURES**

### **I. APPLICATION OF CONTROLS**

#### **A. Preparing to Shut Down Equipment**

1. Prior to equipment shutdown, the authorized employee(s) must have knowledge of:
  - a. The type(s) and magnitude of power.
  - b. The hazards of the energy to be controlled.
  - c. The method(s) to control the energy.
  - d. The location and identity of all isolating devices that control or feed the equipment to be locked/tagged out.
2. Notify all affected employees that the lockout/tagout system will be in effect.
3. Assemble applicable lockout/tagout devices, i.e., padlocks, tags, multiple lock hasps, etc.

#### **B. Equipment Shutdown and Isolation**

1. If equipment is in operation, shut it down by the normal stopping procedure (stop button, switch).
2. Operate disconnects, switches, valves, or other energy isolating devices so that the equipment is de-energizing and isolated from its energy source(s).
3. Verify that equipment is shut down by operating equipment from the normal operating location and any remote locations.

#### **C. Installation of Lockout/Tagout Device, Release of Stored Energy, and Verification**

1. Attach individually assigned lock(s) or tag(s) to energy isolating device(s). Where it is not possible to lock a switch, valve or other isolating device, electrical fuses must be removed, blank flanges installed in piping, lines disconnected, or other suitable methods used to ensure that equipment is isolated from energy sources. A tag must be installed at the point of power interruption to warn against energizing.
  - a. Each lock or tag must positively identify the person who applied it and locks must be individually keyed.
  - b. If more than one person is involved in the task, employees will place their own lock and tag. Multiple lock hasps are available for this.
2. Release, restrain, or dissipate stored energy such spring tension, elevated machine members, rotating flywheels, hydraulic pressure, pistons and air, gas, steam, water pressure, etc. by repositioning, blocking bleeding, or other suitable means.
3. Prior to starting work on equipment and after ensuring that no personnel are exposed, the authorized employee will verify that isolation and de-energization have been accomplished by:
  - a. Attempting, through normal effort, to operate energy isolating devices such as switches, valves, or circuit breaker with locks or tags installed.
  - b. Attempting to operate the equipment or machinery that is locked or tagged out. This includes all sources of energy, i.e. electrical, hydraulic, gravity, air,



- water, stream pressure, etc.
    - c. Verifying the presence and effectiveness of restraint (blocking) and energy dissipation or release (bleeding).
  - 4. If there is a possibility of the re-accumulation of stored energy to a hazardous level, verification of isolation will be contained until the servicing or maintenance is completed, or until the possibility of such accumulation no longer exists.
- D. Group Lockout/Tagout
  - 1. When more than one individual is involved in locking or tagging equipment out of operation, each individual will attach their individual lock or tag, or the equivalent, to the energy isolating device(s).
    - a. An equivalent lockout device may be in the form of a group lockout device such as a multiple lock hasp or lock box.
    - b. Primary responsibility for a group of authorized employees working under a group lockout device will be vested in a designated authorized employee.
    - c. Group lockout methods will provide a level of protection equal to that afforded by a personal lockout/tagout device.

## II. RETURNING EQUIPMENT TO SERVICE

- A. Restore Equipment to Normal Operating Status
  - 1. Re-install all parts or subassemblies removed for servicing or maintenance.
  - 2. Re-install all tools, rests, or other operating devices
  - 3. Re-install all guards and protective devices (i.e. limit switches).
  - 4. Remove all blocks, wedges, or other restraints from the operating area of the equipment (ways, slides, etc.).
  - 5. Remove all tools, equipment, and shop towels from the operating area of the equipment.
- B. Verify Equipment Ready for Operation
  - 1. Inspect area for non-essential items
  - 2. Ensure that all employees are safely positioned clear of the operating areas of the equipment.  
Post a watch if energy isolation devices are not in line of sight of the equipment.
- C. Notify Affected Employees of Impending Start-up
  - 1. The sudden noise of start-up may startle nearby employees.
  - 2. Equipment may need to be tested to determine operational safety by a qualified operator.
- D. Remove Energy Isolation Devices - Only by authorized employee(s) who installed it/them.
  - 1. Remove line blanks, reconnect piping (if applicable), and remove warning tag.
  - 2. Close bleeder valves, remove warning tag.
  - 3. Replace fuse(s), close circuit breaker(s) and remove warning tag.
  - 4. Remove lock and tag from control panel, valve, etc.

Employee(s) who installed them may make an exception for removal of lockout/tagout devices. If it is necessary to operate a piece of equipment that is locked/tagged out, every effort must be made to locate the employee whose lock or tag is on the equipment. If he or she cannot be located and only after positive assurance is made that no one is working on the locked out equipment, the supervisor may personally remove the lock. The supervisor must assure that the equipment is once again locked out, or the employee notified that the equipment has been re-energized, before the employee resumes work. Employees will recheck locked out equipment if they have left the equipment (breaks, lunch, and end of shift) to make sure it is still de-energized and locked out.

## III. TEMPORARY REMOVAL OF LOCKOUT/TAGOUT PROTECTION

- A. In situations when the equipment must be temporarily energized to test or position the equipment or its components, the following steps will be followed:
  - 1. Clear the equipment of tools and materials that are non-essential to the operation.
  - 2. Ensure the equipment components are operationally intact.
  - 3. Remove employees from the equipment area.
  - 4. Remove the lockout/tagout devices by the employee who installed in/them.
  - 5. Energize and proceed with testing or positioning.

6. De-energize all systems and re-install all energy control measures.
7. Verify re-installed energy control measures are effective.

#### IV. SHIFT OR PERSONNEL CHANGES

A. The following steps will be followed to ensure continuity of employee protection during personnel changes.

1. All personnel involved in the maintenance or servicing activity will be notified that a transfer of personal locks/tags is about to occur.
2. Clear all personnel from hazardous area(s) of equipment.
3. Under the supervision of the shift supervisor or group designee, the off-going employee will immediately install theirs.
  - a. If an entire group or more than one employee will be transferring work responsibility, locks/tags will be removed and replaced one at a time in order of installation.
4. When the transfer of lockout/tagout devices is complete, the effectiveness of all energy isolation devices will be verified to the satisfaction of all personnel involved.
5. Once the effectiveness of energy isolation protection is confirmed, the service/maintenance operation may continue.

#### V. CONTRACTOR NOTIFICATION

A. Whenever outside personnel may be engaged in activities covered by this program, they will inform the contractor of applicable lockout/tagout procedures used to protect Hydro Tech employees from the hazards of working near energized equipment.

1. The contractor will be expected to ensure that his/her employees understand and comply with the restrictions and prohibitions of this program.
2. Hydro Tech requires, under these circumstances, the contractor to inform us of their lockout/tagout procedures so that HTE employees can comply with the restrictions and prohibitions of the contractor's program.
3. Hydro Tech also requires the contractor to notify the program administrator, the area supervisor, and affected Hydro Tech employees prior to de-energizing, isolating and locking out Hydro Tech equipment. Conversely, notification is also required when this equipment will be returned to service.

#### DEFINITIONS

Affected employee - An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

Authorized employee(s) - A person or persons who locks or implements a tagout system procedure to perform servicing or maintenance on a machine or equipment. An authorized employee and an affected employee may be the same person when the affected employee's duties also include performing maintenance or service on a machine or equipment that must be locked or tagged out.

"Capable of being locked out" - An energy isolating device will be considered to be capable of being locked out either if it is designed with a hasp or other attachment or integral part to which, or through which, a lock can be affixed, or if it has a locking mechanism built into it. Other energy isolating devices will also be considered to be capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy-isolating device or permanently alter its energy control capability.

Energized - Connected to an energy source or containing residual or stored energy.

Energy isolating device - A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: a manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors and, in addition, no pole can be operated independently; a slide gate; a slip

blind; a line valve; a block; and any similar device used to block or isolate energy. The term does not include a push button, selector switch, and other control circuit type devices.

Energy source - any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal or other type of energy.

Lockout - The placement of lockout device on an energy-isolating device, in accordance with an established procedure, is ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lockout device - A device that utilizes positive means such as a lock, either key or combination type, to hold an energy isolating device in the safety position and prevent the energizing of a machine or equipment.

Normal production operations - The utilization of a machine or equipment to perform its intended production function.

Servicing and/or maintenance - Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying, and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or startup of the equipment or release of hazardous energy.

Setting up - Any work performed to prepare a machine or equipment to perform its normal production operation.

Stored energy - Energy that is available and may cause movement even after energy sources have been isolated. Stored energy may be in the form of compressed springs, elevated equipment components, hydraulic oil pressure, pressurized water, air, steam, or gas, or rotating flywheels, shafts or cams.

Tagout - The placement of a tagout device on an energy-isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

Tagout device - A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

#### ***GENERAL MACHINERY AND EQUIPMENT LIST***

##### **EQUIPMENT/LOCATION**

A. Backhoe Machine

##### **ENERGY SOURCES/LOCATION**

Diesel Engine

## **5.0 Training**

### **GENERAL HEALTH AND SAFETY TRAINING**

In accordance with Hydro Tech corporate policy, and pursuant to 29 CFR 1910.120, hazardous waste site workers shall, at the time of job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations. As a minimum, the training shall have consisted of instruction in the topics outlined in the above reference. Personnel who have not met the requirements for initial training will not be allowed to work in any site activities in which they may be exposed to hazards (chemical or physical).

Completion of the Hydro Tech Health and Safety Training Course for Hazardous Waste Operations or an approved equivalent will fulfill the requirements of this section. In addition to the required initial training, each employee shall have received 3 days of directly supervised on-the-job training. This training will address the duties the employees are expected to perform.

The Hydro Tech SSO the responsibility of ensuring that personnel assigned to this project complies with these requirements. Written certification of completion of the required training will be provided to the SSO.

### **MANAGER/SUPERVISOR TRAINING**

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

### **ANNUAL 8-HOUR REFRESHER TRAINING**

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

### **SITE SPECIFIC TRAINING**

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

### **ONSITE SAFETY BRIEFINGS**

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

### **ADDITIONAL TRAINING**

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

## **SUBCONTRACTOR TRAINING**

Subcontractor personnel who work onsite, only occasionally, for a specific limited task and who are unlikely to be exposed over permissible exposure limits, may be exempted from the initial 40-hour training requirement. The SSO will determine if this exemption is allowed. In any case, the subcontractor personnel who are exposed to hazards are not exempted from the 40-hours training requirement nor medical surveillance requirements found in Section 8.1.

### **6.0 Medical Surveillance**

#### **GENERAL**

All contractor and subcontractor personnel performing field work at the Site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120 (f). A physician's medical release for work will be confirmed by the SSO before an employee can begin site activities. Such examinations shall include a statement as to the worker's present health status, the ability to work in a hazardous environment (including any required PPE which may be used during temperature extremes), and the worker's ability to wear respiratory protection.

A medical data sheet will be completed by all onsite personnel and kept at the Site. Where possible, this medical data sheet will accompany the personnel needing medical assistance or transport to hospital facilities.

#### *MEDICAL SURVEILLANCE PROTOCOL*

The medical surveillance protocol to be implemented is the occupational physicians' responsibility, but shall meet the requirements of CFR 1910.120 and ANSI Z88.2 (1980). The medical surveillance protocol shall, as a minimum, cover the following:

- a. Medical and Occupational History
- b. General physical examination (including evaluation of major organ system)
- c. Serum lead and ZPP
- d. Chest X-ray (performed no more frequently than every four years, except when otherwise indicated).
- e. Pulmonary Function Testing (FVC and FEV1.0).
- f. Ability to wear respirator
- g. Audiometric testing.

Additional clinical tests may be included at the discretion of the occupational physician.

## 7.0 Site Control, PPE & Communications

### SITE CONTROL

A Support Zone (SZ) is an uncontaminated area that will be the field support area for most operations. The SZ provides for field team communications and staging for emergency response. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel or materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples. A contamination reduction corridor will be established. This is the route of entry and egress to the Site, and it provides an area for decontamination of personnel and portable equipment as well.

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

- A buddy
- Appropriate personal protective equipment
- Medical authorization
- Training certification

### PERSONAL PROTECTIVE EQUIPMENT

#### *GENERAL*

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

#### *PERSONAL PROTECTIVE EQUIPMENT SPECIFICATIONS*

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

- Cotton or disposable coveralls
- Chemical protective suit (e.g. Saran-coated Tyvek®)
- Gloves, inner (latex)
- Gloves, outer (Nitrile®)
- Boots (PVC), steel toe/shank
- Boot Covers (as needed)
- Hard Hat
- Hearing protection (as needed)

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

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

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

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

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

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

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

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

#### *INITIAL LEVELS OF PROTECTION*

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

#### **LEVEL OF PERSONAL PROTECTIVE EQUIPMENT REQUIRED**

<b>Activity</b>	<b>Level of Protection Respiratory/PPE</b>
Drilling/Coring	C/D
Sampling	C/D
Ground-Penetrating Radar/Magnetometer	C/D

#### **COMMUNICATIONS**

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

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

## **HAND SIGNALS FOR ONSITE COMMUNICATION**

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

### **8.0 Air Monitoring Plan**

#### **GENERAL**

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

#### **REAL-TIME MONITORING**

##### *INSTRUMENTATION*

At least one (1) of the following monitoring instruments will be available for use during field operations as necessary:

- Photoionization Detector (PID), Rae Instruments with 10.2 EV probe or equivalent
- Flame Ionization Detector (FID), Foxboro Model 128 or equivalent
- Combustible Gas Indicator (CGI)/Oxygen (O<sub>2</sub>) Meter, MSA or equivalent.

A FID or PID shall be used to monitor the organic vapor concentrations in active work areas. Organic vapor concentrations shall be measured upwind of the work areas to determine background concentrations. The SSO will interpret monitoring results using professional judgment. The PPE utilized shall always be the most protective, thus the action level criteria are flexible guidelines.

A CGI/O<sub>2</sub> meter shall be used to monitor for combustible gases and oxygen content in the boreholes during drilling activities.

Calibration records shall be documented, and included in the health and safety logbook or instrument calibration logbook. All instruments shall be calibrated before and after each daily use in accordance with the manufacturers' procedures.

##### *ACTION LEVELS*

Action levels for upgrading of PPE in this HASP will apply to all site work during the duration of field activities at the Site. Action levels are for unknown contaminants using direct reading in the Breathing Zone (BZ) for organic vapors and dusts, and at the source for combustible gases.

##### *MONITORING DURING FIELD ACTIVITIES*

Hydro Tech shall perform real time air monitoring prior to the commencement of work to establish baseline conditions. Baseline conditions will be established at the approximate center of the Site and at the perimeter of the Site both upwind and downwind.

During all work activities real time monitoring will occur. As necessary, Hydro Tech shall have at each applicable workstation a PID, explosimeter and oxygen deficiency meter. The real time monitoring for remedial activities will be conducted approximating the Breathing Zone of the workers. The monitoring will be continuous during working operations.



The air-monitoring instrument may indicate that personnel working in the exclusion zone increase their level of protection. All personnel will be trained in the action levels. When conditions warrant an increase in protection, all personnel will stop working and immediately leave the exclusion zone. They will then don the appropriate safety equipment necessary and return to their current workstation. All of this activity will be monitored by the SSO. The SSO will keep the Hydro Tech Project Manager aware of any extraordinary situations and conditions that may occur. Working conditions and monitoring levels will be noted in the Field Notebook along with the time, date and page number. Verbal reports will be given to the Project Manager when there is a change in the PPE level.

The previous day's results shall be reviewed each morning to determine what actions are necessary and the general conditions resulting from and around the Site.

The record keeping will include:

- Date & Time of Monitoring
- Air Monitoring Location
- Instrument, Model #, Serial #
- Calibration/Background Levels
- Results of Monitoring
- SSO Signature
- Comments

Excavation Operations - Monitoring will be performed continuously during all excavation and demolition operations. A PID and/or FID shall be utilized to monitor the breathing zone, the excavated area and any material taken from the excavation. A CGI/O<sub>2</sub> meter shall be used to monitor the excavation for the presence of combustible gases.

#### ***ACTION LEVELS OF AIRBORNE CONTAMINANTS***

<u>Instrument</u>	<u>Action Level</u>	<u>Action to be Taken</u>
FID/PID	< 100 ppm, for a 15-minute average	Stop work & initiate vapor control
	> 100 ppm, for a 15-minute average	Stop work & initiate evacuation procedure
CGI	10% LEL	Stop work, initiate ventilating
	50% LEL	Stop work, initiate evacuation procedure and contact fire dept.

#### **PERSONNEL MONITORING PROCEDURE**

The Site SSO, concurrent with activities that may generate the contaminants in excess of OSHA PEL's, may perform assessment and evaluation of field personnel exposures to airborne contaminants.

Procedures to be followed include:

The SSO may select high-risk individuals who may be subject to contaminant exposure based on job assignment.

The Personal Sampling is being conducted to determine the proper levels of respiratory protection required, to document potential exposures to compounds, and to assure compliance with OSHA standards. Therefore, it is important that the data collected be from "worst case" locations and personnel.

For example: when work is being conducted to excavate at an underground tank location, those persons closest to the excavation and most intimately involved with the work should be sampled. If a backhoe operator solely conducted the excavation, then that employee should be monitored. However, if there are additional workers who must enter the excavation and work with the freshly excavated soil, these persons

would be closer to the potential contaminants and they should be sampled.

To meet the intent of the sampling will require sampling at periods of the most disturbances. To be accurate in determining potential exposures, as many tasks/trades shall be sampled as possible during the course of this project. At completion of the project, a goal of 20% of all workers who must perform their duties in or around the contaminated soil, tanks and excavations is sought.

Hydro Tech must provide all sampling data in writing to the employees within three (3) days of receipt of results.

Air sampling pumps used to collect employee exposure samples shall be calibrated before and after use each day. Calibration shall be accomplished using a primary standard calibration system, e.g. the bubble tube method. Results of the calibrations shall be included in the health and safety field logbook and with the exposure report.

Chemical analysis of samples collected for assessment of employee exposures shall be performed in accordance with NIOSH or OSHA analytical methods only by laboratories accredited by the American Industrial Hygiene Association.

Results of the personal exposure assessment shall be provided to the individual, in writing within fifteen (15) working days after receipt of laboratory reports. Reports to field personnel shall provide calculated time-weighted average exposures and shall provide comparative information relative to established permissible exposure limits. The air sampling data sheet and laboratory report is considered a part of the employee exposure report. A copy of the employee personal exposure assessment report shall also be included in the project file and the employees' medical record for Hydro Tech employees. Reports for subcontractor employees will be sent directly to the subcontractors' employer.

#### **AIR MONITORING REPORTS**

Air Monitoring Reports will be completed by the SSO and/or authorized personnel and submitted to the Project Manager in the daily safety logs and will include the following:

- Date of monitoring
- Equipment utilized for air monitoring
- Real-time air monitoring results from each work location
- Calibration method of equipment and results

## 9.0 Safety Considerations

### GENERAL

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

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

- Persons with long hair and/or loose fitting clothing that could become entangled in power equipment must take adequate precautions.
- Horseplay is prohibited in the work area.
- Work while under the influence of intoxicants, narcotics or controlled substances is prohibited.

## **POSTED SIGNS**

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

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

## **INVASIVE OPERATIONS**

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

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

## **SOIL SAMPLING**

Personnel must wear prescribed protective clothing and equipment including eye protection, chemical resistant gloves and splash aprons (where appropriate) when sampling solids and liquids. Sample bottles are to be bagged prior to sampling to ease decontamination. Personnel must be aware of the location of emergency equipment, including spill containment materials prior to sampling. Personnel are to practice contamination avoidance at all times, as well as to utilize the buddy system and maintain communications with the Command Post.

## **SAMPLE HANDLING**

Personnel responsible for the handling of samples will wear the prescribed level of protection. Samples are to be identified as to their hazard and packaged as to prevent spillage or breakage. Any unusual sample conditions shall be noted. Laboratory personnel and all field personnel shall be advised of sample hazard levels and the potential contaminants present. This can be accomplished by a phone call to the lab coordinator and/or including a written statement with the samples reviewing lab safety procedures in handling in order to assure that the practices are appropriate for the suspected contaminants in the sample.

## **HEAVY EQUIPMENT DECONTAMINATION**

Personnel steam cleaning heavy equipment shall use the prescribed level of protection and adhere to the buddy system. Initially this task usually employs level C. The heavy equipment decontamination shall be

restricted to authorized personnel only. Special consideration will be given to wind speed and direction. Downwind areas are to be kept free of personnel to avoid unnecessary exposure to potential airborne contamination.

#### **ADDITIONAL SAFETY CONSIDERATIONS**

No other additional safety considerations at this time.

#### **10.0 Decontamination and Disposal Procedures**

##### **CONTAMINATION PREVENTION**

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

##### Personnel:

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

##### Sampling and Monitoring:

When required by the SSO, cover instruments with clear plastic, leaving openings for sampling ports and bag sample containers prior to emplacement of sample material.

##### Heavy Equipment:

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

##### **PERSONNEL DECONTAMINATION**

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

##### **EQUIPMENT DECONTAMINATION**

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

##### **DECONTAMINATION DURING MEDICAL EMERGENCIES**

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

surfaces should be used to help prevent contaminating the inside of ambulances and /or medical personnel. Outer garments are then removed at the medical facility.

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

## **DISPOSAL PROCEDURES**

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

### **11.0 Emergency Plan**

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

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

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

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

The cases where the PM is not available, the SSO shall serve as the alternate emergency coordinator.

## **EVACUATION**

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

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

personnel is established, the Fire Department and other emergency response groups as necessary will be notified by telephone of the emergency.

#### **POTENTIAL OR ACTUAL FIRE OR EXPLOSION**

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

#### **PERSONNEL INJURY**

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

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

#### **ACCIDENT/INCIDENT REPORTING**

As soon as first aid and/or emergency response needs have been met, the following parties are to be contacted by telephone:

1. Mark E. Robbins-Cell phone (631) 457-0030
2. The employer of any injured worker if not an Hydro Tech employee

Written confirmation of verbal reports is to be submitted within 24 hours. The report form entitled "Accident Data Report" is to be used for this purpose. All Hydro Tech representatives contacted by telephone are to receive a copy of this report. If the employee involved is not a Hydro Tech employee, his employer shall receive a copy of this report.

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

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

#### **OVERT PERSONNEL EXPOSURE**

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

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

**INGESTION:** Decontamination and transport to emergency medical facility.

**PUNCTURE WOUND  
OR LACERATION:** Decontaminate and transport to emergency medical facility.

#### **ADVERSE WEATHER CONDITIONS**

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

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

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

#### **EMERGENCY RESPONSE EQUIPMENT LIST**

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

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

#### **LARGE EQUIPMENT**

If necessary, Hydro Tech can have the following large equipment brought to the Site within 2-hours:

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



## **12.0 Logs, Reports and Record Keeping**

### **MEDICAL AND TRAINING RECORDS**

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

### **ONSITE LOG**

A log of personnel onsite each day will be kept by the SSO or designee. A copy of these logs will be sent to the Hydro Tech records coordinator for data entry. Originals will be kept in the project file.

### **EXPOSURE RECORDS**

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

### **ACCIDENT/INCIDENT REPORTS**

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

### **OSHA FORM 200**

An OSHA Form 200 (Log of Occupational Injuries and Illnesses) will be kept at the Site. All recordable injuries or illnesses will be recorded on this form. At the end of the project, the original will be sent to the Hydro Tech corporate records administrator for maintenance. Subcontractor employers must also meet the requirements of maintaining an OSHA 200 form.

The Hydro Tech accident/incident report meets the requirements of the OSHA Form 101 (Supplemental Record) and must be maintained with the OSHA Form 200 for all recordable injuries or illnesses.

### **HEALTH AND SAFETY FIELD LOG BOOK**

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

### **13.0 Sanitation**

If sanitary sewers are not provided at the Site, provisions shall be made for access to sanitary systems by using nearby public facilities consistent with provisions of governing local ordinance codes. In the latter case, provisions are required for the removal of accumulated waste products within those units.

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

Personnel and subcontractors sites shall follow decontamination procedures described in the HASP, or as directed by the SSO. This will generally include at a minimum site-specific training in shower usage and cleanup, personal hygiene requirements and the donning of protective equipment/clothing.

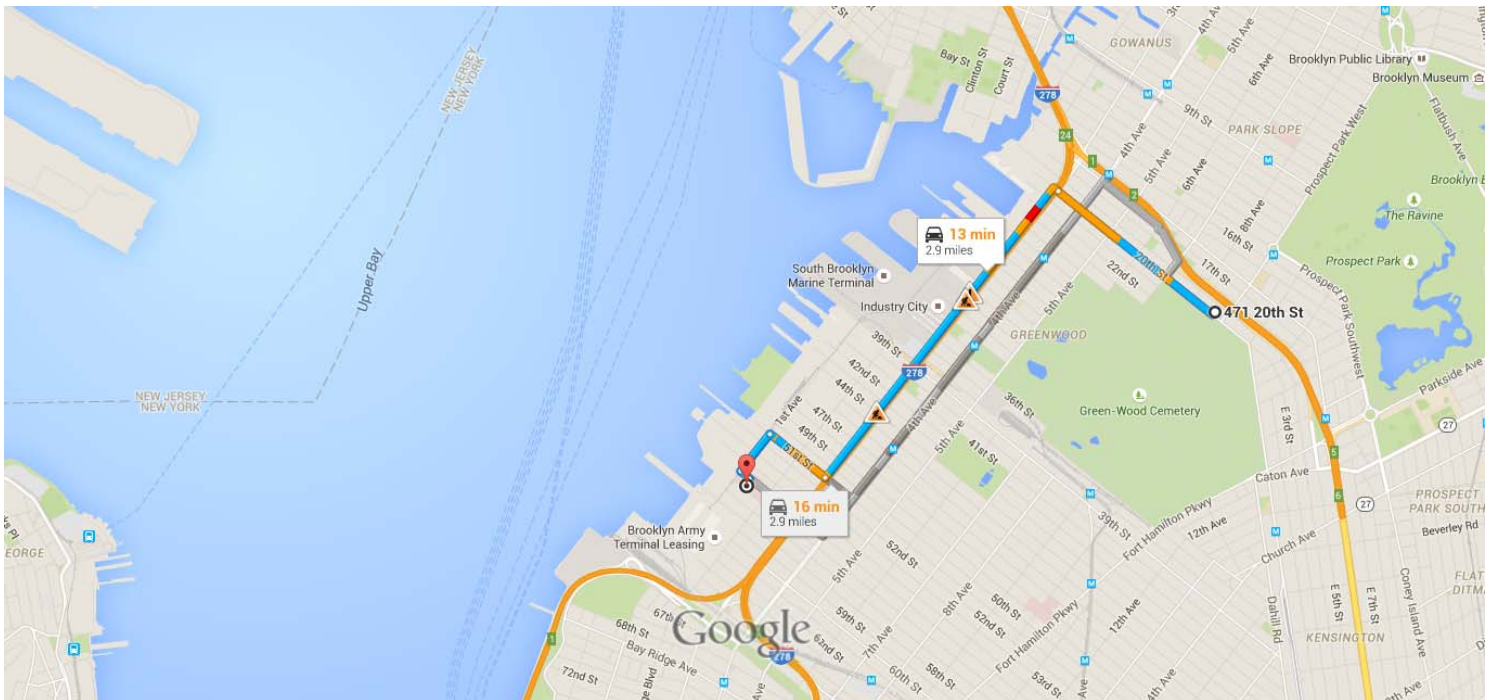
**FIGURE 1**  
**DIRECTIONS TO HOSPITAL**



Google

471 20th St, Brooklyn, NY 11215 to Lutheran Hospital, 55th Street, Brooklyn, NY

Drive 2.9 miles, 13 min



 via 20th St and 3rd Ave

11 min without traffic ·

**13 min**

2.9 miles


Details

 via 4th Ave

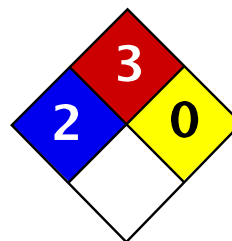
**16 min**

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32 min

Map data ©2015 Google 2000 ft 

**ATTACHMENT A**  
**HEALTH AND SAFETY FACT SHEETS**



Health	2
Fire	3
Reactivity	0
Personal Protection	H

## Material Safety Data Sheet p-Xylene MSDS

### Section 1: Chemical Product and Company Identification

**Product Name:** p-Xylene

**Catalog Codes:** SLX1120

**CAS#:** 106-42-3

**RTECS:** ZE2625000

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

**CI#:** Not applicable.

**Synonym:** p-Methyltoluene

**Chemical Name:** 1,4-Dimethylbenzene

**Chemical Formula:** C<sub>6</sub>H<sub>4</sub>(CH<sub>3</sub>)<sub>2</sub>

#### Contact Information:

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

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

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

Order Online: [ScienceLab.com](http://ScienceLab.com)

**CHEMTREC (24HR Emergency Telephone), call:**

1-800-424-9300

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

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

### Section 2: Composition and Information on Ingredients

#### Composition:

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

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

### Section 3: Hazards Identification

#### Potential Acute Health Effects:

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

#### Potential Chronic Health Effects:

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

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

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

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

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

#### Section 4: First Aid Measures

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

**Skin Contact:**

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

**Serious Skin Contact:**

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

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

**Serious Inhalation:** Not available.

**Ingestion:**

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

**Serious Ingestion:** Not available.

#### Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

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

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

**Flammable Limits:** LOWER: 1.1% UPPER: 7%

**Products of Combustion:** These products are carbon oxides (CO, CO<sub>2</sub>).

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

**Explosion Hazards in Presence of Various Substances:**

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

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

**Fire Fighting Media and Instructions:**

Flammable liquid, insoluble in water.

SMALL FIRE: Use DRY chemical powder.

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

**Special Remarks on Fire Hazards:**

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

**Special Remarks on Explosion Hazards:** Not available.

#### Section 6: Accidental Release Measures

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

**Large Spill:**

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

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

## Section 7: Handling and Storage

**Precautions:**

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

**Storage:**

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

## Section 8: Exposure Controls/Personal Protection

**Engineering Controls:**

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

**Personal Protection:**

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

**Personal Protection in Case of a Large Spill:**

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

**Exposure Limits:**

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

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

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid. (Liquid.)

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 106.17 g/mole

**Color:** Colorless.

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

**Boiling Point:** 138°C (280.4°F)

**Melting Point:** 12°C (53.6°F)



**Critical Temperature:** Not available.

**Specific Gravity:** 0.86 (Water = 1)

**Vapor Pressure:** 9 mm of Hg (@ 20°C)

**Vapor Density:** 3.7 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** 0.62 ppm

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

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

**Solubility:**

Easily soluble in methanol, diethyl ether.

Insoluble in cold water, hot water.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:** Reactive with oxidizing agents.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

## Section 11: Toxicological Information

**Routes of Entry:** Eye contact.

**Toxicity to Animals:**

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

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

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

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

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

**Other Toxic Effects on Humans:**

Very hazardous in case of skin contact (irritant).

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

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:**

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

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

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

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

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

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

## Section 14: Transport Information

**DOT Classification:** Class 3: Flammable liquid.

**Identification:** : Xylene : UN1307 PG: III

**Special Provisions for Transport:** Not available.

## Section 15: Other Regulatory Information

**Federal and State Regulations:**

Pennsylvania RTK: p-Xylene  
Florida: p-Xylene  
Massachusetts RTK: p-Xylene  
New Jersey: p-Xylene  
TSCA 8(b) inventory: p-Xylene  
SARA 313 toxic chemical notification and release reporting: p-Xylene  
CERCLA: Hazardous substances.: p-Xylene

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

**Other Classifications:**

**WHMIS (Canada):**

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F).  
CLASS D-2B: Material causing other toxic effects (TOXIC).

**DSCL (EEC):**

R10- Flammable.  
R38- Irritating to skin.  
R41- Risk of serious damage to eyes.  
R48/20- Harmful: danger of serious

damage to health by prolonged exposure through inhalation.

**HMIS (U.S.A.):**

**Health Hazard:** 2

**Fire Hazard:** 3

**Reactivity:** 0

**Personal Protection:** h

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

**Health:** 2

**Flammability:** 3

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**

Gloves.

Lab coat.

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

Splash goggles.

## Section 16: Other Information

**References:**

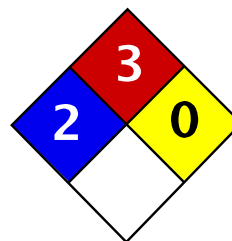
- Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
- Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec.
- SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e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

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 08:33 PM

**Last Updated:** 10/10/2005 08:33 PM

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Health	2
Fire	3
Reactivity	0
Personal Protection	J

## Material Safety Data Sheet m-Xylene MSDS

### Section 1: Chemical Product and Company Identification

**Product Name:** m-Xylene

**Catalog Codes:** SLX1066

**CAS#:** 108-38-3

**RTECS:** ZE2275000

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

**CI#:** Not applicable.

**Synonym:** m-Methyltoluene

**Chemical Name:** 1,3-Dimethylbenzene

**Chemical Formula:** C<sub>6</sub>H<sub>4</sub>(CH<sub>3</sub>)<sub>2</sub>

#### Contact Information:

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

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

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

Order Online: [ScienceLab.com](http://ScienceLab.com)

**CHEMTREC (24HR Emergency Telephone), call:**

1-800-424-9300

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

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

### Section 2: Composition and Information on Ingredients

#### Composition:

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

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

### Section 3: Hazards Identification

#### Potential Acute Health Effects:

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

#### Potential Chronic Health Effects:

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

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

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

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

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

#### Section 4: First Aid Measures

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

**Skin Contact:**

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

**Serious Skin Contact:**

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

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

**Serious Inhalation:** Not available.

**Ingestion:**

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

**Serious Ingestion:** Not available.

#### Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

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

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

**Flammable Limits:** LOWER: 1.1% UPPER: 7%

**Products of Combustion:** These products are carbon oxides (CO, CO<sub>2</sub>).

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

**Explosion Hazards in Presence of Various Substances:**

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

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

**Fire Fighting Media and Instructions:**

Flammable liquid, insoluble in water.

SMALL FIRE: Use DRY chemical powder.

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

**Special Remarks on Fire Hazards:**

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

**Special Remarks on Explosion Hazards:** Not available.

#### Section 6: Accidental Release Measures

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

**Large Spill:**

Flammable liquid, insoluble in water.

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

## Section 7: Handling and Storage

### Precautions:

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

### Storage:

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

## Section 8: Exposure Controls/Personal Protection

### Engineering Controls:

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

**Personal Protection:** Splash goggles. Lab coat. Gloves.

### Personal Protection in Case of a Large Spill:

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

### Exposure Limits:

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

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

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid. (Liquid.)

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 106.17 g/mole

**Color:** Colorless.

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

**Boiling Point:** 139.3°C (282.7°F)

**Melting Point:** -47.87°C (-54.2°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 0.86 (Water = 1)

**Vapor Pressure:** 6 mm of Hg (@ 20°C)

**Vapor Density:** 3.7 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** 0.62 ppm

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

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

**Solubility:**

Easily soluble in methanol, diethyl ether.

Insoluble in cold water, hot water.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:** Reactive with oxidizing agents.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

## Section 11: Toxicological Information

**Routes of Entry:** Eye contact.

**Toxicity to Animals:**

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

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

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

**Other Toxic Effects on Humans:**

Very hazardous in case of skin contact (irritant).

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

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:**

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

0900 Detected in maternal milk in human.

Narcotic effect; may cause nervous system disturbances.

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

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

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

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

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

## Section 14: Transport Information

**DOT Classification:** Class 3: Flammable liquid.

**Identification:** : Xylene : UN1307 PG: III

**Special Provisions for Transport:** Not available.

## Section 15: Other Regulatory Information

**Federal and State Regulations:**

Pennsylvania RTK: m-Xylene

Massachusetts RTK: m-Xylene

TSCA 8(b) inventory: m-Xylene

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

CERCLA: Hazardous substances.: m-Xylene

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

**Other Classifications:**

**WHMIS (Canada):**

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

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

**DSCL (EEC):**

R10- Flammable.

R38- Irritating to skin.

R41- Risk of serious damage to eyes.

**HMIS (U.S.A.):**

**Health Hazard:** 2

**Fire Hazard:** 3

**Reactivity:** 0

**Personal Protection:** j

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



**Health:** 2

**Flammability:** 3

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**

Gloves.

Lab coat.

Wear appropriate respirator when ventilation is inadequate.

Splash goggles.

## Section 16: Other Information

**References:**

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

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

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

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

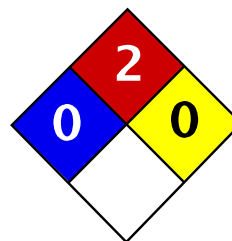
-Guide de la loi et du règlement sur le transport des marchandises dangereuses au Canada. Centre de conformité international Ltée. 1986.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 08:33 PM

**Last Updated:** 10/10/2005 08:33 PM

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Health	0
Fire	2
Reactivity	0
Personal Protection	H

## Material Safety Data Sheet

### Mesitylene MSDS

#### Section 1: Chemical Product and Company Identification

**Product Name:** Mesitylene

**Catalog Codes:** SLM2410

**CAS#:** 108-67-8

**RTECS:** OX6825000

**TSCA:** TSCA 8(b) inventory: Mesitylene

**CI#:** Not available.

**Synonym:** 1,3,5-Trimethylbenzene

**Chemical Formula:** C<sub>9</sub>H<sub>12</sub>

#### Contact Information:

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

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

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

Order Online: [ScienceLab.com](http://ScienceLab.com)

**CHEMTREC (24HR Emergency Telephone), call:**

1-800-424-9300

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

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

#### Section 2: Composition and Information on Ingredients

##### Composition:

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

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

#### Section 3: Hazards Identification

##### Potential Acute Health Effects:

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

##### Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

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

#### Section 4: First Aid Measures

##### Eye Contact:

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

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

**Skin Contact:**

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

**Serious Skin Contact:** Not available.

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

**Serious Inhalation:**

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

**Ingestion:**

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

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

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

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

**Flammable Limits:** Not available.

**Products of Combustion:** These products are carbon oxides (CO, CO<sub>2</sub>).

**Fire Hazards in Presence of Various Substances:** Not available.

**Explosion Hazards in Presence of Various Substances:**

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

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

**Fire Fighting Media and Instructions:**

Flammable liquid, soluble or dispersed in water.

SMALL FIRE: Use DRY chemical powder.

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

**Special Remarks on Fire Hazards:** Not available.

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

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

**Large Spill:**

Flammable liquid.

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

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

## Section 7: Handling and Storage

### Precautions:

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

### Storage:

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

## Section 8: Exposure Controls/Personal Protection

### Engineering Controls:

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

### Personal Protection:

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

### Personal Protection in Case of a Large Spill:

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

### Exposure Limits:

TWA: 25 CEIL: 35 (ppm)

TWA: 125 CEIL: 170 (mg/m3)

Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid.

**Odor:** Aromatic.

**Taste:** Not available.

**Molecular Weight:** 120.2 g/mole

**Color:** Not available.

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

**Boiling Point:** 164.7°C (328.5°F)

**Melting Point:** -44.8°C (-48.6°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 0.8637 (Water = 1)

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

**Vapor Density:** 4.14 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** 0.23 ppm

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

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:** Very slightly soluble in cold water.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:** Not available.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

## Section 11: Toxicological Information

**Routes of Entry:** Eye contact. Ingestion.

### **Toxicity to Animals:**

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

**Chronic Effects on Humans:** Not available.

### **Other Toxic Effects on Humans:**

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

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** Not available.

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

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

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

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

**Special Remarks on the Products of Biodegradation:** Not available.

**Section 13: Disposal Considerations**

**Waste Disposal:**

**Section 14: Transport Information**

**DOT Classification:** Class 3: Flammable liquid.

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

**Special Provisions for Transport:** Marine Pollutant

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

Florida: Mesitylene

New Jersey: Mesitylene

TSCA 8(b) inventory: Mesitylene

**Other Regulations:**

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

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

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

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

**DSCL (EEC):**

R10- Flammable.

R36/37- Irritating to eyes and respiratory system.

**HMIS (U.S.A.):**

**Health Hazard:** 0

**Fire Hazard:** 2

**Reactivity:** 0

**Personal Protection:** h

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

**Health:** 0

**Flammability:** 2

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**

Gloves.

Lab coat.

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

Splash goggles.

## Section 16: Other Information

**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/09/2005 06:06 PM

**Last Updated:** 10/09/2005 06:06 PM

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# International Chemical Safety Cards

## BENZO(B)FLUORANTHENE

ICSC: 0720

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

# International Chemical Safety Cards



**BENZO(B)FLUORANTHENE****ICSC: 0720**

I M P O R T A N T  D A T A	<b>PHYSICAL STATE; APPEARANCE:</b> COLOURLESS TO YELLOW CRYSTALS.	<b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by inhalation of its aerosol and through the skin.
	<b>PHYSICAL DANGERS:</b>	<b>INHALATION RISK:</b> Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.
	<b>CHEMICAL DANGERS:</b> Upon heating, toxic fumes are formed.	<b>EFFECTS OF SHORT-TERM EXPOSURE:</b>
	<b>OCCUPATIONAL EXPOSURE LIMITS (OELs):</b> TLV not established.	<b>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:</b> This substance is possibly carcinogenic to humans.
PHYSICAL PROPERTIES	Melting point: 168°C Solubility in water: none	Vapour pressure, Pa at 20°C: <10 Octanol/water partition coefficient as log Pow: 6.04
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to the total environment. In the food chain important to humans, bioaccumulation takes place, specifically in oils and fats.	
NOTES		
Depending on the degree of exposure, periodic medical examination is indicated. Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home.		
ADDITIONAL INFORMATION		
ICSC: 0720		BENZO(B)FLUORANTHENE
© IPCS, CEC, 1993		

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# International Chemical Safety Cards

## BENZO(K)FLUORANTHENE

ICSC: 0721

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

# International Chemical Safety Cards

**BENZO(K)FLUORANTHENE****ICSC: 0721**

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

## BENZ(a)ANTHRACENE

ICSC: 0385

### BENZ(a)ANTHRACENE

1,2-Benzoanthracene

Benzo(a)anthracene

2,3-Benzphenanthrene

Naphthanthracene

 $C_{18}H_{12}$ 

Molecular mass: 228.3

CAS # 56-55-3

RTECS # CV9275000

ICSC # 0385

EC # 601-033-00-9

BENZ(a)ANTHRACENE			
1,2-Benzoanthracene Benzo(a)anthracene 2,3-Benzphenanthrene Naphthanthracene $C_{18}H_{12}$ Molecular mass: 228.3  CAS # 56-55-3 RTECS # CV9275000 ICSC # 0385 EC # 601-033-00-9			
TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
<b>FIRE</b>	Combustible.		Water spray, powder. In case of fire in the surroundings: all extinguishing agents allowed.
<b>EXPLOSION</b>	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
<b>EXPOSURE</b>		AVOID ALL CONTACT!	
• <b>INHALATION</b>		Local exhaust or breathing protection.	Fresh air, rest.
• <b>SKIN</b>		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
• <b>EYES</b>		Safety goggles, face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
• <b>INGESTION</b>		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.
SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING	
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place (extra personal protection: complete protective clothing including self-contained breathing apparatus).	Well closed.	T symbol R: 45 S: 53-45	

## SEE IMPORTANT INFORMATION ON BACK

ICSC: 0385

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## International Chemical Safety Cards

## BENZ(a)ANTHRACENE

ICSC: 0385

I M P O R T A N T  D A T A	<b>PHYSICAL STATE; APPEARANCE:</b> COLOURLESS TO YELLOW-BROWN FLUORESCENT FLAKES OR POWDER.	<b>ROUTES OF EXPOSURE:</b> The substance can be absorbed into the body by inhalation, through the skin and by ingestion.
	<b>PHYSICAL DANGERS:</b> Dust explosion possible if in powder or granular form, mixed with air.	<b>INHALATION RISK:</b> Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.
	<b>CHEMICAL DANGERS:</b>	<b>EFFECTS OF SHORT-TERM EXPOSURE:</b>
	<b>OCCUPATIONAL EXPOSURE LIMITS (OELs):</b> TLV not established.	<b>EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:</b> This substance is probably carcinogenic to humans.
<b>PHYSICAL PROPERTIES</b>	Sublimation point: 435°C Melting point: 162°C Relative density (water = 1): 1.274	Solubility in water: none Vapour pressure, Pa at 20°C: 292 Octanol/water partition coefficient as log Pow: 5.61
<b>ENVIRONMENTAL DATA</b>	In the food chain important to humans, bioaccumulation takes place, specifically in seafood.	
<b>NOTES</b>		
This substance is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. Tetraphene is a common name.		
<b>ADDITIONAL INFORMATION</b>		
<b>ICSC: 0385</b> <div>© IPCS, CEC, 1993</div>		
<b>BENZ(a)ANTHRACENE</b>		

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# Material Safety Data Sheet

Benzo[a]pyrene, 98%

ACC# 37175

## Section 1 - Chemical Product and Company Identification

**MSDS Name:** Benzo[a]pyrene, 98%

**Catalog Numbers:** AC105600000, AC105600010, AC105601000, AC377200000, AC377200010, AC377201000 AC377201000

**Synonyms:** 3,4-Benzopyrene; 3,4-Benzpyrene; Benzo[def]chrysene.

**Company Identification:**

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

**For information in North America, call:** 800-ACROS-01

**For emergencies in the US, call CHEMTREC:** 800-424-9300

## Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
50-32-8	Benzo[a]pyrene	>96	200-028-5

## Section 3 - Hazards Identification

### EMERGENCY OVERVIEW

Appearance: yellow to brown powder.

**Danger!** May cause harm to the unborn child. May impair fertility. May cause eye, skin, and respiratory tract irritation. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Cancer hazard. May cause allergic skin reaction. May cause heritable genetic damage.

**Target Organs:** Reproductive system, skin.

### Potential Health Effects

**Eye:** May cause eye irritation.

**Skin:** May cause skin irritation. May be harmful if absorbed through the skin. May cause an allergic reaction in certain individuals.

**Ingestion:** May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated. May be harmful if swallowed.

**Inhalation:** May cause respiratory tract irritation. The toxicological properties of this substance have not been fully investigated. May be harmful if inhaled.

**Chronic:** May cause cancer in humans. May cause reproductive and fetal effects. Laboratory experiments have resulted in mutagenic effects.

## Section 4 - First Aid Measures

**Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

**Skin:** Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

**Ingestion:** Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

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

**Flash Point:** Not available.

**Autoignition Temperature:** Not available.

**Explosion Limits, Lower:** Not available.

**Upper:** Not available.

**NFPA Rating:** (estimated) Health: 2; Flammability: 0; Instability: 0

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

**Storage:** Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

### Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs



Benzo[a]pyrene	0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m3 TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m3 IDLH (listed under Coal tar pitches).	0.2 mg/m3 TWA (as benzene soluble fraction) (listed under Coal tar pitches).
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**OSHA Vacated PELs:** Benzo[a]pyrene: No OSHA Vacated PELs are listed for this chemical.

**Personal Protective Equipment**

**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin:** Wear appropriate protective gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to prevent skin exposure.

**Respirators:** A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

## Section 9 - Physical and Chemical Properties

**Physical State:** Powder

**Appearance:** yellow to brown

**Odor:** faint aromatic odor

**pH:** Not available.

**Vapor Pressure:** Not available.

**Vapor Density:** Not available.

**Evaporation Rate:**Not available.

**Viscosity:** Not available.

**Boiling Point:** 495 deg C @ 760 mm Hg

**Freezing/Melting Point:**175 - 179 deg C

**Decomposition Temperature:**Not available.

**Solubility:** 1.60x10<sup>-3</sup> mg/l @25°C

**Specific Gravity/Density:**Not available.

**Molecular Formula:**C<sub>20</sub>H<sub>12</sub>

**Molecular Weight:**252.31

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.

**Conditions to Avoid:** Dust generation.

**Incompatibilities with Other Materials:** Strong oxidizing agents.

**Hazardous Decomposition Products:** Carbon monoxide, carbon dioxide.

**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:**

**CAS#** 50-32-8: DJ3675000

**LD50/LC50:**

Not available.

**Carcinogenicity:**

CAS# 50-32-8:

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

**Epidemiology:** No information found

**Teratogenicity:** No information found

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

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

**Neurotoxicity:** No information found

**Other Studies:**

## Section 12 - Ecological Information

No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.

**RCRA U-Series:**

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

## Section 14 - Transport Information

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

## Section 15 - Regulatory Information

### US FEDERAL

TSCA

CAS# 50-32-8 is listed on the TSCA inventory.

### **Health & Safety Reporting List**

None of the chemicals are on the Health & Safety Reporting List.

### **Chemical Test Rules**

None of the chemicals in this product are under a Chemical Test Rule.

### **Section 12b**

None of the chemicals are listed under TSCA Section 12b.

### **TSCA Significant New Use Rule**

None of the chemicals in this material have a SNUR under TSCA.

### **CERCLA Hazardous Substances and corresponding RQs**

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

### **SARA Section 302 Extremely Hazardous Substances**

None of the chemicals in this product have a TPQ.

### **SARA Codes**

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

### **Section 313**

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

### **Clean Air Act:**

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

### **Clean Water Act:**

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

CAS# 50-32-8 is listed as a Priority Pollutant under the Clean Water Act.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

### **OSHA:**

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

### **STATE**

CAS# 50-32-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

### **California Prop 65**

### **The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:**

WARNING: This product contains Benzo[a]pyrene, a chemical known to the state of California to cause cancer.

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

## **European/International Regulations**

### **European Labeling in Accordance with EC Directives**

### **Hazard Symbols:**

T N

### **Risk Phrases:**

R 43 May cause sensitization by skin contact.

R 45 May cause cancer.

R 46 May cause heritable genetic damage.

R 60 May impair fertility.

R 61 May cause harm to the unborn child.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

### **Safety Phrases:**

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.  
S 60 This material and its container must be disposed of as hazardous waste.  
S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

**WGK (Water Danger/Protection)**

CAS# 50-32-8: No information available.

**Canada - DSL/NDSL**

CAS# 50-32-8 is listed on Canada's DSL List.

**Canada - WHMIS**

This product has a WHMIS classification of D2A.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

**Canadian Ingredient Disclosure List**

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

<b>Section 16 - Additional Information</b>
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**MSDS Creation Date:** 9/02/1997

**Revision #7 Date:** 6/30/2006

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.*

# Material Safety Data Sheet

## Chrysene, 98%

ACC# 95251

### Section 1 - Chemical Product and Company Identification

**MSDS Name:** Chrysene, 98%**Catalog Numbers:** AC224140000, AC224140010, AC224140050, AC224145000**Synonyms:** 1,2-Benzophenanthrene; Benzo(a)phenanthrene; 1,2,5,6-Dibenzonaphthalene.**Company Identification:**

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

**For information in North America, call:** 800-ACROS-01**For emergencies in the US, call CHEMTREC:** 800-424-9300

### Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
218-01-9	Chrysene	98	205-923-4

### Section 3 - Hazards Identification

#### EMERGENCY OVERVIEW

Appearance: very light beige solid.

**Caution!** May cause eye and skin irritation. May cause respiratory tract irritation. May cause cancer in humans.**Target Organs:** Liver, skin.**Potential Health Effects****Eye:** May cause eye irritation.**Skin:** May cause skin irritation.**Ingestion:** May cause gastrointestinal irritation with nausea, vomiting and diarrhea.**Inhalation:** May cause respiratory tract irritation.**Chronic:** May cause cancer according to animal studies.

### Section 4 - First Aid Measures

**Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.**Skin:** Get medical aid. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.**Ingestion:** Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.**Inhalation:** Get medical aid immediately. Remove from exposure and move to fresh air

immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.

**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. This material in sufficient quantity and reduced particle size is capable of creating a dust explosion.

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

**Flash Point:** Not applicable.

**Autoignition Temperature:** Not available.

**Explosion Limits, Lower:** Not available.

**Upper:** Not available.

**NFPA Rating:** (estimated) Health: ; Flammability: 1; Instability:

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Vacuum or sweep up material and place into a suitable disposal container. Clean up spills immediately, observing precautions in the Protective Equipment section. Wear a self contained breathing apparatus and appropriate personal protection. (See Exposure Controls, Personal Protection section). Provide ventilation.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Wash hands before eating. Avoid contact with eyes, skin, and clothing. Use only with adequate ventilation. Avoid breathing dust.

**Storage:** Store in a tightly closed container. Store in a cool, dry area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use process enclosure, local exhaust ventilation, or other engineering controls to control airborne levels.

### Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Chrysene	0.2 mg/m3 TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m3 TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches).80 mg/m3 IDLH (listed under Coal tar pitches).	0.2 mg/m3 TWA (as benzene soluble fraction) (listed under Coal tar pitches).

**OSHA Vacated PELs:** Chrysene: No OSHA Vacated PELs are listed for this chemical.

**Personal Protective Equipment**

**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin:** Wear appropriate protective gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to prevent skin exposure.

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

## Section 9 - Physical and Chemical Properties

**Physical State:** Solid

**Appearance:** very light beige

**Odor:** Not available.

**pH:** Not available.

**Vapor Pressure:** Not available.

**Vapor Density:** Not available.

**Evaporation Rate:** Not available.

**Viscosity:** Not available.

**Boiling Point:** 448 deg C @ 760 mm Hg

**Freezing/Melting Point:** 250-255 deg C

**Decomposition Temperature:** Not available.

**Solubility:** insoluble

**Specific Gravity/Density:** Not available.

**Molecular Formula:** C<sub>18</sub>H<sub>12</sub>

**Molecular Weight:** 228.29

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.

**Conditions to Avoid:** Dust generation.

**Incompatibilities with Other Materials:** Strong oxidizing agents.

**Hazardous Decomposition Products:** Carbon monoxide, carbon dioxide.

**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:**

**CAS#** 218-01-9: GC0700000

**LD50/LC50:**

Not available.

**Carcinogenicity:**

CAS# 218-01-9:

- **ACGIH:** A3 - Confirmed animal carcinogen with unknown relevance to humans

- **California:** carcinogen, initial date 1/1/90
- **NTP:** Known carcinogen (listed as Coal tar pitches).
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

**Epidemiology:** No information found

**Teratogenicity:** No information found

**Reproductive Effects:** No information found

**Mutagenicity:** Chrysene was mutagenic to *S. Typhimurium* in the presence of an exogenous metabolic system.

**Neurotoxicity:** No information found

**Other Studies:**

## Section 12 - Ecological Information

**Ecotoxicity:** Water flea LC50 = 1.9 mg/L; 2 Hr.; Unspecified Fish toxicity : LC50 (96hr) *Neaethes arenacedentata* >1ppm. (Rossi, S.S. et al Marine Pollut. Bull. 1978) Invertebrate toxicity : lethal threshold concentration (24hr) *Daphnia Magna* 0,7æg/l. (\* Newsted, J.L. et al Environ. Toxicol. Chem. 1987) Bioaccumulation : 24hr *Daphnia Magna* log bioconcentration factor 3.7845 (\*)

**Environmental:** Degradation studies : biodegraded by white rot fungus (Proc. Annu. Meet. Am. Wood-Preserv. Assoc. 1989) May be utilised by axenic cultures of microorganisms e.g. *Pseudomonas pancimobilis* EPA505, which may have novel degradative systems (Mueller, J.G. et al ppl. Environ. Microbiol. 1990; Mueller, J.G. et al Environ. Sci. Technol. 1991).

**Physical:** Not found.

**Other:** No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.

**RCRA U-Series:**

CAS# 218-01-9: waste number U050.

## Section 14 - Transport Information

	US DOT	Canada TDG
<b>Shipping Name:</b>	Not regulated as a hazardous material	No information available.
<b>Hazard Class:</b>		
<b>UN Number:</b>		
<b>Packing Group:</b>		

## Section 15 - Regulatory Information



## US FEDERAL

### TSCA

CAS# 218-01-9 is listed on the TSCA inventory.

### Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

### Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

### Section 12b

None of the chemicals are listed under TSCA Section 12b.

### TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

### CERCLA Hazardous Substances and corresponding RQs

CAS# 218-01-9: 100 lb final RQ; 45.4 kg final RQ

### SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

### Section 313

This material contains Chrysene (CAS# 218-01-9, 98%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

### Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

### Clean Water Act:

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

CAS# 218-01-9 is listed as a Priority Pollutant under the Clean Water Act.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

### OSHA:

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

### STATE

CAS# 218-01-9 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

### California Prop 65

### The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains Chrysene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: CAS# 218-01-9: 0.35 æg/day NSRL (oral)

## European/International Regulations

### European Labeling in Accordance with EC Directives

### Hazard Symbols:

T

### Risk Phrases:

R 45 May cause cancer.

R 50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

### Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.

S 60 This material and its container must be disposed of as hazardous waste.

S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

**WGK (Water Danger/Protection)**

CAS# 218-01-9: No information available.

**Canada - DSL/NDSL**

CAS# 218-01-9 is listed on Canada's DSL List.

**Canada - WHMIS**

This product has a WHMIS classification of D2A.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

**Canadian Ingredient Disclosure List**

CAS# 218-01-9 is listed on the Canadian Ingredient Disclosure List.

<b>Section 16 - Additional Information</b>
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**MSDS Creation Date:** 6/30/1999

**Revision #4 Date:** 10/03/2005

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.*

# Material Safety Data Sheet

## Fluoranthene, 98%

ACC# 80991

### Section 1 - Chemical Product and Company Identification

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

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

**For information in North America, call:** 800-ACROS-01**For emergencies in the US, call CHEMTREC:** 800-424-9300

### Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
206-44-0	Fluoranthene	98	205-912-4

### Section 3 - Hazards Identification

#### EMERGENCY OVERVIEW

Appearance: yellow needles.

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

### Section 4 - First Aid Measures

**Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the

upper and lower eyelids. Get medical aid immediately. Do NOT allow victim to rub eyes or keep eyes closed. Extensive irrigation with water is required (at least 30 minutes).

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

**Ingestion:** Never give anything by mouth to an unconscious person. Get medical aid immediately. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water.

**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

**Notes to Physician:** Treat symptomatically and supportively.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

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

**Flash Point:** Not applicable.

**Autoignition Temperature:** Not applicable.

**Explosion Limits, Lower:** Not available.

**Upper:** Not available.

**NFPA Rating:** (estimated) Health: 2; Flammability: 0; Instability: 0

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Use only in a well-ventilated area. Do not get in eyes, on skin, or on clothing. Do not ingest or inhale. Use only in a chemical fume hood. Do not breathe dust.

**Storage:** Keep containers tightly closed. Store in a cool, dry area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

**Exposure Limits**

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

**OSHA Vacated PELs:** Fluoranthene: No OSHA Vacated PELs are listed for this chemical.

**Personal Protective Equipment**

**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin:** Wear appropriate protective gloves and clothing to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to prevent skin exposure.

**Respirators:** A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

## Section 9 - Physical and Chemical Properties

**Physical State:** Needles

**Appearance:** yellow

**Odor:** None reported.

**pH:** Not available.

**Vapor Pressure:** 0.01 mm Hg @ 20 deg C

**Vapor Density:** Not available.

**Evaporation Rate:** Not available.

**Viscosity:** Not available.

**Boiling Point:** 384 deg C @ 760.00mmHg

**Freezing/Melting Point:** 107.00 - 110.00 deg C

**Decomposition Temperature:** Not available.

**Solubility:** insoluble

**Specific Gravity/Density:** 1.252 g/cm<sup>3</sup>

**Molecular Formula:** C<sub>16</sub>H<sub>10</sub>

**Molecular Weight:** 202.25

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.

**Conditions to Avoid:** Incompatible materials, strong oxidants.

**Incompatibilities with Other Materials:** Strong oxidizing agents.

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

**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:**

**CAS#** 206-44-0: LL4025000

**LD50/LC50:**

CAS# 206-44-0:

Oral, rat: LD50 = 2 gm/kg;

Skin, rabbit: LD50 = 3180 mg/kg;

**Carcinogenicity:**

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

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

**Teratogenicity:** No information found

**Reproductive Effects:** No information found

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

**Neurotoxicity:** No information found

**Other Studies:**

## Section 12 - Ecological Information

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

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

**Physical:** No information available.

**Other:** No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.

**RCRA U-Series:**

CAS# 206-44-0: waste number U120.

## Section 14 - Transport Information

	US DOT	Canada TDG
<b>Shipping Name:</b>	Not regulated as a hazardous material	No information available.
<b>Hazard Class:</b>		
<b>UN Number:</b>		
<b>Packing Group:</b>		

## Section 15 - Regulatory Information

## US FEDERAL

### TSCA

CAS# 206-44-0 is listed on the TSCA inventory.

### Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

### Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

### Section 12b

None of the chemicals are listed under TSCA Section 12b.

### TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

### CERCLA Hazardous Substances and corresponding RQs

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

### SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

### SARA Codes

CAS # 206-44-0: immediate.

### Section 313

This material contains Fluoranthene (CAS# 206-44-0, 98%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

### Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

### Clean Water Act:

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

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

### OSHA:

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

### STATE

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

### California Prop 65

California No Significant Risk Level: None of the chemicals in this product are listed.

## European/International Regulations

### European Labeling in Accordance with EC Directives

#### Hazard Symbols:

XN

#### Risk Phrases:

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

#### Safety Phrases:

S 22 Do not breathe dust.

S 24/25 Avoid contact with skin and eyes.

### WGK (Water Danger/Protection)

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

### Canada - DSL/NDSL

CAS# 206-44-0 is listed on Canada's NDSL List.

### Canada - WHMIS

This product has a WHMIS classification of D2B.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

**Canadian Ingredient Disclosure List**

CAS# 206-44-0 is listed on the Canadian Ingredient Disclosure List.

<b>Section 16 - Additional Information</b>
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**MSDS Creation Date:** 9/02/1997

**Revision #5 Date:** 10/03/2005

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

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**MSDS****Material Safety Data Sheet**

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



Mallinckrodt  
CHEMICALS



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  
Chemtec: 703-527-3887

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

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

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# LEAD METAL

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## 1. Product Identification

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

**CAS No.:** 7439-92-1

**Molecular Weight:** 207.19

**Chemical Formula:** Pb

**Product Codes:**

J.T. Baker: 2256, 2266

Mallinckrodt: 5668

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## 2. Composition/Information on Ingredients

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

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## 3. Hazards Identification

**Emergency Overview**

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

**J.T. Baker SAF-T-DATA<sup>(tm)</sup>** Ratings (Provided here for your convenience)

-----

Health Rating: 3 - Severe (Life)

Flammability Rating: 0 - None

Reactivity Rating: 0 - None

Contact Rating: 1 - Slight

Lab Protective Equip: GOGGLES; LAB COAT; PROPER GLOVES

Storage Color Code: Blue (Health)

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### **Potential Health Effects**

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#### **Inhalation:**

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

#### **Ingestion:**

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

#### **Skin Contact:**

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

#### **Eye Contact:**

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

#### **Chronic Exposure:**

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

#### **Aggravation of Pre-existing Conditions:**

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

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## **4. First Aid Measures**

**Inhalation:**

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

**Ingestion:**

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

**Skin Contact:**

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

**Eye Contact:**

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

---

## 5. Fire Fighting Measures

**Fire:**

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

**Explosion:**

Not considered to be an explosion hazard.

**Fire Extinguishing Media:**

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

**Special Information:**

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

---

## 6. Accidental Release Measures

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

---

## 7. Handling and Storage

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

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

---

## 8. Exposure Controls/Personal Protection

### **Airborne Exposure Limits:**

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

-OSHA Permissible Exposure Limit (PEL): 0.05 mg/m<sup>3</sup> (TWA)

For lead, elemental and inorganic compounds, as Pb:

-ACGIH Threshold Limit Value (TLV): 0.05 mg/m<sup>3</sup> (TWA), A3 animal carcinogen

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

For lead, inorganic:

-NIOSH Recommended Exposure Limit (REL): 0.1 mg/m<sup>3</sup> (TWA)

### **Ventilation System:**

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

### **Personal Respirators (NIOSH Approved):**

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

### **Skin Protection:**

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

### **Eye Protection:**

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

### **Other Control Measures:**

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

---

## 9. Physical and Chemical Properties

**Appearance:**

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

**Odor:**

Odorless.

**Solubility:**

Insoluble in water.

**Density:**

11.34

**pH:**

No information found.

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

0

**Boiling Point:**

1740C (3164F)

**Melting Point:**

327.5C (622F)

**Vapor Density (Air=1):**

No information found.

**Vapor Pressure (mm Hg):**

1.77 @ 1000C (1832F)

**Evaporation Rate (BuAc=1):**

No information found.

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage.

**Hazardous Decomposition Products:**

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

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

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

**Conditions to Avoid:**

Heat, flames, ignition sources and incompatibles.

---

## 11. Toxicological Information

**Toxicological Data:**

Investigated as a tumorigen, mutagen, reproductive effector.

**Reproductive Toxicity:**

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

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

**Carcinogenicity:**

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

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

---

## 12. Ecological Information

**Environmental Fate:**

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

**Environmental Toxicity:**

No information found.

---

## 13. Disposal Considerations

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

---

## 14. Transport Information

Not regulated.

---

## 15. Regulatory Information

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

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

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

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

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

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

**WARNING:**

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

**Australian Hazchem Code:** None allocated.

**Poison Schedule:** S6

**WHMIS:**

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

## 16. Other Information

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

**Label Hazard Warning:**

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

**Label Precautions:**

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

Do not breathe dust.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

**Label First Aid:**

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

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

**Product Use:**

Laboratory Reagent.

**Revision Information:**

No Changes.

**Disclaimer:**

\*\*\*\*\*

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\*\*\*\*\*

**Prepared by:** Environmental Health & Safety

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



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

---

**MSDS****Material Safety Data Sheet**

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



Mallinckrodt  
CHEMICALS



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  
Chemtec: 703-527-3887

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

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

---

# MERCURY

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## 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<sup>(tm)</sup>** 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**

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#### **Inhalation:**

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

#### **Ingestion:**

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

#### **Skin Contact:**

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

#### **Eye Contact:**

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

#### **Chronic Exposure:**

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

#### **Aggravation of Pre-existing Conditions:**

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

## 4. First Aid Measures

**Inhalation:**

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

**Ingestion:**

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

**Skin Contact:**

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

**Eye Contact:**

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

---

## 5. Fire Fighting Measures

**Fire:**

Not considered to be a fire hazard.

**Explosion:**

Not considered to be an explosion hazard.

**Fire Extinguishing Media:**

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

**Special Information:**

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

---

## 6. Accidental Release Measures

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

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

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

---

## 7. Handling and Storage

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

---

## 8. Exposure Controls/Personal Protection

### **Airborne Exposure Limits:**

- OSHA Acceptable Ceiling Concentration:  
mercury and mercury compounds: 0.1 mg/m<sup>3</sup> (TWA), skin
- ACGIH Threshold Limit Value (TLV):  
inorganic and metallic mercury, as Hg: 0.025 mg/m<sup>3</sup> (TWA) skin, A4 Not classifiable as a human carcinogen.
- ACGIH Biological Exposure Indices:  
total inorganic mercury in urine (preshift): 35 ug/g creatinine;  
total inorganic mercury in blood (end of shift): 15 ug/l.

### **Ventilation System:**

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

### **Personal Respirators (NIOSH Approved):**

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

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

### **Skin Protection:**

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

### **Eye Protection:**

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

---

## 9. Physical and Chemical Properties

**Appearance:**

Silver-white, heavy, mobile, liquid metal.

**Odor:**

Odorless.

**Solubility:**

Insoluble in water.

**Density:**

13.55

**pH:**

No information found.

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

100

**Boiling Point:**

356.7C (675F)

**Melting Point:**

-38.87C (-38F)

**Vapor Density (Air=1):**

7.0

**Vapor Pressure (mm Hg):**

0.0018 @ 25C (77F)

**Evaporation Rate (BuAc=1):**

4

---

## 10. Stability and Reactivity

**Stability:**

Stable under ordinary conditions of use and storage.

**Hazardous Decomposition Products:**

At high temperatures, vaporizes to form extremely toxic fumes.

**Hazardous Polymerization:**

Will not occur.

**Incompatibilities:**

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

**Conditions to Avoid:**

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

---

## 11. Toxicological Information

**Toxicological Data:**

Investigated as a tumorigen, mutagen, reproductive effector.

**Reproductive Toxicity:**

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

been learned from experimental animals. See Chronic Health Hazards.

**Carcinogenicity:**

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

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

---

## 12. Ecological Information

**Environmental Fate:**

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

**Environmental Toxicity:**

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

---

## 13. Disposal Considerations

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

---

## 14. Transport Information

**Domestic (Land, D.O.T.)**

-----

**Proper Shipping Name:** RQ, MERCURY

**Hazard Class:** 8

**UN/NA:** UN2809

**Packing Group:** III

**Information reported for product/size:** 1LB

**International (Water, I.M.O.)**

-----

**Proper Shipping Name:** MERCURY

**Hazard Class:** 8

**UN/NA:** UN2809

**Packing Group:** III

**Information reported for product/size:** 1LB

**International (Air, I.C.A.O.)****Proper Shipping Name:** MERCURY**Hazard Class:** 8**UN/NA:** UN2809**Packing Group:** III**Information reported for product/size:** 1LB

## 15. Regulatory Information

```

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

```

```

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

```

```

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

```

```

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

```

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

**WARNING:**

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

**Australian Hazchem Code:** 2Z**Poison Schedule:** S7**WHMIS:**

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

## 16. Other Information

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

**Label Hazard Warning:**

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

**Label Precautions:**

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

Do not breathe vapor.

Keep container closed.

Use only with adequate ventilation.

Wash thoroughly after handling.

**Label First Aid:**

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

**Product Use:**

Laboratory Reagent.

**Revision Information:**

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

**Disclaimer:**

\*\*\*\*\*

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\*\*\*\*\*

**Prepared by:** Environmental Health & Safety

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



# Material Safety Data Sheet

## Phenanthrene, 90%

ACC# 59921

### Section 1 - Chemical Product and Company Identification

**MSDS Name:** Phenanthrene, 90%**Catalog Numbers:** AC130100000, AC130100010, AC130102500**Synonyms:****Company Identification:**

Acros Organics N.V.

One Reagent Lane

Fair Lawn, NJ 07410

**For information in North America, call:** 800-ACROS-01**For emergencies in the US, call CHEMTREC:** 800-424-9300

### Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
85-01-8	Phenanthrene	90.0	201-581-5

### Section 3 - Hazards Identification

#### EMERGENCY OVERVIEW

Appearance: brown solid.

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

**Target Organs:** None.

#### Potential Health Effects

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

### Section 4 - First Aid Measures

**Eyes:** Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

**Skin:** Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes.

**Ingestion:** If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately.

**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

**Notes to Physician:** Treat symptomatically.

## Section 5 - Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Dusts at sufficient concentrations can form explosive mixtures with air. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

**Extinguishing Media:** Use water spray or dry chemical.

**Flash Point:** Not available.

**Autoignition Temperature:** Not available.

**Explosion Limits, Lower:** Not available.

**Upper:** Not available.

**NFPA Rating:** (estimated) Health: 1; Flammability: 1; Instability: 0

## Section 6 - Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8.

**Spills/Leaks:** Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation. Do not let this chemical enter the environment.

## Section 7 - Handling and Storage

**Handling:** Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

**Storage:** Keep container closed when not in use. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

## Section 8 - Exposure Controls, Personal Protection

**Engineering Controls:** Use adequate ventilation to keep airborne concentrations low.

### Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Phenanthrene	0.2 mg/m <sup>3</sup> TWA (as benzene soluble aerosol) (listed under Coal tar pitches).	0.1 mg/m <sup>3</sup> TWA (cyclohexane-extractable fraction) (listed under Coal tar pitches). 80 mg/m <sup>3</sup> IDLH (listed under Coal tar pitches).	0.2 mg/m <sup>3</sup> TWA (as benzene soluble fraction) (listed under Coal tar pitches).

**OSHA Vacated PELs:** Phenanthrene: No OSHA Vacated PELs are listed for this chemical.

**Personal Protective Equipment**

**Eyes:** Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

**Skin:** Wear appropriate protective gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to prevent skin exposure.

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

## Section 9 - Physical and Chemical Properties

**Physical State:** Solid

**Appearance:** brown

**Odor:** none reported

**pH:** Not available.

**Vapor Pressure:** 1 mm Hg @116c

**Vapor Density:** Not available.

**Evaporation Rate:**Not available.

**Viscosity:** Not available.

**Boiling Point:** 340 deg C

**Freezing/Melting Point:**101 deg C

**Decomposition Temperature:**Not available.

**Solubility:** insoluble

**Specific Gravity/Density:**1.0630g/cm<sup>3</sup>

**Molecular Formula:**C<sub>14</sub>H<sub>10</sub>

**Molecular Weight:**178.23

## Section 10 - Stability and Reactivity

**Chemical Stability:** Stable under normal temperatures and pressures.

**Conditions to Avoid:** Incompatible materials, dust generation, strong oxidants.

**Incompatibilities with Other Materials:** Strong oxidizing agents.

**Hazardous Decomposition Products:** Carbon monoxide, carbon dioxide.

**Hazardous Polymerization:** Has not been reported.

## Section 11 - Toxicological Information

**RTECS#:**

**CAS#** 85-01-8: SF7175000

**LD50/LC50:**

**CAS#** 85-01-8:

Oral, mouse: LD50 = 700 mg/kg;

Oral, rat: LD50 = 1.8 gm/kg;

**Carcinogenicity:**

**CAS#** 85-01-8:

- **ACGIH:** A1 - Confirmed Human Carcinogen (as benzene soluble aerosol) (listed as 'Coal tar pitches').
- **California:** Not listed.
- **NTP:** Known carcinogen (listed as Coal tar pitches).
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

**Epidemiology:** No data available.

**Teratogenicity:** No data available.

**Reproductive Effects:** No data available.

**Mutagenicity:** No data available.

**Neurotoxicity:** No data available.

**Other Studies:**

## Section 12 - Ecological Information

No information available.

## Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

**RCRA P-Series:** None listed.

**RCRA U-Series:** None listed.

## Section 14 - Transport Information

	US DOT	Canada TDG
<b>Shipping Name:</b>	Not regulated as a hazardous material	No information available.
<b>Hazard Class:</b>		
<b>UN Number:</b>		
<b>Packing Group:</b>		

## Section 15 - Regulatory Information

### US FEDERAL

#### TSCA

CAS# 85-01-8 is listed on the TSCA inventory.

#### Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

#### Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

#### Section 12b

None of the chemicals are listed under TSCA Section 12b.

**TSCA Significant New Use Rule**

None of the chemicals in this material have a SNUR under TSCA.

**CERCLA Hazardous Substances and corresponding RQs**

CAS# 85-01-8: 5000 lb final RQ; 2270 kg final RQ

**SARA Section 302 Extremely Hazardous Substances**

None of the chemicals in this product have a TPQ.

**SARA Codes**

CAS # 85-01-8: immediate.

**Section 313**

This material contains Phenanthrene (CAS# 85-01-8, 90.0%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 373.

**Clean Air Act:**

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

**Clean Water Act:**

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

CAS# 85-01-8 is listed as a Priority Pollutant under the Clean Water Act.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

**OSHA:**

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

**STATE**

CAS# 85-01-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, (listed as Coal tar pitches), Massachusetts.

**California Prop 65**

California No Significant Risk Level: None of the chemicals in this product are listed.

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

T

**Risk Phrases:**

R 45 May cause cancer.

**Safety Phrases:**

S 24/25 Avoid contact with skin and eyes.

**WGK (Water Danger/Protection)**

CAS# 85-01-8: No information available.

**Canada - DSL/NDSL**

CAS# 85-01-8 is listed on Canada's DSL List.

**Canada - WHMIS**

This product has a WHMIS classification of D2B.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

**Canadian Ingredient Disclosure List**

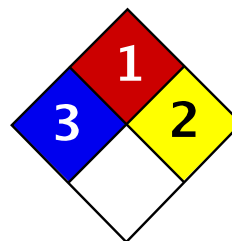
CAS# 85-01-8 is listed on the Canadian Ingredient Disclosure List.

<b>Section 16 - Additional Information</b>
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**MSDS Creation Date:** 7/14/1998

**Revision #3 Date:** 10/03/2005

*The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.*



Health	3
Fire	1
Reactivity	2
Personal Protection	E

## Material Safety Data Sheet

### Arsenic MSDS

#### Section 1: Chemical Product and Company Identification

**Product Name:** Arsenic

**Catalog Codes:** SLA1006

**CAS#:** 7440-38-2

**RTECS:** CG0525000

**TSCA:** TSCA 8(b) inventory: Arsenic

**CI#:** Not applicable.

**Synonym:**

**Chemical Name:** Arsenic

**Chemical Formula:** As

#### Contact Information:

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

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

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

Order Online: [ScienceLab.com](http://ScienceLab.com)

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

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

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

#### Section 2: Composition and Information on Ingredients

##### Composition:

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

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

#### Section 3: Hazards Identification

##### Potential Acute Health Effects:

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

##### Potential Chronic Health Effects:

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

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

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

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

#### Section 4: First Aid Measures

**Eye Contact:**

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

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

**Serious Skin Contact:** Not available.

**Inhalation:**

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

**Serious Inhalation:**

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

**Ingestion:**

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

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

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

**Auto-Ignition Temperature:** Not available.

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** Some metallic oxides.

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

**Explosion Hazards in Presence of Various Substances:**

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

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

**Fire Fighting Media and Instructions:**

SMALL FIRE: Use DRY chemical powder.

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

**Special Remarks on Fire Hazards:**

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

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

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

**Large Spill:**

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



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

## Section 7: Handling and Storage

### Precautions:

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

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

## Section 8: Exposure Controls/Personal Protection

### Engineering Controls:

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

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

### Personal Protection in Case of a Large Spill:

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

### Exposure Limits:

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

## Section 9: Physical and Chemical Properties

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

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 74.92 g/mole

**Color:** Silvery.

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

**Boiling Point:** Not available.

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

**Critical Temperature:** Not available.

**Specific Gravity:** 5.72 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:** Insoluble in cold water, hot water.

### Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

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

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** Will not occur.

### Section 11: Toxicological Information

**Routes of Entry:** Inhalation. Ingestion.

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

**Chronic Effects on Humans:**

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

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

**Other Toxic Effects on Humans:**

Very hazardous in case of ingestion, of inhalation.

Slightly hazardous in case of skin contact (irritant).

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** Not available.

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

### Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

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

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

**Special Remarks on the Products of Biodegradation:** Not available.

### Section 13: Disposal Considerations

**Waste Disposal:**

### Section 14: Transport Information

**DOT Classification:** CLASS 6.1: Poisonous material.

**Identification:** : Arsenic UNNA: UN1558 PG: II

**Special Provisions for Transport:** Not available.

### Section 15: Other Regulatory Information

**Federal and State Regulations:**

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

Pennsylvania RTK: Arsenic

Massachusetts RTK: Arsenic

TSCA 8(b) inventory: Arsenic

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

**Other Classifications:**

**WHMIS (Canada):**

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

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

**DSCL (EEC):**

R22- Harmful if swallowed.

R45- May cause cancer.

**HMIS (U.S.A.):**

**Health Hazard:** 3

**Fire Hazard:** 1

**Reactivity:** 2

**Personal Protection:** E

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

**Health:** 3

**Flammability:** 1

**Reactivity:** 2

**Specific hazard:**

**Protective Equipment:**

Gloves.

Lab coat.

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

Safety glasses.

**Section 16: Other Information****References:**

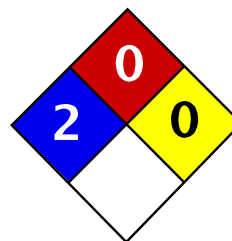
- Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
- Liste des produits purs tératogènes, mutagènes, cancérigènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec.
- Material safety data sheet emitted by: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

**Other Special Considerations:** Not available.

**Created:** 10/09/2005 04:16 PM

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

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Health	2
Fire	0
Reactivity	0
Personal Protection	E

## Material Safety Data Sheet

### Nickel metal MSDS

#### Section 1: Chemical Product and Company Identification

**Product Name:** Nickel metal

**Catalog Codes:** SLN2296, SLN1342, SLN1954

**CAS#:** 7440-02-0

**RTECS:** QR5950000

**TSCA:** TSCA 8(b) inventory: Nickel metal

**CI#:** Not applicable.

**Synonym:** Nickel Metal shot; Nickel metal foil.

**Chemical Name:** Nickel

**Chemical Formula:** Ni

#### Contact Information:

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

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

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

Order Online: [ScienceLab.com](http://ScienceLab.com)

**CHEMTREC (24HR Emergency Telephone), call:**

1-800-424-9300

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

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

#### Section 2: Composition and Information on Ingredients

##### Composition:

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

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

#### Section 3: Hazards Identification

##### Potential Acute Health Effects:

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

##### Potential Chronic Health Effects:

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

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

**MUTAGENIC EFFECTS:** Not available.

**TERATOGENIC EFFECTS:** Not available.

**DEVELOPMENTAL TOXICITY:** Not available.

The substance is toxic to skin.

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

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

## Section 4: First Aid Measures

### Eye Contact:

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

### Skin Contact:

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

**Serious Skin Contact:** Not available.

### Inhalation:

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

**Serious Inhalation:** Not available.

### Ingestion:

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

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Non-flammable.

**Auto-Ignition Temperature:** Not applicable.

**Flash Points:** Not applicable.

**Flammable Limits:** Not applicable.

**Products of Combustion:** Not available.

**Fire Hazards in Presence of Various Substances:** Not applicable.

### Explosion Hazards in Presence of Various Substances:

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

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

### Fire Fighting Media and Instructions:

Flammable solid.

SMALL FIRE: Use DRY chemical powder.

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

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

### Special Remarks on Explosion Hazards:

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

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

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

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

## Section 6: Accidental Release Measures

**Small Spill:**

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

**Large Spill:**

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

## Section 7: Handling and Storage

**Precautions:**

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

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

## Section 8: Exposure Controls/Personal Protection

**Engineering Controls:**

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

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

**Personal Protection in Case of a Large Spill:**

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

**Exposure Limits:**

TWA: 1 (mg/m<sup>3</sup>) from ACGIH (TLV) [United States] Inhalation Respirable.

TWA: 0.5 (mg/m<sup>3</sup>) [United Kingdom (UK)]

TWA: 1 (mg/m<sup>3</sup>) from OSHA (PEL) [United States] Inhalation Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

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

**Odor:** Odorless.

**Taste:** Not available.

**Molecular Weight:** 58.71 g/mole

**Color:** Silvery.

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

**Boiling Point:** 2730°C (4946°F)

**Melting Point:** 1455°C (2651°F)

**Critical Temperature:** Not available.

**Specific Gravity:** Density: 8.908 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:**

Insoluble in cold water, hot water.

Insoluble in Ammonia.

Soluble in dilute Nitric Acid.

Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Incompatible materials

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

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:**

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

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Inhalation. Ingestion.

**Toxicity to Animals:**

LD50: Not available.

LC50: Not available.

**Chronic Effects on Humans:**

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

Causes damage to the following organs: skin.

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

**Other Toxic Effects on Humans:**



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

**Special Remarks on Toxicity to Animals:**

Lowest Published Lethal Dose/Conc:

LDL [Rat] - Route: Oral; Dose: 5000 mg/kg

LDL [Guinea Pig] - Route: Oral; Dose: 5000 mg/kg

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

**Special Remarks on other Toxic Effects on Humans:**

Acute Potential Health Effects:

Skin: Nickel dust and fume can irritate skin.

Eyes: Nickel dust and fume can irritate eyes.

Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis.

Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal , and diarrhea. Nickel may damage the kidneys(proteinuria), and may affect liver function. It may also affect behavior (somnolence), and cardiovascular system (increased coronary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venus dilation).

Chronic Potential Health Effects:

Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis.

Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count).

Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy. Chronic ingestion of Nickel may also affect respiration and cause pneumoconiosis or fibrosis.

Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

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

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

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

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

## Section 14: Transport Information

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

**Identification:** Not applicable.

**Special Provisions for Transport:** Not applicable.

## Section 15: Other Regulatory Information

### Federal and State Regulations:

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

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

Connecticut hazardous material survey.: Nickel metal

Illinois toxic substances disclosure to employee act: Nickel metal

Illinois chemical safety act: Nickel metal

New York release reporting list: Nickel metal

Rhode Island RTK hazardous substances: Nickel metal

Pennsylvania RTK: Nickel metal

Michigan critical material: Nickel metal

Massachusetts RTK: Nickel metal

Massachusetts spill list: Nickel metal

New Jersey: Nickel metal

New Jersey spill list: Nickel metal

Louisiana spill reporting: Nickel metal

California Director's List of Hazardous Substances: Nickel metal

TSCA 8(b) inventory: Nickel metal

### Other Regulations:

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

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

### Other Classifications:

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

### DSCL (EEC):

R40- Possible risks of irreversible effects.

R43- May cause sensitization by skin contact.

S22- Do not breathe dust.

S36- Wear suitable protective clothing.

### HMIS (U.S.A.):

**Health Hazard:** 2

**Fire Hazard:** 0

**Reactivity:** 0

**Personal Protection:** E

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

**Health:** 2

**Flammability:** 0

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**

Gloves.

Lab coat.

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

Safety glasses.

**Section 16: Other Information**

**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 08:42 PM

**Last Updated:** 10/10/2005 08:42 PM

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## U.S. Environmental Protection Agency

# Pesticides: Topical & Chemical Fact Sheets

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Health & Safety

Specific Chemicals

Regulatory Actions

## Assessing Health Risks from Pesticides

January 1999  
735-F-99-002

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

### Background

There are more than 865 active ingredients registered as pesticides, which are formulated into thousands of pesticide products that are available in the marketplace. About 350 pesticides are used on the foods we eat, and to protect our homes and pets.

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

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

**Step One:** Hazard Identification

**Step Two:** Dose-Response Assessment

**Step Three:** Exposure Assessment

**Step Four:** Risk Characterization

### Step One: Hazard Identification (Toxicology)

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

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

## Step Two: Dose-Response Assessment

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

"The dose makes the poison."

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

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

## Step Three: Exposure Assessment

People can be exposed to pesticides in three ways:

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

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

- **Food**

Most of the foods we eat have been grown with the use of pesticides. Therefore, pesticide residues may be present inside or on the surfaces of these foods.

- **Home and Personal Use Pesticides**

You might use pesticides in and around your home to control insects, weeds, mold, mildew, bacteria, lawn and garden pests and to protect your pets from pests such as fleas. Pesticides may also be used as insect repellants which are directly applied to the skin or clothing.

- **Pesticides in Drinking Water**

Some pesticides that are applied to farmland or other land structures can make their way in small amounts to the ground water or surface water systems that feed drinking water supplies.

- **Worker Exposure to Pesticides**

Pesticide applicators, vegetable and fruit pickers and others who work around pesticides can be exposed due to the nature of their jobs. To address the unique risks workers face from occupational exposure, EPA evaluates occupational exposure through a separate program. All pesticides registered by EPA have been shown to be safe when used properly.

## Step Four: Risk Characterization

Risk characterization is the final step in assessing human health risks from pesticides. It is the process of combining the hazard, dose-response and exposure assessments to describe the overall risk from a pesticide. It explains the assumptions used in assessing exposure as well as the uncertainties that are built into the dose-response assessment. The strength of the overall database is considered, and broad

conclusions are made. EPA's role is to evaluate both toxicity and exposure and to determine the risk associated with use of the pesticide.

Simply put,

$$\text{RISK} = \text{TOXICITY} \times \text{EXPOSURE}.$$

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

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

### **Types of Toxicity Tests EPA Requires for Human Health Risk Assessments**

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

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

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

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

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

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

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

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

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

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

## Risk Management

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

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

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

## Human Health Risk Assessment and the Law

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

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

## For More Information

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

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

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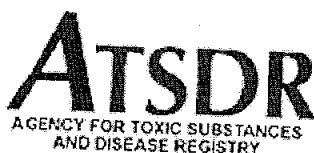
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Last updated on Tuesday, May 2nd, 2006

URL: <http://www.epa.gov/pesticides/factsheets/riskassess.htm>



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## ToxFAQs™

for

### Polychlorinated Biphenyls (PCBs)

*(Bifenilos Policlorados (BPCs))*

February 2001






This fact sheet answers the most frequently asked health questions about polychlorinated biphenyls (PCBs). For more information, you may call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

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

#### What are polychlorinated biphenyls (PCBs)?

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

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

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and old microscope and hydraulic oils.

[back to top](#)**What happens to polychlorinated biphenyls (PCBs) when they enter the environment?**

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

[back to top](#)**How might I be exposed to polychlorinated biphenyls (PCBs)?**

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

[back to top](#)**How can polychlorinated biphenyls (PCBs) affect my health?**

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

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

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### **How likely are polychlorinated biphenyls (PCBs) to cause cancer?**

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

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### **How do polychlorinated biphenyls (PCBs) affect children?**

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

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### **How can families reduce the risk of exposure to polychlorinated biphenyls (PCBs)?**

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

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### **Is there a medical test to show whether I've been exposed to polychlorinated biphenyls (PCBs)?**

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

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### **Has the federal government made recommendations to protect human health?**

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

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## References

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

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## Where can I get more information?

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

## For more information, contact:

Agency for Toxic Substances and Disease Registry  
Division of Toxicology  
1600 Clifton Road NE, Mailstop F-32  
Atlanta, GA 30333  
Phone: 1-888-42-ATSDR (1-888-422-8737)  
FAX: (770)-488-4178  
Email: [ATSDRIC@cdc.gov](mailto:ATSDRIC@cdc.gov)

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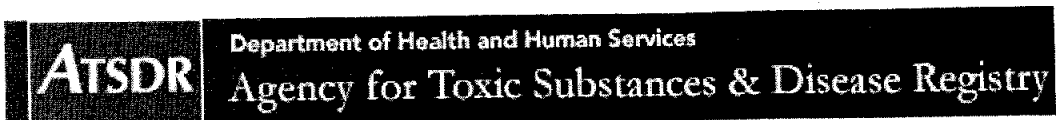
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This page was updated on January , 2007

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U.S. Department of Health and Human Services


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**2007 CERCLA Priority List of Hazardous Substances**

2007 RANK	SUBSTANCE NAME	TOTAL POINTS	2005 RANK	CAS #
1	ARSENIC	1672.58	1	007440-38-2
2	LEAD	1534.07	2	007439-92-1
3	MERCURY	1504.69	3	007439-97-6
4	VINYL CHLORIDE	1387.75	4	000075-01-4
5	POLYCHLORINATED BIPHENYLS	1365.78	5	001336-36-3
6	BENZENE	1355.96	6	000071-43-2
7	CADMIUM	1324.22	8	007440-43-9
8	POLYCYCLIC AROMATIC HYDROCARBONS	1316.98	7	130498-29-2
9	BENZO(A)PYRENE	1312.45	9	000050-32-8
10	BENZO(B)FLUORANTHENE	1266.55	10	000205-99-2
11	CHLOROFORM	1223.03	11	000067-66-3
12	DDT, P,P'-	1193.36	12	000050-29-3
13	AROCLOR 1254	1182.63	13	011097-69-1
14	AROCLOR 1260	1177.77	14	011096-82-5
15	DIBENZO(A,H)ANTHRACENE	1165.88	15	000053-70-3
16	TRICHLOROETHYLENE	1154.73	16	000079-01-6
17	DIELDRIN	1150.91	17	000060-57-1
18	CHROMIUM, HEXAVALENT	1149.98	18	018540-29-9
19	PHOSPHORUS, WHITE	1144.77	19	007723-14-0
20	CHLORDANE	1133.21	21	000057-74-9
21	DDE, P,P'-	1132.49	20	000072-55-9
22	HEXACHLOROBUTADIENE	1129.63	22	000087-68-3
23	COAL TAR CREOSOTE	1124.32	23	008001-58-9
24	ALDRIN	1117.22	25	000309-00-2
25	DDD, P,P'-	1114.83	24	000072-54-8
26	BENZIDINE	1114.24	26	000092-87-5
27	AROCLOR 1248	1112.20	27	012672-29-6
28	CYANIDE	1099.48	28	000057-12-5
29	AROCLOR 1242	1093.14	29	053469-21-9
30	AROCLOR	1091.52	62	012767-79-2
31	TOXAPHENE	1086.65	30	008001-35-2
32	HEXACHLOROCYCLOHEXANE, GAMMA-	1081.63	32	000058-89-9
33	TETRACHLOROETHYLENE	1080.43	31	000127-18-4
34	HEPTACHLOR	1072.67	33	000076-44-8
35	1,2-DIBROMOETHANE	1064.06	34	000106-93-4
36	HEXACHLOROCYCLOHEXANE, BETA-	1060.22	37	000319-85-7
37	ACROLEIN	1059.07	36	000107-02-8
38	DISULFOTON	1058.85	35	000298-04-4
39	BENZO(A)ANTHRACENE	1057.96	38	000056-55-3
40	3,3'-DICHLOROBENZIDINE	1051.61	39	000091-94-1

41	ENDRIN	1048.57	41	000072-20-8
42	BERYLLIUM	1046.12	40	007440-41-7
43	HEXACHLOROCYCLOHEXANE, DELTA-	1038.27	42	000319-86-8
44	1,2-DIBROMO-3-CHLOROPROPANE	1035.55	43	000096-12-8
45	PENTACHLOROPHENOL	1028.01	45	000087-86-5
46	HEPTACHLOR EPOXIDE	1027.12	44	001024-57-3
47	CARBON TETRACHLORIDE	1023.32	46	000056-23-5
48	AROCLOR 1221	1018.41	47	011104-28-2
49	COBALT	1015.57	50	007440-48-4
50	DDT, O,P'-	1014.71	49	000789-02-6
51	AROCLOR 1016	1014.33	48	012674-11-2
52	DI-N-BUTYL PHTHALATE	1007.49	52	000084-74-2
53	NICKEL	1005.40	55	007440-02-0
54	ENDOSULFAN	1004.65	54	000115-29-7
55	ENDOSULFAN SULFATE	1003.56	53	001031-07-8
56	DIAZINON	1002.08	57	000333-41-5
57	ENDOSULFAN, ALPHA	1001.30	58	000959-98-8
58	XYLENES, TOTAL	996.07	59	001330-20-7
59	CIS-CHLORDANE	995.08	51	005103-71-9
60	DIBROMOCHLOROPROPANE	994.87	60	067708-83-2
61	METHOXYCHLOR	994.47	61	000072-43-5
62	BENZO(K)FLUORANTHENE	981.26	63	000207-08-9
63	ENDRIN KETONE	978.99	64	053494-70-5
64	TRANS-CHLORDANE	973.99	56	005103-74-2
65	CHROMIUM(VI) OXIDE	969.58	66	001333-82-0
66	METHANE	959.78	67	000074-82-8
67	ENDOSULFAN, BETA	959.19	65	033213-65-9
68	AROCLOR 1232	955.64	68	011141-16-5
69	ENDRIN ALDEHYDE	954.86	69	007421-93-4
70	BENZOFLUORANTHENE	951.48	70	056832-73-6
71	TOLUENE	947.50	71	000108-88-3
72	2-HEXANONE	942.02	72	000591-78-6
73	2,3,7,8-TETRACHLORODIBENZO-P-DIOXIN	938.11	73	001746-01-6
74	ZINC	932.89	74	007440-66-6
75	DIMETHYLARSINIC ACID	922.06	75	000075-60-5
76	DI(2-ETHYLHEXYL)PHTHALATE	919.02	76	000117-81-7
77	CHROMIUM	908.52	77	007440-47-3
78	NAPHTHALENE	896.67	78	000091-20-3
79	1,1-DICHLOROETHENE	891.19	79	000075-35-4
80	METHYLENE CHLORIDE	888.96	81	000075-09-2
81	AROCLOR 1240	888.11	80	071328-89-7
82	2,4,6-TRINITROTOLUENE	883.59	82	000118-96-7
83	BROMODICHLOROETHANE	870.00	83	000683-53-4
84	HYDRAZINE	864.41	85	000302-01-2
85	1,2-DICHLOROETHANE	863.99	84	000107-06-2
86	2,4,6-TRICHLOROPHENOL	863.71	86	000088-06-2
87	2,4-DINITROPHENOL	860.45	87	000051-28-5
88	BIS(2-CHLOROETHYL) ETHER	859.88	88	000111-44-4
89	THIOCYANATE	849.21	89	000302-04-5
90	ASBESTOS	841.54	90	001332-21-4
91	CHLORINE	840.37	92	007782-50-5
92	CYCLOTTRIMETHYLENETRINITRAMINE (RDX)	840.28	91	000121-82-4
93	HEXACHLOROBENZENE	838.34	93	000118-74-1

94	2,4-DINITROTOLUENE	837.88	96	000121-14-2
95	RADIUM-226	835.93	94	013982-63-3
96	ETHION	834.03	97	000563-12-2
97	1,1,1-TRICHLOROETHANE	833.81	95	000071-55-6
98	URANIUM	833.41	98	007440-61-1
99	ETHYLBENZENE	832.13	99	000100-41-4
100	RADIUM	828.07	100	007440-14-4
101	THORIUM	825.17	101	007440-29-1
102	4,6-DINITRO-O-CRESOL	822.78	102	000534-52-1
103	1,3,5-TRINITROBENZENE	820.17	103	000099-35-4
104	CHLOROBENZENE	819.69	105	000108-90-7
105	RADON	817.89	104	010043-92-2
106	RADIUM-228	816.76	106	015262-20-1
107	THORIUM-230	814.72	107	014269-63-7
107	URANIUM-235	814.72	107	015117-96-1
109	BARIUM	813.46	109	007440-39-3
110	FLUORANTHENE	812.40	113	000206-44-0
111	URANIUM-234	812.11	110	013966-29-5
112	N-NITROSODI-N-PROPYLAMINE	811.05	111	000621-64-7
113	THORIUM-228	810.36	112	014274-82-9
114	RADON-222	809.78	114	014859-67-7
115	HEXACHLOROCYCLOHEXANE, ALPHA-	809.56	116	000319-84-6
116	1,2,3-TRICHLOROBENZENE	808.41	143	000087-61-6
117	MANGANESE	807.90	115	007439-96-5
118	COAL TARS	807.07	117	008007-45-2
119	CHRYSTILE ASBESTOS	806.68	119	012001-29-5
119	STRONTIUM-90	806.68	119	010098-97-2
121	PLUTONIUM-239	806.67	118	015117-48-3
122	POLONIUM-210	806.39	122	013981-52-7
123	METHYLMERCURY	806.39	121	022967-92-6
124	PLUTONIUM-238	806.01	123	013981-16-3
125	LEAD-210	805.90	124	014255-04-0
126	PLUTONIUM	805.23	125	007440-07-5
127	CHLORPYRIFOS	804.93	125	002921-88-2
128	COPPER	804.86	133	007440-50-8
129	AMERICIUM-241	804.55	128	086954-36-1
130	RADON-220	804.54	127	022481-48-7
131	AMOSITE ASBESTOS	804.07	129	012172-73-5
132	IODINE-131	803.48	130	010043-66-0
133	HYDROGEN CYANIDE	803.08	132	000074-90-8
134	TRIBUTYL TIN	802.61	131	000688-73-3
135	GUTHION	802.32	134	000086-50-0
136	NEPTUNIUM-237	802.13	135	013994-20-2
137	CHRYSENE	802.10	139	000218-01-9
138	CHLORDECONE	801.64	136	000143-50-0
138	IODINE-129	801.64	136	015046-84-1
138	PLUTONIUM-240	801.64	136	014119-33-6
141	S,S,S-TRIBUTYL PHOSPHOROTRITHIOATE	797.88	140	000078-48-8
142	BROMINE	789.15	142	007726-95-6
143	POLYBROMINATED BIPHENYLS	789.11	141	067774-32-7
144	DICOFOL	787.56	144	000115-32-2
145	PARATHION	784.14	145	000056-38-2
146	1,1,2,2-TETRACHLOROETHANE	782.15	146	000079-34-5



147	SELENIUM	778.98	147	007782-49-2
148	HEXACHLOROCYCLOHEXANE, TECHNICAL GRADE	774.91	148	000608-73-1
149	TRICHLOROFLUOROETHANE	770.74	149	027154-33-2
150	TRIFLURALIN	770.12	150	001582-09-8
151	DDD, O,P'-	768.73	151	000053-19-0
152	4,4'-METHYLENEBIS(2-CHLOROANILINE)	766.66	152	000101-14-4
153	HEXACHLORODIBENZO-P-DIOXIN	760.42	153	034465-46-8
154	HEPTACHLORODIBENZO-P-DIOXIN	754.47	154	037871-00-4
155	PENTACHLOROBENZENE	753.58	155	000608-93-5
156	1,3-BUTADIENE	747.31	201	000106-99-0
157	AMMONIA	745.55	156	007664-41-7
158	2-METHYLNAPHTHALENE	743.24	157	000091-57-6
159	1,4-DICHLOROBENZENE	737.32	159	000106-46-7
160	1,1-DICHLOROETHANE	736.23	158	000075-34-3
161	ACENAPHTHENE	731.25	160	000083-32-9
162	1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN	726.14	161	039001-02-0
163	1,1,2-TRICHLOROETHANE	724.96	162	000079-00-5
164	TRICHLOROETHANE	723.32	163	025323-89-1
165	HEXACHLOROCYCLOPENTADIENE	719.01	164	000077-47-4
166	HEPTACHLORODIBENZOFURAN	718.58	165	038998-75-3
167	1,2-DIPHENYLHYDRAZINE	713.90	166	000122-66-7
168	2,3,4,7,8-PENTACHLORODIBENZOFURAN	710.71	167	057117-31-4
169	TETRACHLOROBIPHENYL	709.21	168	026914-33-0
170	CRESOL, PARA-	707.83	169	000106-44-5
171	OXYCHLORDANE	706.32	170	027304-13-8
172	1,2-DICHLOROBENZENE	704.91	171	000095-50-1
173	1,2-DICHLOROETHENE, TRANS-	704.04	178	000156-60-5
174	INDENO(1,2,3-CD)PYRENE	703.30	180	000193-39-5
175	GAMMA-CHLORDENE	702.59	172	056641-38-4
176	CARBON DISULFIDE	702.55	174	000075-15-0
177	TETRACHLOROPHENOL	702.54	173	025167-83-3
178	AMERICIUM	701.62	175	007440-35-9
178	URANIUM-233	701.62	175	013968-55-3
180	PALLADIUM	700.66	177	007440-05-3
181	HEXACHLORODIBENZOFURAN	700.56	179	055684-94-1
182	PHENOL	696.96	183	000108-95-2
183	CHLOROETHANE	693.90	182	000075-00-3
184	ACETONE	693.31	181	000067-64-1
185	P-XYLENE	690.20	185	000106-42-3
186	DIBENZOFURAN	689.19	187	000132-64-9
187	ALUMINUM	688.13	186	007429-90-5
188	2,4-DIMETHYLPHENOL	685.76	189	000105-67-9
189	CARBON MONOXIDE	684.49	188	000630-08-0
190	TETRACHLOROETHANE	677.97	190	025322-20-7
191	HYDROGEN SULFIDE	676.51	193	007783-06-4
192	PENTACHLORODIBENZOFURAN	673.21	192	030402-15-4
193	CHLOROMETHANE	670.19	191	000074-87-3
194	BIS(2-METHOXYETHYL) PHTHALATE	666.08	194	034006-76-3
195	BUTYL BENZYL PHTHALATE	659.38	195	000085-68-7
196	CRESOL, ORTHO-	658.66	196	000095-48-7
197	HEXACHLOROETHANE	653.10	199	000067-72-1
198	VANADIUM	651.70	198	007440-62-2

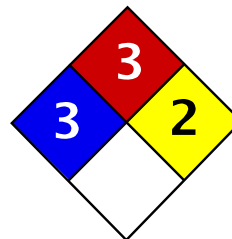
199	N-NITROSODIMETHYLAMINE	650.71	200	000062-75-9
200	1,2,4-TRICHLOROBENZENE	647.30	203	000120-82-1
201	BROMOFORM	643.53	202	000075-25-2
202	TETRACHLORODIBENZO-P-DIOXIN	635.74	204	041903-57-5
203	1,3-DICHLOROBENZENE	631.41	205	000541-73-1
204	PENTACHLORODIBENZO-P-DIOXIN	625.12	207	036088-22-9
205	N-NITROSODIPHENYLAMINE	624.79	208	000086-30-6
206	1,2-DICHLOROETHYLENE	622.49	206	000540-59-0
207	2,3,7,8-TETRACHLORODIBENZOFURAN	622.15	210	051207-31-9
208	2-BUTANONE	620.01	209	000078-93-3
209	2,4-DICHLOROPHENOL	616.45	212	000120-83-2
210	1,4-DIOXANE	616.29	215	000123-91-1
211	FLUORINE	613.28	214	007782-41-4
212	NITRITE	612.64	216	014797-65-0
213	CESIUM-137	612.50	217	010045-97-3
214	SILVER	612.19	213	007440-22-4
215	CHROMIUM TRIOXIDE	610.85	218	007738-94-5
216	NITRATE	610.66	219	014797-55-8
217	POTASSIUM-40	608.91	220	013966-00-2
218	DINITROTOLUENE	607.65	221	025321-14-6
219	ANTIMONY	605.37	222	007440-36-0
220	COAL TAR PITCH	605.33	224	065996-93-2
221	THORIUM-227	605.32	223	015623-47-9
222	2,4,5-TRICHLOROPHENOL	604.83	225	000095-95-4
223	ARSENIC ACID	604.45	226	007778-39-4
224	ARSENIC TRIOXIDE	604.36	227	001327-53-3
225	PHORATE	603.10	228	000298-02-2
226	BENZOPYRENE	603.00	230	073467-76-2
227	CRESOLS	602.74	229	001319-77-3
228	CHLORDANE, TECHNICAL	602.62	231	012789-03-6
229	DIMETHOATE	602.61	232	000060-51-5
230	ACTINIUM-227	602.57	233	014952-40-0
230	STROBANE	602.57	233	008001-50-1
232	4-AMINOBIIPHENYL	602.51	235	000092-67-1
232	PYRETHRUM	602.51	235	008003-34-7
234	ARSINE	602.42	237	007784-42-1
235	NALED	602.32	238	000300-76-5
236	DIBENZOFURANS, CHLORINATED	602.13	239	042934-53-2
236	ETHOPROP	602.13	239	013194-48-4
238	ALPHA-CHLORDENE	601.94	241	056534-02-2
238	CARBOPHENOTHION	601.94	241	000786-19-6
240	DICHLORVOS	601.64	243	000062-73-7
241	CALCIUM ARSENATE	601.45	244	007778-44-1
241	MERCURIC CHLORIDE	601.45	244	007487-94-7
241	SODIUM ARSENITE	601.45	244	007784-46-5
244	FORMALDEHYDE	599.64	247	000050-00-0
245	2-CHLOROPHENOL	599.62	248	000095-57-8
246	PHENANTHRENE	597.68	249	000085-01-8
247	HYDROGEN FLUORIDE	588.03	250	007664-39-3
248	2,4-D ACID	584.47	251	000094-75-7
249	DIBROMOCHLOROMETHANE	580.59	252	000124-48-1
250	DIURON	579.16	253	000330-54-1
251	BUTYLATE	578.43	254	002008-41-5

252	DIMETHYL FORMAMIDE	578.23	255	000068-12-2
253	PYRENE	577.95	256	000129-00-0
254	DICHLOROBENZENE	577.70	211	025321-22-6
255	ETHYL ETHER	572.47	257	000060-29-7
256	DICHLOROETHANE	570.46	258	001300-21-6
257	4-NITROPHENOL	567.79	259	000100-02-7
258	1,3-DICHLOROPROPENE, CIS-	561.82	184	010061-01-5
259	PHOSPHINE	559.74	260	007803-51-2
260	TRICHLOROBENZENE	557.96	261	012002-48-1
261	2,6-DINITROTOLUENE	555.20	262	000606-20-2
262	FLUORIDE ION	549.64	263	016984-48-8
263	1,2,3,4,6,7,8-HEPTACHLORODIBENZO-P-DIOXIN	547.90	264	035822-46-9
264	METHYL PARATHION	545.83	265	000298-00-0
265	PENTAERYTHRITOL TETRANITRATE	545.59	266	000078-11-5
266	1,3-DICHLOROPROPENE, TRANS-	543.37	267	010061-02-6
267	BIS(2-ETHYLHEXYL)ADIPATE	540.20	268	000103-23-1
268	CARBAZOLE	534.52	269	000086-74-8
269	METHYL ISOBUTYL KETONE	533.24	271	000108-10-1
270	1,2-DICHLOROETHENE, CIS-	533.15	270	000156-59-2
271	STYRENE	532.70	272	000100-42-5
272	CARBARYL	530.98	273	000063-25-2
273	1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	529.45	274	067562-39-4
274	ACRYLONITRILE	528.28	275	000107-13-1
275	1-METHYLNAPHTHALENE	526.51	NEW	

Substances were assigned the same rank when two (or more) substances received equivalent total point scores.

CAS # = Chemical Abstracts Service Registry Number

This page was updated on 01/10/2008



Health	3
Fire	3
Reactivity	2
Personal Protection	J

## Material Safety Data Sheet

### Calcium MSDS

#### Section 1: Chemical Product and Company Identification

**Product Name:** Calcium

**Catalog Codes:** SLC2782

**CAS#:** 7440-70-2

**RTECS:** EV8040000

**TSCA:** TSCA 8(b) inventory: Calcium

**CI#:** Not available.

**Synonym:**

**Chemical Formula:** Ca

#### Contact Information:

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

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

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

Order Online: [ScienceLab.com](http://ScienceLab.com)

**CHEMTREC (24HR Emergency Telephone), call:**

1-800-424-9300

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

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

#### Section 2: Composition and Information on Ingredients

##### Composition:

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

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

#### Section 3: Hazards Identification

##### Potential Acute Health Effects:

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

##### Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to lungs, mucous membranes.

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

#### Section 4: First Aid Measures

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

**Skin Contact:**

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

**Serious Skin Contact:**

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

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

**Serious Inhalation:**

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

**Ingestion:**

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

**Serious Ingestion:** Not available.

#### Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

**Auto-Ignition Temperature:** Not available.

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** Some metallic oxides.

**Fire Hazards in Presence of Various Substances:** Not available.

**Explosion Hazards in Presence of Various Substances:**

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

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

**Fire Fighting Media and Instructions:**

Flammable solid.

SMALL FIRE: Use DRY chemical powder.

LARGE FIRE: Use water spray or fog.

**Special Remarks on Fire Hazards:** Not available.

**Special Remarks on Explosion Hazards:** Not available.

#### Section 6: Accidental Release Measures

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

**Large Spill:**

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

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

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

**Storage:**

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

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

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

**Personal Protection:**

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

**Personal Protection in Case of a Large Spill:**

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

**Exposure Limits:** Not available.

**Section 9: Physical and Chemical Properties**

**Physical state and appearance:** Solid.

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 40.08 g/mole

**Color:** Not available.

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

**Boiling Point:** 1484°C (2703.2°F)

**Melting Point:** 839°C (1542.2°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 1.54 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:** Not available.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:**

Highly reactive with acids.

Reactive with moisture.

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

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

## Section 11: Toxicological Information

**Routes of Entry:** Eye contact. Inhalation. Ingestion.

**Toxicity to Animals:**

LD50: Not available.

LC50: Not available.

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

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

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** Not available.

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

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

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

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

**Special Remarks on the Products of Biodegradation:** Not available.

### Section 13: Disposal Considerations

**Waste Disposal:**

### Section 14: Transport Information

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

**Identification:** : Calcium : UN1401 PG: II

**Special Provisions for Transport:** Not available.

### Section 15: Other Regulatory Information

**Federal and State Regulations:**

Pennsylvania RTK: Calcium

Massachusetts RTK: Calcium

TSCA 8(b) inventory: Calcium

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

**Other Classifications:**

**WHMIS (Canada):**

CLASS B-6: Reactive and very flammable material.

CLASS E: Corrosive solid.

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

**HMIS (U.S.A.):**

**Health Hazard:** 3

**Fire Hazard:** 3

**Reactivity:** 2

**Personal Protection:** j

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

**Health:** 3

**Flammability:** 3

**Reactivity:** 2

**Specific hazard:**



**Protective Equipment:**

Gloves.

Lab coat.

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

Splash goggles.

**Section 16: Other Information**

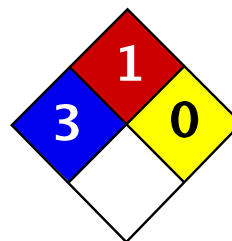
**References:** Not available.

**Other Special Considerations:** Not available.

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**Last Updated:** 11/06/2008 12:00 PM

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Health	3
Fire	1
Reactivity	0
Personal Protection	E

## Material Safety Data Sheet Cadmium MSDS

### Section 1: Chemical Product and Company Identification

**Product Name:** Cadmium

**Catalog Codes:** SLC3484, SLC5272, SLC2482

**CAS#:** 7440-43-9

**RTECS:** EU9800000

**TSCA:** TSCA 8(b) inventory: Cadmium

**CI#:** Not applicable.

**Synonym:**

**Chemical Name:** Cadmium

**Chemical Formula:** Cd

**Contact Information:**

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

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

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

Order Online: [ScienceLab.com](http://ScienceLab.com)

**CHEMTREC (24HR Emergency Telephone), call:**

1-800-424-9300

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

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

### Section 2: Composition and Information on Ingredients

**Composition:**

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

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

### Section 3: Hazards Identification

**Potential Acute Health Effects:**

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

**Potential Chronic Health Effects:**

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

**MUTAGENIC EFFECTS:** Not available.

**TERATOGENIC EFFECTS:** Not available.

**DEVELOPMENTAL TOXICITY:** Not available.

The substance is toxic to kidneys, lungs, liver.

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

## Section 4: First Aid Measures

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

**Skin Contact:**

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

**Serious Skin Contact:** Not available.

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

**Serious Inhalation:**

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

**Ingestion:**

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

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

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

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

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** Some metallic oxides.

**Fire Hazards in Presence of Various Substances:**

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

**Explosion Hazards in Presence of Various Substances:**

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

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

**Fire Fighting Media and Instructions:**

SMALL FIRE: Use DRY chemical powder.

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

**Special Remarks on Fire Hazards:**

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

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

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

**Large Spill:**

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

## Section 7: Handling and Storage

**Precautions:**

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

**Storage:**

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

## Section 8: Exposure Controls/Personal Protection

**Engineering Controls:**

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

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

**Personal Protection in Case of a Large Spill:**

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

**Exposure Limits:**

TWA: 0.01 (ppm)

Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

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

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 112.4 g/mole

**Color:** Silvery.

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

**Boiling Point:** 765°C (1409°F)

**Melting Point:** 320.9°C (609.6°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 8.64 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

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

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:** Reactive with oxidizing agents.

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

**Special Remarks on Reactivity:** Reacts violently with potassium.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

## Section 11: Toxicological Information

**Routes of Entry:** Inhalation. Ingestion.

### Toxicity to Animals:

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

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

Acute toxicity of the dust (LC50): 229.9 mg/m<sup>3</sup> 4 hour(s) [Rat].

### Chronic Effects on Humans:

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

The substance is toxic to kidneys, lungs, liver.

### Other Toxic Effects on Humans:

Hazardous in case of ingestion, of inhalation.

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

**Special Remarks on Toxicity to Animals:** Not available.

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

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

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

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

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

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

## Section 14: Transport Information

**DOT Classification:**

**Identification:**

**Special Provisions for Transport:**

## Section 15: Other Regulatory Information

**Federal and State Regulations:**

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

Cadmium

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

Pennsylvania RTK: Cadmium

Massachusetts RTK: Cadmium

TSCA 8(b) inventory: Cadmium

SARA 313 toxic chemical notification and release reporting: Cadmium

CERCLA: Hazardous substances.: Cadmium

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

**Other Classifications:**

**WHMIS (Canada):**

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

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

**DSCL (EEC):**

R26- Very toxic by inhalation.

R45- May cause cancer.

**HMIS (U.S.A.):**

**Health Hazard:** 3

**Fire Hazard:** 1

**Reactivity:** 0

**Personal Protection:** E

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

**Health:** 3

**Flammability:** 1

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**

Gloves.

Lab coat.

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

Safety glasses.

## Section 16: Other Information

### References:

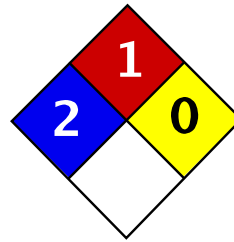
- Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987.
- Liste des produits purs tératogènes, mutagènes, cancérrogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec.
- Material safety data sheet emitted by: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

**Other Special Considerations:** Not available.

**Created:** 10/09/2005 04:29 PM

**Last Updated:** 11/06/2008 12:00 PM

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Health	2
Fire	1
Reactivity	0
Personal Protection	E

## Material Safety Data Sheet

### Copper MSDS

#### Section 1: Chemical Product and Company Identification

**Product Name:** Copper

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

**CAS#:** 7440-50-8

**RTECS:** GL5325000

**TSCA:** TSCA 8(b) inventory: Copper

**CI#:** Not available.

**Synonym:**

**Chemical Name:** Not available.

**Chemical Formula:** Cu

**Contact Information:**

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

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

Order Online: [ScienceLab.com](http://ScienceLab.com)

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1-800-424-9300

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

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

#### Section 2: Composition and Information on Ingredients

**Composition:**

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

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

#### Section 3: Hazards Identification

**Potential Acute Health Effects:**

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

**Potential Chronic Health Effects:**

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

The substance is toxic to lungs, mucous membranes.

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

#### Section 4: First Aid Measures



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

**Skin Contact:**

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

**Serious Skin Contact:** Not available.

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

**Serious Inhalation:** Not available.

**Ingestion:**

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

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

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

**Auto-Ignition Temperature:** Not available.

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** Some metallic oxides.

**Fire Hazards in Presence of Various Substances:** Not available.

**Explosion Hazards in Presence of Various Substances:**

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

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

**Fire Fighting Media and Instructions:**

SMALL FIRE: Use DRY chemical powder.

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

**Special Remarks on Fire Hazards:** Not available.

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

**Small Spill:**

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

**Large Spill:**

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

## Section 7: Handling and Storage

### Precautions:

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

### Storage:

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

## Section 8: Exposure Controls/Personal Protection

### Engineering Controls:

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

### Personal Protection:

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

### Personal Protection in Case of a Large Spill:

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

### Exposure Limits:

TWA: 1 (mg/m<sup>3</sup>) from ACGIH [1990]

Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Solid.

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 63.54 g/mole

**Color:** Not available.

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

**Boiling Point:** 2595°C (4703°F)

**Melting Point:** 1083°C (1981.4°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 8.94 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:** Insoluble in cold water.

### Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Not available.

**Incompatibility with various substances:** Not available.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:** Not available.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** No.

### Section 11: Toxicological Information

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

**Toxicity to Animals:**

LD50: Not available.

LC50: Not available.

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

**Other Toxic Effects on Humans:**

Very hazardous in case of ingestion.

Hazardous in case of inhalation.

Slightly hazardous in case of skin contact (irritant).

**Special Remarks on Toxicity to Animals:** Not available.

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

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

### Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

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

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

**Special Remarks on the Products of Biodegradation:** Not available.

### Section 13: Disposal Considerations

**Waste Disposal:**

### Section 14: Transport Information

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

**Identification:** Not applicable.

**Special Provisions for Transport:** Marine Pollutant

### Section 15: Other Regulatory Information

**Federal and State Regulations:**

Pennsylvania RTK: Copper

Massachusetts RTK: Copper

TSCA 8(b) inventory: Copper

CERCLA: Hazardous substances.: Copper

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

**Other Classifications:**

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

**DSCL (EEC):** R36- Irritating to eyes.

**HMIS (U.S.A.):**

**Health Hazard:** 2

**Fire Hazard:** 1

**Reactivity:** 0

**Personal Protection:** E

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

**Health:** 2

**Flammability:** 1

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**

Gloves.

Lab coat.

Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator

when ventilation is inadequate.  
Splash goggles.

## Section 16: Other Information

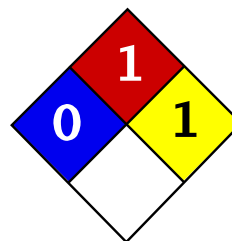
**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/09/2005 04:58 PM

**Last Updated:** 11/06/2008 12:00 PM

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Health	1
Fire	3
Reactivity	2
Personal Protection	E

## Material Safety Data Sheet Magnesium MSDS

### Section 1: Chemical Product and Company Identification

**Product Name:** Magnesium

**Catalog Codes:** SLM4408, SLM2263, SLM3637

**CAS#:** 7439-95-4

**RTECS:** OM2100000

**TSCA:** TSCA 8(b) inventory: Magnesium

**CI#:** Not applicable.

**Synonym:** Magnesium ribbons, turnings or sticks

**Chemical Name:** Magnesium

**Chemical Formula:** Mg

#### Contact Information:

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

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

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

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**CHEMTREC (24HR Emergency Telephone), call:**

1-800-424-9300

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

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

### Section 2: Composition and Information on Ingredients

#### Composition:

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

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

### Section 3: Hazards Identification

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

#### Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

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

### Section 4: First Aid Measures

#### Eye Contact:

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

least 15 minutes. Get medical attention if irritation occurs.

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

**Serious Skin Contact:** Not available.

**Inhalation:**

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

**Serious Inhalation:**

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

**Ingestion:**

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

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

**Auto-Ignition Temperature:** Not available.

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** Some metallic oxides.

**Fire Hazards in Presence of Various Substances:**

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

Flammable in presence of acids, of moisture.

Non-flammable in presence of shocks.

**Explosion Hazards in Presence of Various Substances:**

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

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

Explosive in presence of acids, of moisture.

**Fire Fighting Media and Instructions:**

Flammable solid.

SMALL FIRE: Use DRY chemical powder.

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

**Special Remarks on Fire Hazards:**

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

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

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

## Section 6: Accidental Release Measures

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

**Large Spill:**

Flammable solid.

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

## Section 7: Handling and Storage

**Precautions:**

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

**Storage:**

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

## Section 8: Exposure Controls/Personal Protection

**Engineering Controls:**

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

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

**Personal Protection in Case of a Large Spill:**

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

**Exposure Limits:** Not available.

## Section 9: Physical and Chemical Properties

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

**Odor:** Odorless.

**Taste:** Not available.

**Molecular Weight:** 24.31 g/mole

**Color:** Silver-white

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

**Boiling Point:** 1100°C (2012°F)

**Melting Point:** 651°C (1203.8°F)

**Critical Temperature:** Not available.

**Specific Gravity:** 1.74 (Water = 1)

**Vapor Pressure:** Not applicable.



**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:**

Very slightly soluble in hot water.

Insoluble in cold water.

Insoluble in chromium trioxides, and mineral acids, alkalies.

Slightly soluble with decomposition in hot water.

Soluble in concentrated hydrogen fluoride, and ammonium salts.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

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

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

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:**

Violent chemical reaction with oxidizing agents.

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

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

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

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Inhalation. Ingestion.

**Toxicity to Animals:**

LD50: Not available.

LC50: Not available.

**Chronic Effects on Humans:** Not available.

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

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** Not available.

**Special Remarks on other Toxic Effects on Humans:**

Acute Potential Health Effects:

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

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

Inhalation: Low hazard for usual industrial handling. It may cause respiratory tract irritation. However, it is unlikely due to physical form. When Magnesium metal is heated during welding or smelting process, Metal Fume Fever may result from inhalation of magnesium fumes. Metal Fume Fever is a flu-like condition consisting of fever, chills, sweating, aches, pains, cough, weakness, headache, nausea, vomiting, and breathing difficulty.

Other symptoms may include metallic taste, increased white blood cell count. There is no permanent ill-effect.

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

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

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

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

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

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

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

## Section 14: Transport Information

**DOT Classification:** CLASS 4.1: Flammable solid.

**Identification:** : Magnesium UNNA: 1869 PG: III

**Special Provisions for Transport:** Not available.

## Section 15: Other Regulatory Information

**Federal and State Regulations:**

Connecticut hazardous material survey.: Magnesium

Rhode Island RTK hazardous substances: Magnesium

Pennsylvania RTK: Magnesium

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

**Other Regulations:**

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

**Other Classifications:**

**WHMIS (Canada):**

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

**DSCL (EEC):**

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

**HMIS (U.S.A.):**

**Health Hazard:** 1

**Fire Hazard:** 3

**Reactivity:** 2

**Personal Protection:** E

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

**Health:** 0

**Flammability:** 1

**Reactivity:** 1

**Specific hazard:**

**Protective Equipment:**

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

**Section 16: Other Information**

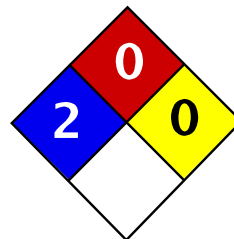
**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/09/2005 06:00 PM

**Last Updated:** 11/06/2008 12:00 PM

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Health	2
Fire	0
Reactivity	0
Personal Protection	E

## Material Safety Data Sheet

### Nickel metal MSDS

#### Section 1: Chemical Product and Company Identification

**Product Name:** Nickel metal

**Catalog Codes:** SLN2296, SLN1342, SLN1954

**CAS#:** 7440-02-0

**RTECS:** QR5950000

**TSCA:** TSCA 8(b) inventory: Nickel metal

**CI#:** Not applicable.

**Synonym:** Nickel Metal shot; Nickel metal foil.

**Chemical Name:** Nickel

**Chemical Formula:** Ni

#### Contact Information:

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

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

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

Order Online: [ScienceLab.com](http://ScienceLab.com)

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

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

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

#### Section 2: Composition and Information on Ingredients

##### Composition:

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

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

#### Section 3: Hazards Identification

##### Potential Acute Health Effects:

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

##### Potential Chronic Health Effects:

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

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

**MUTAGENIC EFFECTS:** Not available.

**TERATOGENIC EFFECTS:** Not available.

**DEVELOPMENTAL TOXICITY:** Not available.

The substance is toxic to skin.

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

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

## Section 4: First Aid Measures

### Eye Contact:

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

### Skin Contact:

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

**Serious Skin Contact:** Not available.

### Inhalation:

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

**Serious Inhalation:** Not available.

### Ingestion:

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

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Non-flammable.

**Auto-Ignition Temperature:** Not applicable.

**Flash Points:** Not applicable.

**Flammable Limits:** Not applicable.

**Products of Combustion:** Not available.

**Fire Hazards in Presence of Various Substances:** Not applicable.

### Explosion Hazards in Presence of Various Substances:

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

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

### Fire Fighting Media and Instructions:

Flammable solid.

SMALL FIRE: Use DRY chemical powder.

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

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

### Special Remarks on Explosion Hazards:

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

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

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

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

## Section 6: Accidental Release Measures

**Small Spill:**

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

**Large Spill:**

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

## Section 7: Handling and Storage

**Precautions:**

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

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

## Section 8: Exposure Controls/Personal Protection

**Engineering Controls:**

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

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

**Personal Protection in Case of a Large Spill:**

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

**Exposure Limits:**

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

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

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

## Section 9: Physical and Chemical Properties

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

**Odor:** Odorless.

**Taste:** Not available.

**Molecular Weight:** 58.71 g/mole

**Color:** Silvery.

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

**Boiling Point:** 2730°C (4946°F)

**Melting Point:** 1455°C (2651°F)

**Critical Temperature:** Not available.

**Specific Gravity:** Density: 8.908 (Water = 1)

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:**

Insoluble in cold water, hot water.

Insoluble in Ammonia.

Soluble in dilute Nitric Acid.

Slightly soluble in Hydrochloric Acid, Sulfuric Acid.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Incompatible materials

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

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:**

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

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Inhalation. Ingestion.

**Toxicity to Animals:**

LD50: Not available.

LC50: Not available.

**Chronic Effects on Humans:**

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

Causes damage to the following organs: skin.

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

**Other Toxic Effects on Humans:**



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

**Special Remarks on Toxicity to Animals:**

Lowest Published Lethal Dose/Conc:

LDL [Rat] - Route: Oral; Dose: 5000 mg/kg

LDL [Guinea Pig] - Route: Oral; Dose: 5000 mg/kg

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

**Special Remarks on other Toxic Effects on Humans:**

Acute Potential Health Effects:

Skin: Nickel dust and fume can irritate skin.

Eyes: Nickel dust and fume can irritate eyes.

Inhalation: Inhalation of dust or fume may cause respiratory tract irritation with non-productive cough, hoarseness, sore throat, headache, vertigo, weakness, chest pain, followed by delayed effects, including tachypnea, dyspnea, and ARDS. Death due to ARDS has been reported following inhalation of high concentrations of respirable metallic nickel dust. Later effects may include pulmonary edema and fibrosis.

Ingestion: Metallic nickel is generally considered not to be acutely toxic if ingested. Ingestion may cause nausea, vomiting, abdominal , and diarrhea. Nickel may damage the kidneys(proteinuria), and may affect liver function. It may also affect behavior (somnolence), and cardiovascular system (increased coronary artery resistance, decreased myocardial contractility, myocardial damage, regional or general arteriolar or venus dilation).

Chronic Potential Health Effects:

Skin: May cause skin allergy. Nickel and nickel compounds are among the most common sensitizers inducing allergic contact dermatitis.

Inhalation: Chronic inhalation nickel dust or fume can cause chronic hypertrophic rhinitis, sinusitis, nasal polyps, perforation of the nasal septum, chronic pulmonary irritation, fibrosis, pulmonary edema, pulmonary eosinophilia, Pneumoconiosis, allergies (asthma-like allergy), and cancer of the nasal sinus cavities, lungs, and possibly other organs. Future exposures can cause asthma attacks with shortness of breath, wheezing, cough, and/or chest tightness. Chronic inhalation of nickel dust or fume may also affect the liver (impaired liver function tests), and blood (changes in red blood cell count).

Ingestion: Prolonged or repeated ingestion of nickel can be a source chronic urticaria and other signs of allergy. Chronic ingestion of Nickel may also affect respiration and cause pneumoconiosis or fibrosis.

Note: In the general population, sensitization occurs from exposure to nickel-containing coins, jewelry, watches,

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

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

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

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

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

## Section 14: Transport Information

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

**Identification:** Not applicable.

**Special Provisions for Transport:** Not applicable.

## Section 15: Other Regulatory Information

### Federal and State Regulations:

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

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

Connecticut hazardous material survey.: Nickel metal

Illinois toxic substances disclosure to employee act: Nickel metal

Illinois chemical safety act: Nickel metal

New York release reporting list: Nickel metal

Rhode Island RTK hazardous substances: Nickel metal

Pennsylvania RTK: Nickel metal

Michigan critical material: Nickel metal

Massachusetts RTK: Nickel metal

Massachusetts spill list: Nickel metal

New Jersey: Nickel metal

New Jersey spill list: Nickel metal

Louisiana spill reporting: Nickel metal

California Director's List of Hazardous Substances: Nickel metal

TSCA 8(b) inventory: Nickel metal

### Other Regulations:

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

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

### Other Classifications:

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

### DSCL (EEC):

R40- Possible risks of irreversible effects.

R43- May cause sensitization by skin contact.

S22- Do not breathe dust.

S36- Wear suitable protective clothing.

### HMIS (U.S.A.):

**Health Hazard:** 2

**Fire Hazard:** 0

**Reactivity:** 0

**Personal Protection:** E

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

**Health:** 2

**Flammability:** 0

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**

Gloves.

Lab coat.

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

Safety glasses.

**Section 16: Other Information**

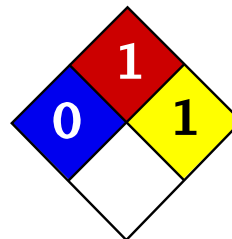
**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 08:42 PM

**Last Updated:** 11/06/2008 12:00 PM

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Health	1
Fire	1
Reactivity	1
Personal Protection	E

## Material Safety Data Sheet

### Zinc Metal MSDS

#### Section 1: Chemical Product and Company Identification

**Product Name:** Zinc Metal

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

**CAS#:** 7440-66-6

**RTECS:** ZG8600000

**TSCA:** TSCA 8(b) inventory: Zinc Metal

**CI#:** Not applicable.

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

**Chemical Name:** Zinc Metal

**Chemical Formula:** Zn

#### Contact Information:

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

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

Order Online: [ScienceLab.com](http://ScienceLab.com)

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

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

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

#### Section 2: Composition and Information on Ingredients

##### Composition:

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

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

#### Section 3: Hazards Identification

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

##### Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available.

MUTAGENIC EFFECTS: Not available.

TERATOGENIC EFFECTS: Not available.

DEVELOPMENTAL TOXICITY: Not available.

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

#### Section 4: First Aid Measures

**Eye Contact:**

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

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

**Serious Skin Contact:** Not available.

**Inhalation:**

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

**Serious Inhalation:** Not available.

**Ingestion:**

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

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Flammable.

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

**Flash Points:** Not available.

**Flammable Limits:** Not available.

**Products of Combustion:** Not available.

**Fire Hazards in Presence of Various Substances:**

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

Non-flammable in presence of shocks.

**Explosion Hazards in Presence of Various Substances:**

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

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

**Fire Fighting Media and Instructions:**

Flammable solid.

SMALL FIRE: Use DRY chemical powder.

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

**Special Remarks on Fire Hazards:**

Zinc + NaOH causes ignition.

Oxidation of zinc by potassium proceeds with incandescence.

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

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

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

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

Zinc foil ignites if traces of moisture are present.

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

moist air.

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

### Small Spill:

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

### Large Spill:

Flammable solid that, in contact with water, emits flammable gases.

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

## Section 7: Handling and Storage

### Precautions:

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

### Storage:

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

## Section 8: Exposure Controls/Personal Protection

### Engineering Controls:

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

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

### Personal Protection in Case of a Large Spill:

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

**Exposure Limits:** Not available.

## Section 9: Physical and Chemical Properties

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

**Odor:** Not available.

**Taste:** Not available.

**Molecular Weight:** 65.39 g/mole

**Color:** Bluish-grey

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

**Boiling Point:** 907°C (1664.6°F)

**Melting Point:** 419°C (786.2°F)

**Critical Temperature:** Not available.

**Specific Gravity:** Not available.

**Vapor Pressure:** Not applicable.

**Vapor Density:** Not available.

**Volatility:** Not available.

**Odor Threshold:** Not available.

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

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

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Excess heat, incompatible materials, moisture

**Incompatibility with various substances:**

Reactive with oxidizing agents, acids, alkalis.

Slightly reactive to reactive with moisture.

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

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:**

Incompatible with acids, halogenated hydrocarbons,  $\text{NH}_4\text{NO}_3$ , barium oxide,  $\text{Ba}(\text{NO}_3)_2$ , Cadmium,  $\text{CS}_2$ , chlorates,  $\text{Cl}_2$ ,  $\text{CrO}_3$ ,  $\text{F}_2$ , Hydroxylamine,  $\text{Pb}(\text{N}_3)_2$ ,  $\text{MnCl}_2$ ,  $\text{HNO}_3$ , performic acid,  $\text{KClO}_3$ ,  $\text{KNO}_3$ ,  $\text{N}_2\text{O}_2$ , Selenium,  $\text{NaClO}_3$ ,  $\text{Na}_2\text{O}_2$ , Sulfur, Te, water,  $(\text{NH}_4)_2\text{S}$ ,  $\text{As}_2\text{O}_3$ ,  $\text{CS}_2$ ,  $\text{CaCl}_2$ , chlorinated rubber, catalytic metals, halocarbons, o-nitroanisole, nitrobenzene, nonmetals, oxidants, paint primer base, pentacarbonoyliron, transition metal halides, seleninyl bromide,  $\text{HCl}$ ,  $\text{H}_2\text{SO}_4$ ,  $(\text{Mg} + \text{Ba}(\text{NO}_3)_2 + \text{BaO}_2)$ , (ethyl acetoacetate +tribromoneopentyl alcohol.

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

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

May react with water.

**Special Remarks on Corrosivity:** Not available.

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Inhalation. Ingestion.

**Toxicity to Animals:**

LD50: Not available.

LC50: Not available.

**Chronic Effects on Humans:** Not available.

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

**Special Remarks on Toxicity to Animals:** Not available.

**Special Remarks on Chronic Effects on Humans:** Not available.

**Special Remarks on other Toxic Effects on Humans:**

Acute Potential Health Effects:

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

Eyes: May cause eye irritation.

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

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

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

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

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

**Toxicity of the Products of Biodegradation:** Not available.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

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

## Section 14: Transport Information

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

**Identification:** Not applicable.

**Special Provisions for Transport:** Not applicable.

## Section 15: Other Regulatory Information

**Federal and State Regulations:**



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

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

**Other Classifications:**

**WHMIS (Canada):** Not Available

**DSCL (EEC):**

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

**HMIS (U.S.A.):**

**Health Hazard:** 1

**Fire Hazard:** 1

**Reactivity:** 1

**Personal Protection:** E

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

**Health:** 0

**Flammability:** 1

**Reactivity:** 1

**Specific hazard:**

**Protective Equipment:**

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

## Section 16: Other Information

**References:** Not available.

**Other Special Considerations:** Not available.

**Created:** 10/10/2005 12:18 AM

**Last Updated:** 11/06/2008 12:00 PM

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## ToxFAQs™: Chemical Agent Briefing Sheets (CABS)

# Lead

January 2006

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### What is lead?

Lead is a heavy, bluish-gray metal that has a low melting point. It occurs naturally in the Earth's crust, but it is not a particularly abundant element. It is rarely found naturally as a metal, but rather in its divalent (2+) oxidative state in ore deposits widely distributed throughout the world. The most important lead containing ores are galena (PbS), anglesite (PbSO<sub>4</sub>), and cerussite (PbCO<sub>3</sub>). Natural lead is a mixture of four stable isotopes: <sup>208</sup>Pb (51%–53%), <sup>206</sup>Pb (23.5%–27%), <sup>207</sup>Pb (20.5%–23%), and <sup>204</sup>Pb (1.35%–1.5%).

### What are the forms of lead?

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

### What are the common uses of lead?

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

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

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

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

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

liga, bali goli, pay-loo-ah, coral, and rueda.

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

#### Organic

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

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

#### Current Uses

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

#### Past Uses

- Gasoline additives (to increase octane rating)

### What are the routes of exposure for lead?

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

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

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

People living near hazardous waste sites, lead smelters or refineries, battery recycling or crushing centers, or other industrial lead sources may be exposed to lead and chemicals that contain lead. Workers in occupations that have sources of lead exposure ( e.g., plumbers, miners, mechanics, and lead smelter or refinery workers).

Certain hobbies, folk remedies, home activities, and car repairs ( e.g., radiator repair) can contribute to lead exposure. Smoking cigarettes or breathing second-hand smoke increases exposure because tobacco smoke contains small amounts of lead.

Pregnant women, the developing fetuses, and young children are particularly vulnerable to the effects of lead. Young children are more likely to play in dirt and to place their hands and other objects in their

mouths, thereby increasing the opportunity for exposure via ingestion of lead-contaminated soil and dust.

### What are the possible toxic effects of lead?

The most sensitive targets for lead toxicity are the developing nervous system, the hematological and cardiovascular systems, and the kidney. However, because of lead's many modes of action in biological systems, lead could potentially affect any system or organs in the body. The effects are the same whether it is breathed or swallowed.

#### Blood Lead Concentrations Corresponding to Adverse Health Effects

Life Stage	Effect	Blood lead (µg/dL)
Children	Depressed ALAD* activity	<5
	Neurodevelopmental effects	<10
	Sexual maturation	<10
	Depressed vitamin D	>15
	Elevated EP**	>15
	Depressed NCV***	>30
	Depressed hemoglobin	>40
	Colic	>60
Adults	Depressed GFR****	<10
	Elevated blood pressure	<10
	Elevated EP (females)	>20
	Enzymuria/proteinuria	>30
	Peripheral neuropathy	>40
	Neurobehavioral effects	>40
	Altered thyroid hormone	>40
	Reduced fertility	>40
	Depressed hemoglobin	>50
Elderly adults	Depressed ALAD*	<5
	Neurobehavioral effects	>4

\*aminolevulinic acid dehydratase (ALAD)

\*\*erythrocyte porphyrin (EP)

\*\*\*nerve conduction velocity (NCV)

\*\*\*\*glomerular filtration rate (GFR)

Source: ATSDR Toxicological Profile for Lead (Draft for Public Comment), 2005.

### How can I reduce the risk of exposure to lead?

- Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint (homes built before 1978).
- If you have a water lead problem, the U.S. Environmental Protection Agency (EPA) recommends that you flush your cold water pipes if they have not been used in over 6 hours by running water until it is cold (5 seconds to 2 minutes) before drinking or cooking with it.
- Avoid some types of paints and pigments that contain lead and are used as make-up or hair coloring; keep these kinds of products away from children.
- Hire a professional contractor, who is required to follow certain health safety requirements for remediation or renovation involving lead-based paint, ([www.epa.gov/lead/pubs/leadinfo.htm#remodeling](http://www.epa.gov/lead/pubs/leadinfo.htm#remodeling)).
- Wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

### What are the safety guidelines for lead exposure?

#### Air

- [National Institute for Occupational Safety and Health](http://www.cdc.gov/niosh) (NIOSH)

Recommended exposure limit (REL) time-weighted average (TWA) - 0.05 mg/m<sup>3</sup>  
Immediately dangerous to life or health (IDLH) - 100 mg/m<sup>3</sup>

- [Occupational Safety and Health Administration](http://www.osha-slc.org) (OSHA)

Air - workplace 50 µg/m<sup>3</sup>  
Action level - 40 µg/100 g of whole blood

- The [American Conference of Governmental Industrial Hygienists](http://www.acgi.org) (ACGIH)

Threshold limit values (TLV)/(TWA) - 0.05 mg/m<sup>3</sup>  
 TLV/TWA guideline for lead arsenate - 150 µg/m<sup>3</sup>  
 TLV/TWA guideline for other forms of lead - 50 µg lead/m<sup>3</sup>

- [U.S. Environmental Protection Agency](#) (EPA)

National Primary and Secondary Ambient Air Quality Standards - 1.5 µg/m<sup>3</sup>

- [World Health Organization](#) (WHO)

Air quality guidelines -- 0.5 µg/m<sup>3</sup>

#### Water

- EPA

Maximum contaminant level (MCL) - action level 0.015 mg/L  
 Action level for public supplies - 15 µg/L

- WHO

Drinking Water Quality Guidelines - 0.01 mg/L

#### Blood

- [Centers for Disease Control and Prevention](#) (CDC)

Level of concern for children - 10 µg/dL

- OSHA

Cause for written notification and medical exam - 40 µg/dL  
 Cause for medical removal from exposure - 50 µg/dL

- ACGIH

Advisory; biological exposure index - 30 µg/dL

#### Food

- [Food and Drug Administration](#) (FDA)

Bottled drinking water - 0.005 mg/L

#### Other

- ACGIH

Biological exposure indices (lead in blood) - 30 µg/100 mL

- [Consumer Product Safety Commission](#)

Paint - 600 ppm

- FDA

Ceramicware (µg/mL leaching solution) - 0.5-3.0 µg/mL

µg/m<sup>3</sup>: micrograms per cubic meter  
 µg/dL: micrograms per deciliter  
 µg/L: micrograms per liter  
 g: gram

mg/L: milligrams per liter  
 mL: milliliter  
 ppm: parts per million

### What are the most important or common mediating factors?

Factors that determine the severity of the health effects from lead exposure include

- Dose
- Age of the person exposed
  - the developing nervous system is the most sensitive system to the effects of lead
  - the efficiency of lead absorption from the gastrointestinal tract is greater in children than in adults
- Life stages of women (childbirth, lactating, menopause)
- Occupational exposures
- Duration of exposure
- Health and lifestyle of the person exposed
- Nutritional status of the person exposed
  - a diet adequate in calcium and iron may decrease lead absorption

The toxic effects of lead exposure may be worse in individuals with inherited genetic diseases or gene polymorphisms such as thalassemia, individuals with glucose-6-phosphate dehydrogenase (G6PD) deficiency, and carriers of certain gene polymorphic forms (e.g., ALAD and vitamin D receptor). Research continues about this topic.

## Is there a test to see if my child or I have been exposed to lead?

- |                       |   |
|-----------------------|---|
| <b>Blood</b>          | <ul style="list-style-type: none"> <li>• The screening test of choice is blood lead levels.</li> <li>• Blood tests are commonly used to screen children for lead poisoning.</li> <li>• Analysis of lead in whole blood is the most common and accurate method of assessing lead exposure.</li> <li>• 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).</li> </ul> |
| <b>Bone and Teeth</b> | <ul style="list-style-type: none"> <li>• X-ray fluorescence techniques have been used to determine lead concentration in bones and teeth. It is not widely available and is used mostly in research.</li> <li>• Lead partitions to bone over a lifetime of exposure; therefore, bone lead measurements may be a better indicator of cumulative exposure than blood lead.</li> </ul>   |
| <b>Urine</b>          | <ul style="list-style-type: none"> <li>• Measurements of urinary lead levels have been used to assess lead exposure.</li> <li>• The measurement of lead excreted in urine following chelation with calcium disodium EDTA (EDTA provocation) has been used to detect elevated body burden of lead in adults and children.</li> </ul>   |
| <b>Hair and Nails</b> | <ul style="list-style-type: none"> <li>• These are not reliable for testing due to errors external contamination. They are relatively poor predictors of blood lead, particularly at low concentrations.</li> </ul>   |

## Future Research Needs

To close current gaps in the scientific database on the health effects of lead, a long-term research program is needed that might include the following:

- Further short-term studies or studies in vitro designed to clarify mechanisms of action for the various toxicities might be useful.
- Studies identifying exposures during different developmental periods can help identify critical periods of vulnerability for immunocompetence, development of sex organs, or neurobehavioral parameters.
- Chronic-duration exposure studies in animals would expand information on the toxicity of lead. Special studies that examine biochemical and morphological effects of lead may provide new information on mechanisms of action of lead, particularly for the effects of greatest concern such as neurobehavioral changes in children.
- Development of new and more sensitive tests of specific neuropsychological functions.
- Further investigation of links between lead and amyotrophic lateral sclerosis, essential tremor, schizophrenia, and Parkinson's disease.
- Epidemiological studies designed in a manner that permits more rigorous assessments of effect modification.
- Studies about the long-term consequences of lead-related neurobehavioral deficits detected in infants and children and the manifestation of chronic neurobehavioral problems in adolescence and adulthood.
- Further characterization of bone lead concentration as a biomarker of exposure for various effect end points (e.g., blood pressure and renal effects).
- Studies of the potential prevalence of elevated bone lead stores in women of reproductive age and the associated risk that this poses to fetal development by mobilization of maternal bone stores during pregnancy.
- Further clarification of the role of some genetic polymorphisms.
- Evaluation of cohorts from prospective studies into adulthood for potential late-appearing effects including cancer.

## For more information

- Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profile for Lead  
<http://www.atsdr.cdc.gov/toxprofiles/tp13.html>
- ATSDR ToxFAQs™ for Lead  
<http://www.atsdr.cdc.gov/tfacts13.html>
- ATSDR Case Studies in Environmental Medicine Lead Toxicity  
<http://www.atsdr.cdc.gov/csem/lead/>
- ATSDR Interaction Profile for Chemical Mixtures for Arsenic, Cadmium, Chromium, and Lead  
<http://www.atsdr.cdc.gov/interactionprofiles/ip04.html>

- ATSDR Interaction Profile for Chemical Mixtures for Lead, Manganese, Zinc, and Copper  
<http://www.atsdr.cdc.gov/interactionprofiles/ip06.html>
- ATSDR Interaction Profile for Chemical Mixtures for Chlorpyrifos, Lead, Mercury, and Methylmercury  
<http://www.atsdr.cdc.gov/interactionprofiles/ip11.html>
- Centers for Disease Control and Prevention Lead Web Page  
<http://www.cdc.gov/lead/>
- U.S. Environmental Protection Agency Lead Web Page  
<http://www.epa.gov/lead/>
- U.S. Department of Labor, Occupational Safety & Health Administration  
<http://www.osha.gov/SLTC/lead/>

**For more information, contact:**

*Agency for Toxic Substances and Disease Registry  
Division of Toxicology and Environmental Medicine  
1600 Clifton Road NE, Mailstop F-32  
Atlanta, GA 30333  
Phone: 1-800-CDC-INFO (800-232-4636)  
TTY 888-232-6348*

*FAX: (770)-488-4178  
Email: [CDCINFO@cdc.gov](mailto:CDCINFO@cdc.gov)*

This page was updated on 01/04/2008





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## Mercury

Mercury is a naturally occurring metal found in air, water, and soil. It exists in several forms, including elemental (or metallic) mercury, inorganic mercury compounds, and organic mercury compounds:

- **Elemental mercury** is liquid at room temperature and is used in thermometers, fluorescent light bulbs, some electrical switches, and some industrial processes.
- **Inorganic mercury** compounds are formed when mercury combines with other elements to form salts, which are usually powders or crystals. Inorganic mercury compounds are found naturally in the environment. Some forms of inorganic mercury have been used in antiseptic creams, ointments, and preservatives.
- **Organic mercury** compounds are formed when mercury combines with carbon. Microscopic organisms can produce organic mercury compounds (methylmercury) in contaminated water and soil, which can accumulate in the food chain. Other special types of organomercurials have been used as medical preservatives and medicines.

### How People Are Exposed to Mercury

- Eating fish or shellfish that is contaminated with methylmercury, which is the main source of general human exposures to mercury;
- Breathing air contaminated with elemental mercury vapors (e.g., in workplaces such as dental offices and industries that use mercury or in locations where a mercury spill or release has occurred);
- Having dental fillings that contain mercury; and
- Practicing cultural or religious rituals that use mercury.

### How Mercury Affects People's Health

- Short-term exposure to extremely high levels of elemental mercury vapors can result in lung damage, nausea, diarrhea, increases in blood pressure or heart rate, skin rashes, eye irritation, and injury to the nervous system.
- Prolonged exposure to lower levels of elemental mercury can permanently damage the brain and kidneys.
- The developing brain of a fetus can be injured if the mother is exposed to methylmercury.

### Levels of Mercury in U.S. Population

Scientists tested levels of mercury in the blood of 16,780 participants who took part in CDC's national study known as the National Health and Nutrition Examination Survey (NHANES). These findings are based on total blood mercury levels in the U.S. general

population for persons aged 1 year and older who participated in NHANES during 2003–2006, as well as trends in the total mercury of children aged 1–5 and females aged 16–49 during 1999–2006.

- In the total population during 2003–2006, the total blood mercury levels for non-Hispanic blacks and non-Hispanic whites were higher than those for Mexican Americans.
- Across the age groups in the total population during 2003–2006, total blood mercury levels increased with age, peaked at the fifth or sixth decade, depending on race/ethnicity, and then declined.
- In the most recent survey period of 2005–2006, the 95th percentile levels for total blood mercury in children aged 1–5 years and females aged 16–49 years were 1.43 µg/L and 4.48 µg/L, respectively. The 95th percentile means that 95 percent of the U.S. population's exposure is below this estimated level. Conversely, only 5 percent of the population will have values at this level or higher.
- Over the four survey periods from 1999–2006, blood mercury levels increased slightly for non-Hispanic white children and decreased slightly for non-Hispanic black and Mexican American children. Female children had slightly higher blood mercury levels than male children.

#### **For More Information**

- Agency for Toxic Substances and Disease Registry  
Detailed information about mercury and public health is available at <http://www.atsdr.cdc.gov/alerts/970626.html> and <http://www.atsdr.cdc.gov/cabs/mercury/index.html>
- CDC Emergency Preparedness and Response  
Case definitions of mercury, toxicology FAQs, and toxicological profile at <http://emergency.cdc.gov/agent/mercury/>

May 2009

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The Centers for Disease Control and Prevention (CDC) protects people's health and safety by preventing and controlling diseases and injuries; enhances health decisions by providing credible information on critical health issues; and promotes healthy living through strong partnerships with local, national, and international organizations.



[ATSDR Home](#) > [ToxFAQs™](#) Arsenic

## ToxFAQs™

ToxFAQs™  
for  
**Arsenic**  
(*Arsénico*)  
August 2007



[PDF Version, 92 KB](#)

CAS#: 7440-38-2

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

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### Highlights

Exposure to higher than average levels of arsenic occur mostly in the workplace, near hazardous waste sites, or in areas with high natural levels. At high levels, inorganic arsenic can cause death. Exposure to lower levels for a long time can cause a discoloration of the skin and the appearance of small corns or warts. Arsenic has been found in at least 1,149 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

### What is arsenic?

Arsenic is a naturally occurring element widely distributed in the earth's crust. In the environment, arsenic is combined with oxygen, chlorine, and sulfur to form inorganic arsenic compounds. Arsenic in animals and plants combines with carbon and hydrogen to form organic arsenic compounds.

Inorganic arsenic compounds are mainly used to preserve wood. Copper chromated arsenate (CCA) is used to make "pressure-treated" lumber. CCA is no longer used in the U.S. for residential uses; it is still used in industrial applications. Organic arsenic compounds are used as pesticides, primarily on cotton fields and orchards.

### What happens to arsenic when it enters the environment?

- Arsenic occurs naturally in soil and minerals and may enter the air, water, and land from wind-blown dust and may get into water from runoff and leaching.
- Arsenic cannot be destroyed in the environment. It can only change its form.
- Rain and snow remove arsenic dust particles from the air.
- Many common arsenic compounds can dissolve in water. Most of the arsenic in water will ultimately end up in soil or sediment.
- Fish and shellfish can accumulate arsenic; most of this arsenic is in an organic form called arsenobetaine that is much less harmful.

### How might I be exposed to arsenic?

- Ingesting small amounts present in your food and water or breathing air containing arsenic.
- Breathing sawdust or burning smoke from wood treated with arsenic.
- Living in areas with unusually high natural levels of arsenic in rock.
- Working in a job that involves arsenic production or use, such as copper or lead smelting, wood treating, or pesticide application.

### How can arsenic affect my health?

Breathing high levels of inorganic arsenic can give you a sore throat or irritated lungs.

Ingesting very high levels of arsenic can result in death. Exposure to lower levels can cause nausea and vomiting, decreased production of red and white blood cells, abnormal heart rhythm, damage to blood vessels, and a sensation of "pins and needles" in hands and feet.

Ingesting or breathing low levels of inorganic arsenic for a long time can cause a darkening of the skin and the appearance of small "corns" or "warts" on the palms, soles, and torso.

Skin contact with inorganic arsenic may cause redness and swelling.

Almost nothing is known regarding health effects of organic arsenic compounds in humans. Studies in animals show that some simple organic arsenic compounds are less toxic than inorganic forms. Ingestion of methyl and dimethyl compounds can cause diarrhea and damage to the kidneys.

### How likely is arsenic to cause cancer?

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

### How does arsenic affect children?

There is some evidence that long-term exposure to arsenic in children may result in lower IQ scores. There is also some evidence that exposure to arsenic in the womb and early childhood may increase mortality in young adults.

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

### How can families reduce their risk for exposure to arsenic?

- If you use arsenic-treated wood in home projects, you should wear dust masks, gloves, and protective clothing to decrease exposure to sawdust.
- If you live in an area with high levels of arsenic in water or soil, you should use cleaner sources of water and limit contact with soil.
- If you work in a job that may expose you to arsenic, be aware that you may carry arsenic home on your clothing, skin, hair, or tools. Be sure to shower and change clothes before going home.

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

There are tests available to measure arsenic in your blood, urine, hair, and fingernails. The urine test is the most reliable test for arsenic exposure within the last few days. Tests on hair and fingernails can measure exposure to high levels of arsenic over the past 6-12 months. These tests can determine if you have been exposed to above-average levels of arsenic. They cannot predict whether the arsenic levels in your body will affect your health.

### Has the federal government made recommendations to protect human health?

The EPA has set limits on the amount of arsenic that industrial sources can release to the environment and has restricted or cancelled many of the uses of arsenic in pesticides. EPA has set a limit of 0.01 parts per million (ppm) for arsenic in drinking water.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit (PEL) of 10 micrograms of arsenic per cubic meter of workplace air ( $10 \mu\text{g}/\text{m}^3$ ) for 8 hour shifts and 40 hour work weeks.

### References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. [Toxicological Profile for Arsenic \(Update\)](#). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

### Where can I get more information?

#### For more information, contact:

Agency for Toxic Substances and Disease Registry  
Division of Toxicology and Environmental Medicine  
1600 Clifton Road NE, Mailstop F-62  
Atlanta, GA 30333  
Phone: 1-800-CDC-INFO • 888-232-6348 (TTY)  
FAX: 770-488-4178  
Email: [cdcinfo@cdc.gov](mailto:cdcinfo@cdc.gov)

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

This page was updated on 10/05/2007

B. CAMP

## COMMUNITY AIR MONITORING PLAN (CAMP)

471-483 20<sup>th</sup> Street  
Block 888; Lots 50 & 52  
Brooklyn, New York

NYSDEC BCP Site Number: C224187

### 1- Introduction

The Community Air Monitoring Plan (CAMP) has been prepared to monitor the air quality during the intrusive activities proposed as a part of the Remedial Investigation (RI) activities at the property located at 471-483 20<sup>th</sup> street in Brooklyn, New York. Levels of VOCs and dust in the air will be monitored continuously and periodically utilizing a Photo Ionization Detector (PID) and Real-Time Particulate Dust Tracker, respectively. For this investigation, the PID will be calibrated at the beginning of each day to the compound isobutylene, which is published by the manufacturer. The PID has a minimum detection limit of 0.1 parts per million (ppm). The Dust Tracker provides real-time measurement based on 90° light scattering. The Dust Tracker has a minimum detection limit of 0.001 mg/m<sup>3</sup>.

Continuous real-time air monitoring for VOCs and particulate levels at the perimeter of the exclusion zone or work area will be performed for all ground intrusive activities. Ground intrusive activities include, but are not limited to the installation of soil borings, monitoring wells and soil/sub-slab vapor probes.

Periodic monitoring for VOCs will be performed during non-intrusive activities such as the collection of soil samples, the collection of groundwater samples from monitoring wells. For instance, periodic monitoring during sample collection will consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well bailing/purging, and taking a reading prior to leaving a sample location. Depending upon the proximity of potentially exposed individuals, continuous monitoring may be performed during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence. Exceedances of action levels observed during performance of the Community Air Monitoring Plan (CAMP) will be reported to the NYSDEC and recorded in a field daily log. A summary of daily logs/reports will be provided in the Remedial Investigation Report (RIR).

### 2- VOCs Monitoring, Response Levels And Actions

VOCs will be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis during invasive work. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work will be performed using a PID, which will be calibrated at least daily for to the compound isobutylene. The PID will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

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

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

Activities will be shut down if the organic vapor level at the perimeter of the work area is above 25 ppm.

All 15-minute readings must be recorded in a daily field log. Instantaneous readings, if any, used for decision purposes will also be recorded.

### **3- PM Monitoring, Response Levels And Actions**

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

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

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

## C.Sample Boring Log





Hydro Tech Environmental, Corp.

Main Office  
2171 Jericho Turnpike, Suite 240  
Commack, New York 11725  
T (631) 462-5866 · F (631) 462-5877  
www.hydrotechenvironmental.com

NYC Office  
15 Ocean Avenue, 2nd Floor  
Brooklyn, New York 11225  
T (718) 636-0800 · F (718) 636-0900

Soil Probe  
Log

Job No:	xxxxxx	Date:	xx/xx/xxxx	Page:	1 of 1
Location:	ABCD, EF, GH			Sampling Interval:	2 feet
Boring No.:	SP-x	Sampling Method:	Grab		
Drilling Method:	Direct Push	Driller:			
Total Depth:	12 feet	Depth to Water:			

USCS SYMBOLS

GW - Well Graded Gravel	SW - Well Graded Sand	ML - Inorganic Silt / Sandy Silt	CH - Inorganic Clay, High Plastic
GP - Poorly Graded Gravel	SP - Poorly Graded Sand	CL - Inorganic Clays/Sandy Clay	OH - Organic Silt / Clay
GM - Silty Gravel	SM - Silty Sand	OL - Inorganic Silts/Organic Silty Clay	PT - Peat/High Organics
GC - Clayey Gravel	SC - Clayey Sand	MH- Elastic Silts	

Depth Below Grade and Lithology	PID Reading (ppm)	USCS	Soil Description
---------------------------------------	----------------------	------	------------------

0	0.0	SP	concrete/dark brown, med grained sandy loam with brick and pebble sized clasts
-2	0.0	SP	dark brown, med grained sandy loam with brick and pebble sized clasts
-4	0.0	SP	brown, med grained sand
-6	0.0	SP	brown, med grained sand
-8	0.0	SP	brown, med grained sand
-10	0.0	SP	brown, med grained sand
-12			

D.QAPP

## QUALITY ASSURANCE PROJECT PLAN

471-483 20<sup>th</sup> Street  
Block 888; Lots 50 & 52  
Brooklyn, New York

NYSDEC BCP Site Number: C224187

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1.0 Introduction.....	2
2.0 Project Objective and Scope of Work .....	2
3.0 Sampling Procedures, Decontamination Methods and Data Quality Usability Objectives .....	2
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3.2 Decontamination Methods/ Quality Assurance and Quality Usability Objectives.....	3

### Tables

1. Sampling and Analytical Method Requirements for Soil

### Attachments

- A. Resumes of Key Personnel involved in this Project
- B. Sample Chain of Custody Form
- C. Conventional Laboratory QA/QC

## 1.0 Introduction

This Quality Assurance Project Plan (QAPP) has been prepared for the samples to be collected in accordance with the Remedial Investigation Work Plan (RIWP) developed for the property located at 471-483 20<sup>th</sup> street in Brooklyn, NY. The intent of the QAPP is to ensure that (1) proper equipment handling and maintenance is followed, (2) cross-contamination between sampling locations does not occur, (3) standard number of quality control replicate environmental samples are obtained, (4) proper procedures for samples custody are performed and (5) data review, validation and verification requirements are complete.

All related portions of the fieldwork will be performed, at a minimum, in accordance with acceptable industry standards. These acceptable industry standards include, but are not limited to, the ASTM Standard Guide for Phase II Environmental Site Assessments (E 1903-97) and the New York State Department of Environmental Conservation (NYSDEC) Bureau of Spill Prevention & Response Sampling Guidelines and Protocols, March 1991 and NYSDEC DER-10, Technical Guidance for Site Investigation and Remediation, May 2010, 6 NYCRR Subpart 360.

## 2.0 Project Objective and Scope of Work

The objective of the investigation as set forth in the RIWP is to characterize the vertical and horizontal delineation of soil contamination beneath the Site. This investigation will be performed in accordance to the New York State Department of Environmental Conservation (NYSDEC) requirements under the NYS Brownfield Cleanup Program (BCP) and in compliance with the NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation (May 2010) and other acceptable industry standards.

To meet the above objectives a total of seven (7) soil probes will be installed and sampled during this investigation. Soil probes installation shall conform to NYCRR Part 360.

## 3.0 Sampling Procedures, Decontamination Methods and Data Quality Usability Objectives

### 3.1 Soil Sampling

Soil samples will be collected from soil probes SP-4 through SP-10. All soil samples will be obtained at 2-foot intervals utilizing a 1½-inch diameter 4-foot long Macro Core sampler fitted with dedicated acetate liners. The location of the soil probes is provided in Figure 4 of the RIWP.

At minimum two (2) soil sample will be selected from each of the soil probes for lab analysis and will consist of the the sample that exhibits a considerable level of hydrocarbons based upon the field screening results and the sample collected from the deepest sampling interval determined in each soil probe.

Each soil sample will be placed directly into pre-cleaned containers provided by the laboratory samples from select soil probes. Sample containers will be labeled and placed in a cooler filled with ice and maintained at 4 degrees Celsius. Each sample will be transmitted under proper chain of custody procedures to a NYSDOH ELAP-certified laboratory for analysis. **Table 1** provides the sample containers, volumes, test methods, preservation techniques, reporting limits and holding times for soil samples.

### 3.2 Decontamination Methods/ Quality Assurance And Quality Usability Objectives

A Hydro Tech Quality Assurance (QA) officer (Paul I. Matli.) will adopt this QAPP during the collection of soil and groundwater samples in order to ensure that (1) proper equipment handling and maintenance is followed, (2) cross-contamination between sampling locations does not occur, (3) standard number of quality control replicate environmental samples are obtained, (4) proper procedures for samples custody are performed and (5) data review, validation and verification requirements are complete. Attachment A provides resumes of key personnel involved with this project.

During the field sampling, Hydro Tech QA officer will be responsible for monitoring the decontamination procedure of every piece of sampling equipment prior to each use by field personnel. The following procedure will be implemented during the decontamination process:

- Wipe clean and wash with Alconox®
- Potable water rinse
- Methanol rinse
- Deionized water rinse
- Air dry

All decontamination procedures will be performed in an area segregated from any sampling areas. Any rinsate from the decontamination area will be contained and placed in 55-gallons drums and properly disposed of. The following Quality Assurance (QA) and Quality Control (QC) samples will also be collected and analyzed.

- One trip blank per trip will be analyzed via EPA Method 8260
- One field blank (rinsate blank) for soil will be analyzed via EPA Method 8260, EPA Method 8270, EPA Method 8081, EPA Method 8151, EPA Method 8082, EPA Method 6010 and EPA Method 7471.

Matrix Spike (MS) and Matrix Spike Duplicate (MSD) samples will also be collected and analyzed.

- One MS soil sample and one MSD soil sample will be analyzed via EPA Method 8260, EPA Method 8270, EPA Method 8081, EPA Method 8151, EPA Method 8082, EPA Method 6010 and EPA Method 7471.

The soil samples will be managed and analysis with the following protocol:

- Samples will be labeled and logged in a monitor notebook upon collection.
- In the field, samples will be the responsibility of, and will stay with, the Hydro Tech QA officer.
- Once samples have been collected they are returned to Hydro Tech office and logged in for temporary (i.e. < 48 hrs) storage.
- Samples will be refrigerated to maintain a temperature at a maximum 4 degrees Celsius.
- Hydro Tech QA officer will be then responsible for arranging transport of samples to State-certified (ELAP) laboratory for analysis under a proper Chain of Custody. Attachment B provides a sample chain of custody form.
- Laboratory personnel will record the date and time of samples arrival at the lab and ensure that all holding times for each matrix and analysis will be met.
- After samples are analyzed, laboratory information is added to the label.
- The Sample Chain of Custody Form will be used to record all transport and storage information.
- Samples analytical data report will undergo QA/QC performed by a laboratory officer who checks each data sheet for precision, missing or illegible information, errors in calculation and values outside of the expected range. Attachment C provides a conventional lab QA/QC procedures associated with soil, vapor/air and groundwater methods and analyses.
- As necessary, data uploads will be conducted utilizing EQUIS.
- ASP Protocol, Category B deliverables.

Upon completion of the sampling and analysis, an independent QA Officer will generate a data usability analysis. The analysis shall consist of (1) an assessment to determine if the data quality objectives were met; (2) evaluation of field duplicate results to indicate the samples are representative; (3) comparison of the results of all field blanks, trip blanks and methods blanks with full data sets to provide information concerning contaminants that may have been introduced during sampling, shipping or analyzing; (4) evaluation of matrix effects to assess the performance of the analytical method with respect to sample matrix, and determine whether the data has been biased high or low due to matrix effects. The data usability analysis shall be included in the QA summary of the Field Investigation Report. Tables 1 provides the sampling and analytical Method Requirements for soil.

**Table 1: Sampling & Analytical Method Requirements – Soil Samples**

Soil Matrix <sup>(1)</sup>	Parameters	Minimum Sample Volume	Sample Container	Sample Preservation	Analytical Method	Lab Reporting Limit	Technical Holding Time
Sample ID							
SP-4 to SP-10 & Matrix Spike /Matrix Spike Duplicate	TCL VOCs	120 ml + 2 OZ	2 oz. clear wide-mouth glass with Teflon lined septum + 40 ml methanol vial with Teflon lined cap + 40 ml DI water vial with Teflon lined cap + 40 ml unpreserved vial with Teflon lined cap	Cool to 4 °C <sup>(2)</sup>	EPA Method 8260	Compound Specific (0.001-0.05 mg/Kg)	14 days
	TCL SVOCs	8 OZ	8 oz. clear wide-mouth glass with Teflon lined septum	Cool to 4 °C	EPA Method 8270	Compound Specific (0.065-0.250 mg/Kg)	14 days
	TAL Metals	8 OZ	8 oz. clear wide-mouth glass with Teflon lined septum	Cool to 4 °C	EPA Method 6010/EPA 7470 for Mercury	Compound Specific (0.05-10 mg/Kg)	6 months/ Chromium Hexavalent 24 hours/ Mercury 28 days
	Pesticides	8 OZ	8 oz. clear wide-mouth glass with Teflon lined septum	Cool to 4 °C	EPA Method 8082	Compound Specific (0.005-0.02 mg/Kg)	14 days
	PCBs	8 OZ	8 oz. clear wide-mouth glass with Teflon lined septum	Cool to 4 °C	EPA Method 8081	Compound Specific (0.025 mg/Kg)	14 days
Field Blank	TCL VOCs	120 ml	40 ml VOC vial with Teflon lined cap	1:1 HCL to pH<2 Cool to 4 °C	EPA Method 8260	Compound Specific (0.2-10 µg/L)	14 days
	TCL SVOCs	1 liter	Amber glass with Teflon lined cap	Cool to 4 °C	EPA Method 8270	Compound Specific (2-20 µg/L)	7 days
	TAL Metals	500 ml	500 ml Poly cup with Teflon lined cap	HNO3 to pH<2 Cool to 4 °C	EPA Method 6010/EPA 7470 for Mercury	Compound Specific (2-20 µg/L)	6 months/ Chromium Hexavalent 24 hours/ Mercury 28 days
	Pesticides	1 liter	Amber glass with Teflon lined cap	Cool to 4 °C	EPA Method 8082	Compound Specific (0.01-0.1 µg/L)	7 days
	PCBs	1 liter	Amber glass with Teflon lined cap	Cool to 4 °C	EPA Method 8081	Compound Specific (0.05 µg/L)	7 days
Trip Blank	TCL VOCs	80 ml	40 ml VOC vial with Teflon lined cap	1:1 HCL to pH<2 Cool to 4 °C	EPA Method 8260	Compound Compound Specific (0.2-10 µg/L)	14 days

<sup>(1)</sup>.....Analytical Services Protocols (ASP) Deliverables Package Category B.

<sup>(2)</sup>...If samples are not delivered to the lab with 48 hours after collection, the 40 ml DI Water vials should be preserved in a frozen condition following sampling

**ATTACHMENT A**  
**RESUME OF KEY PERSONNEL**

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

Mr. Robbins has over nine (9) years experience in geology and hydrogeology, involving such activities as Phase I Environmental Site Assessments, Phase II Environmental Site Assessments, Subsurface Investigations, Remedial Actions, data acquisition, evaluation and contouring, and geotechnical investigations. Mr. Robbins has performed over 400 Phase I Assessments involving residential through heavy industrial properties and over 200 Subsurface Investigations throughout the United States. Mr. Robbins has also designed and implemented over 20 remediation systems for both public and private sectors.

**Representative Occupational Experience**

- ❑ *Environmental Site Assessments*  
Conducted Phase I and II Environmental Site Assessments, analysis of site investigation reports, identifying contamination locations and sources. Soil, soil-vapor and water sampling, analyzing laboratory results for QA/QC, magnetometer and Ground-Penetrating Radar surveys for locating buried drums and underground storage tanks (USTs), estimating UST and other subsurface leaks, monitoring well logging, Project Management, liability assessments and estimating costs to attain compliance.
- ❑ *Remedial Investigation and Feasibility Studies*  
Oversight/planning of site investigations; data analysis, including statistical analysis and geostatistical contouring utilizing SURFER; performance of feasibility studies, including technology evaluations, alternatives development and evaluation and cost estimations.
- ❑ *Due- Diligence Programs*  
Designed and implemented due-diligence programs (ranging from Phase I Assessment to Comprehensive Hydrogeologic Investigations) to assess environmental liabilities for numerous land development clientele.
- ❑ *Delineation of Chlorinated Organic Plumes*  
Supervised the delineation of a dissolved chlorinated organic plume from underground tank loss. Developed a remedial action program in accordance with New York State regulatory guidelines to abate soil and groundwater contamination.
- ❑ *Remedial Action*  
Prepared numerous Remedial Action Plans. Designed and implemented hydrocarbon and chlorinated solvent remediation systems for soil and groundwater.
- ❑ *Pump Test Aquifer Analysis*  
Conducted several pump tests and pump test analysis and field coordination in relation to dewatering permit requirements for Keyspan Energy and the private sector.

**Employment**

2001 - Present

Vice President, Senior Geologist  
Hydro Tech Environmental Corp., Commack, New York



- |             |  |
|-------------|--|
| 2000 – 2001 | Assistant Director, Professional Services<br>Fenley & Nicol Environmental, Inc., Deer Park, New York |
| 1999 – 2000 | Senior Geologist<br>Fenley & Nicol Environmental, Inc. Deer Park, New York                           |
| 1995 – 1999 | Operations Director<br>Advanced Cleanup Technologies, Inc., Farmingdale, New York                    |
| 1992 – 1995 | Project Geologist<br>Advanced Cleanup Technologies, Inc., Roslyn Heights, New York                   |

#### Education

B.S. Geology, State University of New York at Oneonta, 1991

#### Affiliations and Certifications

- American Institute of Professional Geologists
- American Association of Petroleum Geologists
- Long Island Geologist Organization
- Geological Society of America
- American Standards in Testing Materials – E50 Committee Member
- Environmental Assessment Association
- OSHA 40-Hour & 8-Hour, Supervisor

#### Registrations and Certifications

- Certified Professional Geologist (C.P.G. # 10527)
- Certified Environmental Inspector (C.E.I. # 73383)
- GPR Operator's Course, Geophysical Survey Systems, Inc., 1993.

#### Publications/Presentations

- *A Case Study of the Impact of MTBE on the Investigation and Remediation of a Fuel Oil Release*, National Groundwater Focus Conference MTBE in Groundwater: Assessment, Remediation Technologies & Public Policy, Baltimore, MD June 4-5, 2001.
- *Is MTBE in Fuel Oil? Why MTBE Plays a Major Concern on Long Island*, Long Island Business News, February 2001.

# **Paul I. Matli (Ph.D.)**

## **EXPERIENCES**

### **Senior Project Manager**

#### **Hydro Tech Environmental Corp. - USA**

**Apr. 2005 - Nov. 2005 & July 2006 - Present**

Completed Environmental Assessment Statements, Phase I Environmental Site Assessments, Phase II Investigations Work Plans, environmental monitoring programs of groundwater and indoor air quality, field sampling of soil, water, air, soil gas, mold and solid wastes, data evaluation through Quality Assurance and Quality Control programs and reports writing. Prepared and engineered Phase III Remedial Action Work Plans for regulated developments, superfund sites and hazardous waste facilities by implementing in-situ bio-chemical remedial technologies, ex-situ disposal of impacted media and on-site mitigation methods of soil vapor intrusion. Supervised and coordinated the closure and removal of petroleum storage tanks. Fulfilled the task of Health and Safety Officer and the duties of a Geologist at a New York State Brownfield Cleanup Program site and multiple New York City Brownfield Cleanup Program sites.

### **Vocational Lecturer of the Course “Ecology and Environment”**

#### **Saint Joseph University – Lebanon**

**Nov. 2003 - Feb. 2004**

Introduced undergraduate students in the School of Agriculture Engineering and the Nursing School to advanced knowledge in the fields of ecology, environment, ecosystem management, earth science and multivariate statistical analytical methods.

### **Agriculture Engineer in the Italian Rural Development Project in the Upper Bekaa Valley, Baalbek-Hermel Region**

#### **Lebanese Agricultural Research Institute - Lebanon**

**May 2003 - Jan. 2004**

Contributed to boosting agricultural production in rural communities in a semi-arid region by identifying deficient production and marketing elements in their farming system and promoting sustainable agriculture by introducing drought tolerant crops and the construction and management of engineered water reservoirs.

### **Teaching Assistant**

#### **Tokyo University of Agriculture and Technology - Japan**

**Apr. 1999 - Sept. 2002**

Played a key role in the completion of research thesis of graduate research students by instructing and assisting them in their experimental designs and the application of statistical analytical methods.

### **Environmental Manager of Ammiq Private Wetlands in the Bekaa Valley - Lebanon**

**Oct. 1997 - Sept. 1998**

Successfully managed the exploitation of natural resources of privately owned wetlands by local stakeholders and implemented the United Nations strategies to suppress hunting of endangered bird species and waterfowls in coordination with government and international non-government organizations.

## **EDUCATION**

### **Ph.D. in Environmental Sciences <sup>(a)</sup>**

#### **Tokyo University of Agriculture and Technology- Japan**

**Apr. 1999 - Sept. 2002**

**Research Theme:** Conducted field research of crop physiological responses to micro-climatic conditions and developed empirical and multivariate statistical models predicting the impact of future global warming on crop production.

**M.Sc. in Environmental Sciences <sup>(b)</sup>**

**International Center for Advanced Mediterranean Agronomic Studies - Greece**

**Sept. 1995 - Sept. 1997**

**Research Theme:** Performed field surveys and laboratory analytical studies of the physico-chemical properties of forest and plant species in promoting wildland fires and developed empirical statistical models predicting their inputs into forest fire behavior prediction systems.

**D.S.P.G.S. in Management and Conservation of Mediterranean Ecosystems**

**International Center for Advanced Mediterranean Agronomic Studies - Greece**

**Nov. 1994 - Aug. 1995**

Top second among 15% of students successfully passing a one-year postgraduate program of intensive multidisciplinary courses for the major of management and conservation of natural renewable resources with a GPA of 4.0.

**Diploma of Agricultural Engineer <sup>(c)</sup>**

**University of Saint Joseph - Lebanon**

**Sept. 1989 - July 1994**

Successfully passed a five-year engineering program in agronomy and ranked first in the 1994 class graduation with a GPA of 3.69.

**Research Theme:** Collected and established a socio-economic database of the impact of trout fish farms on the bio-chemical property and microbial quality of fresh watercourses.

**PEER-REVIEWED PUBLICATIONS**

**Matli P.I.**, Aoki M., Ozawa Y., Hideshima Y., Nakayama H., and Maruya S. 2002. Characterization of canopy photosynthetic CO<sub>2</sub> flux and leaf stomatal conductance responses of potato crop to changing field meteorological conditions in Hokkaido (in English). *Journal of Agricultural Meteorology*, **58**(3):115-122.

Dimitrakopoulos A.P., and **Matli P.** 2001. Bulk density and physical properties of *Sarcopoterium spinosum* (L.) Spach as fuel characteristics (in English). *Journal of Mediterranean Ecology*, **2**:75-82.

Elzein G., **Matli P.**, and Darwish S. 1997. The Study of physico-chemical and biological parameters of fresh water in fisheries in the Bekaa Valley (in French). *Lebanese Scientific Bulletin*, **10**(1):3-20.

**Matli P.** 1998. Measures and strategies to prevent and manage forest fires in Lebanon (in Arabic). *Al Nahar Newspaper*; Nahar El Shabab, Sept. 22, pp.2-3.

**Matli P.** 1997. A preliminary planning of managerial strategies for the conservation and management of Ammiq private wetlands (in English). Technical report submitted to the owners committee of Ammiq Estates-Lebanon, 10p.

**EXTRACURRICULAR TRAININGS AND SKILLS**

40 Hours OSHA training Course in Health & Safety Methods in Handling Hazardous Materials, USA, Feb. 2010.

10 Hours OSHA Training Course in Construction Safety & Health, Feb. 2013.

Turbo Training in pursuing environmental remedial activities at hazardous sites in compliance with the New York City Mayor's Office of Environmental Remediation, Feb. 2015.

(a), (b), (c) Accredited US Educational Equivalence, Globe Language Services, Inc.

# DONALD C. ANNÉ

## SENIOR CHEMIST

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**EDUCATION:** M.S., Chemical Oceanography, Florida Institute of Technology, 1981  
B.A., Earth Sciences, Millersville University of Pennsylvania, 1975

**SPECIAL TRAINING:** Certified 40-Hour OSHA Health and Safety  
Certified 8-Hour OSHA Supervisory Course  
Ground Water Geochemistry (NWWA)  
Ground Water Pollution and Hydrology (Princeton Associates)  
Quality Assurance Programs for Environmental Monitoring Data  
(Stat-A-Matrix)

**PROFESSIONAL AFFILIATIONS:** American Chemical Society (AFS), 1979-Present

### EXPERIENCE SUMMARY:

Mr. Anné has more than 27 years of environmental chemistry experience specializing in data validation, environmental sampling, analytical methodologies, petroleum fingerprinting, laboratory audits, field sampling audits, and preparing Quality Assurance Project Plans and Quality Assurance Manuals. Mr. Anné's experience includes analytical laboratory work with gas chromatography, atomic absorption, infrared spectrometry and wet chemistry methods.

### PROJECT EXPERIENCE:

#### Quality Assurance/Quality Control of Chemical Data

Mr. Anné has more than 20 years experience as a data validator and quality assurance officer. Mr. Anné has validated data for most EPA Regions and under several independent state programs, including the NYSDEC. He has performed laboratory and field audits as well as written Quality Assurance Project Plans. Mr. Anné has written, reviewed, and initiated laboratory Quality Assurance Manuals for laboratories to maintain their regulatory compliance. Typical project experience includes:

- Senior Chemist responsible for data validation. Reviewed chemical data for several projects under the New Jersey ISRA regulations. The clients included industry and utilities.
- Supervising Environmental Scientist responsible for data validation. Reviewed chemical laboratory data for adherence to QA/QC protocols for several key projects, including National Priorities List sites and RCRA Corrective Actions located in EPA Regions I, II, III, IV, V, and IX. Validated analytical data, outlined problems and actions to be taken, and qualified all affected data. Consulted with project managers on data usability, and recommended corrective actions to support project goals. Responded to comments made by regulators regarding data quality.
- Supervising Environmental Scientist recognized by the New York State Department of Environmental Conservation (NYSDEC) to perform third party data validation. Attended NYSDEC workshop on data validation as part of the requirements set forth by NYSDEC. Performed data validation in support of NYSDEC STARS and ASP programs as well as data in support of the NYSDEC Part 360 Regulations for landfills. Validated data for an Albany area municipal landfill.
- Supervising Environmental Scientist responsible for developing and preparing Quality Assurance Project Plans (QAPPs) for several state and federal Superfund sites and federal RCRA corrective action sites. Negotiated with regulators for the acceptance of the QAPPs. The sites were located throughout the eastern United States.

- Environmental Chemist responsible for developing a laboratory QA/QC program which fulfilled requirements of the EPA and agencies from the States of Texas and Louisiana. Implemented and managed the program throughout DOE's SPR Environmental laboratories. Received verbal commendations from EPA and the Texas Water commission on the QA/QC Program.

### **Environmental Chemistry**

Mr. Anné is experienced in sampling soil, water, air, and wastes in accordance with federal and state guidelines. He has performed field sampling audits and prepared sampling plans for numerous projects in accordance with applicable programmatic requirements. Mr. Anné is familiar with the geochemical aspects of fate and transport of contaminants. Mr. Anné's typical project experience includes:

- Data manager for the Pennwalt Corporation's RCRA Corrective Action RFI Phase I program. The project included quantifying and characterizing soil contamination and hydrogeologic flow systems of 12 SWMUs at a fluorochemicals plant in Thorofare, New Jersey. Validated and prepared QA/QC reports for data generated during the project. Qualified all data in preparation of the final report. Work was performed under the direction of NJDEP.
- Project Chemist in charge of field sampling activities, including coordinating and scheduling all subcontracted laboratory work for more than 25 sites in Connecticut. Trained field teams in sampling techniques for soil, groundwater, and surface water; chain of custody requirements; sampling QA/QC protocols; and analytical requirements. Work was performed under the scrutiny of ConnDEP.
- Field Team Leader for a major hazardous waste drum excavation project. Supervised all field activities including site safety; excavation; removal, sampling, and over packing of drums; staging and sampling of contaminated soil; and preparation of samples. Coordinated excavation and laboratory subcontractors. Work was performed under the scrutiny of ConnDEP.
- Created an environmental monitoring program for the Bryan Mound site of DOE's Strategic Petroleum Reserve for testing ground water and surface water. Developed sampling protocols, frequency of sampling, and lists of target analytes. This program was designed to provide baseline data for pre-spill conditions in the event of a release. The site was under scrutiny by EPA Region V and the Texas Water commission.
- Project Chemist responsible for developing analytical QA/QC program that included sampling and chemical analyses of surface water, groundwater, soil, and sediment matrices as part of a Remedial Investigation/Feasibility Study (RI/FS). The RI/FS involved more than 25 sites throughout the State of Connecticut. Work was under the guidance of ConnDEP.

### **Analytical Chemistry**

Mr. Anné has experience working in both fixed-base and mobile laboratories. His experience includes the use of gas chromatography, atomic absorption spectrometers, infrared spectrometers, and numerous wet chemistry and preparation equipment methods. He has served in the laboratory as an analyst, laboratory advisor, and QA officer. He has interfaced with regulators in the area of analytical chemistry and has experience in petroleum fingerprinting techniques and methods. Typical projects include:

- Performed bench scale experiments for St. Lawrence Zinc in order to obtain the optimum level of Phlotec necessary to treat discharged water to resolve an N.O.V. for the SPDES outfall. The optimum level of Phlotec would precipitate enough dissolved zinc for the water to meet the discharge requirement. Also performed routine analyses of samples after implementing the treatment, to insure that the proper concentration was being used.
- Environmental Chemist in charge of project to design updates for the DOE's laboratories at its SPR facilities. Evaluated IR and FT-IR instrumentation and personal computers to link with existing and future instrumentation. Wrote procedures for the acceptance of an alternative oil & grease method for NPDES permit

monitoring by EPA Region V. Coordinated all site activities necessary for implementing upgrades.

- Environmental Chemist in charge of replacing obsolete total organic carbon (TOC) analyzers for the SPR laboratories. Evaluated state-of-the-art TOC analyzers and recommended replacement TOC analyzer. Negotiated with supplier and wrote technical specification for the bid process required by DOE. Supervised installation and set-up of all new TOC analyzers.
- Analytical Chemist for Berkley Products Company responsible for product development. Analyzed competitor's products and formulated new coatings with equal or better quality. Responsible for solvent operations which included managing the waste solvent recovery operations, solvent formulation, and manufacturing QA/QC. Worked with sales and manufacturing staff to address and resolve client complaints. Received two cash bonuses for suggestions on the manufacture of products which saved the company money.
- Analytical Chemist for the mobile laboratory responsible for sample preparation in support of several projects for a range of clients located in three EPA regions and in conjunction with several state agencies. Extracted, concentrated, and prepared water and soil samples for analyses by GC/FIND, GC/ECD, GC/PID, and GC/MS. Samples were prepared for PCB, pesticide, polynuclear aromatic hydrocarbon, and petroleum hydrocarbon analyses.

**EMPLOYMENT:**

2005- present, Alpha Geoscience  
1998-2005, Alpha Environmental Consultants, Inc.  
1990-1998, McLaren/Hart  
1986-1990, Fred C. Hart Associates  
1985-1986, Boeing Petroleum Services  
1982-1985, Petroleum Operations and Support Services  
1981-1982, Dravo Utility Constructors  
1979-1981, Florida Institute of Technology  
1975-1979, Berkley Products Company

Z:\ALPHA\RESUMES\DCA\DCA-DATA VAL.DOC

**ATTACHMENT B**  
**SAMPLE CHAIN OF CUSTODY FORM**

## Field Chain-of-Custody Record

**NOTE:** York's Std. Terms & Conditions are listed on the back side of this document.  
This document serves as your written authorization to York to proceed with the analyses requested and your signature binds you to York's Std. Terms & Conditions unless superseded by written contract.

**York Project No.**

Client Information	Report To:	Invoice To:	Client Project ID	Turn-Around Time	Report Type/Deliverbles
Company: _____	Company: _____	Company: _____	Purchase Order No.	24 hr _____	Summary _____ QA/QC Summary _____
Address: _____	Address: _____	Address: _____		48 hr _____	Results Only _____
_____	_____	_____		72 hr _____	RCP Package _____ ASP B Pkg _____
Phone No. _____	Phone No. _____	Phone No. _____		5 Day _____	ASP A Pkg _____ Excel format _____
Contact Person: _____	Attention: _____	Attention: _____		Standard _____	EDD _____ OTHER _____
E-Mail Address: _____	E-Mail Address: _____	E-Mail Address: _____			

***Print Clearly and Legibly. All Information must be complete. Samples will NOT be logged in and the turn-around time clock will not begin until any questions by York are resolved.***

<b><i>Print Clearly and Legibly. All Information must be complete. Samples will NOT be logged in and the turn-around time clock will not begin until any questions by York are resolved.</i></b>			Volatiles	Semi-Vols.	Pest/PCB/Herb	Metals	Misc. Org.	Full Lists	Miscellaneous Parameters			Special
8260 full	TICs	8270 or 625	8082PCB	RCRA8	TPH GRO	Pri. Poll.	Corrosivity	Nitrate	Color	<b>Instructions</b> Field Filtered <input type="checkbox"/> Lab to Filter <input type="checkbox"/>		
624	Site Spec.	STARS	8081Pest	PP13	TPH DRO	TCL Organics	Reactivity	Nitrite	Phenols			
STARS	SPLPorTCLP	BN Only	8151Herb	TAL	CT ETHP	TAL Met/CN	Ignitability	TKN	Cyanide-T			
BTEX	Benzene	Acids Only	CT RCP	CT15	NY 310-13	Full TCLP	Flash Point	Tot. Nitrogen	Cyanide-A			
MTBE	Nassau Co.	PAH	App. IX	Total	TPH 418.1	Full App. IX	Sieve Anal.	Ammonia-N	BOD5			
TCL list	Suffolk Co.	TAGM	Site Spec.	Dissolved	Air TO14A	Part 360-Routine	Heterotrophs	Chloride	CBOD5			
TAGM	Ketones	CT RCP	SPLPorTCLP	SPLPorTCLP	Air TO15	Part 360-Baseline	TOX	Phosphate	BOD28			
CT RCP	Oxygenates	TCL list	TCLP Pest	Indiv. Metals	Air STARS	Part 360-Expanded No Decons-Furans	BTU/lb.	Tot. Phos.	COD			
Arom.	TCLP list	TICs	TCLP Herb	Hg, Pb, As, Cd	Air VPH	Part 360-Expanded Full List	Aquatic Tox.	Oil&Grease	TSS			
Halogen	524.2	App. IX	Chlordane	Cr, Ni, Be, Fe,	Air TICs	NYCDEPsewer	TOC	F.O.G.	Total Solids			
App. IX	502.2	SPLPorTCLP	608 Pest	Se, Ti, Sb, Cu,	Methane	NYSDECsewer	Asbestos	pH	TDS			
8021B list	5035	TCLP BNA	608 PCB	Na, Mn, Ag, etc.	Helium	TAGM	Silica	MBAS	TPH - IR			

[illegible]

Comments	Preservation Check those Applicable	4°C _____ Frozen _____ HCl                      MeOH	4°C _____	4°C _____	HNO <sub>3</sub> _____ 4°C	4°C _____ H <sub>2</sub> SO <sub>4</sub> _____	4°C _____ Other	4°C _____ ZnAc	H <sub>2</sub> SO <sub>4</sub> _____ Ascorbic	NaOH _____ Other	Temperature on Receipt  _____ °C
	Samples Relinquished By _____		Date/Time _____		Samples Received By _____		Date/Time _____				
		Samples Relinquished By _____		Date/Time _____		Samples Received in <b>LAB</b> by _____		Date/Time _____			



ATTACHMENT C  
CONVENTIONAL LABORATORY QA/QC



120 Research Drive  
Stratford, CT 06615  
203-325-1371



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# Quality Manual

Laboratory Director:

Ben Gulizia

Quality Manager:

Teresa V. Weikel

Date of Issue:

April 12, 2013


Revision:

2.4



Controlled Copy #:

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	<b>Quality Manual</b> York Analytical Laboratories, Inc.	Issue Date: <b>Apr. 12, 2013</b>	Rev.: <b>2.4</b>

## Quality Manual

This Quality Manual meets the requirements of ISO 17025, ISO 9001 and NELAC. This Quality Manual is confidential and assigned as outlined below.

Issued to: \_\_\_\_\_


### Revision History

Revision 2.0	04/30/2010	First issue rewritten quality manual
Revision 2.1	11/13/2011	Updated Org Chart and Master List of Documents
Revision 2.2	06/29/2012	Updated Org Chart and Master List of Documents
Revision 2.3	12/26/2012	Added Data Integrity Plan, Reformatted document
Revision 2.4	04/12/2013	Added Aquatic Toxicity information

Controlled Copy in Canary Yellow only


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	<b>Quality Manual</b> York Analytical Laboratories, Inc.	Issue Date: <b>Apr. 12, 2013</b>	Rev.: <b>2.4</b>

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ATTACHMENT A – Laboratory Functional Organization Chart  
 ATTACHMENT B – Master List of Documents

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# 1. Introduction

## Purpose

This Quality Manual contains all the requirements that our laboratory uses to demonstrate our quality management system, technical competence, and valid results.

Analytical data are used for many purposes, including: compliance with regulatory requirements; determination for the presence, concentration, and movement of hazardous materials in the environment; potential effects upon or protection required for persons; and the actions necessary for disposal of treatment of hazardous materials.

Analytical data may be used to support a broader-based project involved with: site characterization and/or remediation; on-site treatment; treatment and/or disposal or health and safety protection of York personnel and the public. Data may also be produced for outside commercial testing and submitted directly to clients for their decision making. In all cases, data must be of known quality.

It is the purpose of the York Quality Assurance Program, as expressed in this Quality Systems Manual, to provide all data which are of known quality. To achieve this, a system is described which controls:


- Preservation of samples
- Receipt and handling of samples
- Processing and analyses of samples
- Analytical instrumentation
- Data verification
- Data reporting

Section 4 specifies how we demonstrate sound management and maintain client satisfaction.

Section 5 specifies how we demonstrate technical competence in our laboratory.

In addition, this Quality Manual outlines how York complies with:

- ISO 17025
- ISO 9001
- NELAC

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All personnel are to take an active role in establishing, implementing, and maintaining our quality management program. We do not separate quality from our daily business. Quality cannot be something that we do just to pass audits. Quality is integrated into every facet of the decision-making process in the management of our laboratory and the science that we practice.

## **Distribution List**

The Quality Assurance Officer (QAO) maintains the distribution list for this Quality Manual.

## **2. Scope**

This Quality Manual facilitates:

- Recognition of technical competence for standardized methods, non-routine methods, and laboratory-developed methods we perform
- Inspection and product certification capabilities and/or services we provide
- Total quality for our administrative and technical systems
- Audits by clients, regulatory authorities and accreditation bodies
- Meeting the requirements of NELAC, ISO 17025, and ISO 9001
- Client satisfaction

## **3. Normative References**

### **Reference List**


ISO/IEC 17000, Conformity assessment – Vocabulary and general principles

VIM, International vocabulary of basic and general terms in metrology, issued by BIPM, IEC, IFCC, ISO, IUPAC, IUPAP and OIML.

ISO 9001:2008 – Quality Management Systems – Requirements.

ISO 17025:2005 – General Requirements for the Competence of Testing and Calibration Laboratories.

NELAC 2003-Quality Systems

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## 4. Management Requirements

### 4.1 Organization

This section discusses general positions and quality-related responsibilities which provide for the implementation of the Quality Assurance Program and completion of quality control activities. Also discussed is the role of the York Quality Assurance Officer.

#### 4.1.1 Legal Identification / Registration


York Analytical Laboratories, Inc.  
120 Research Drive  
Stratford, Connecticut 06615  
203-325-1371  
Fax 203-357-0166  
E-mail: [ClientServices@yorklab.com](mailto:ClientServices@yorklab.com)

State of Connecticut Department of Health (CTDOH) License no. PH-0723  
New York State Department of Health (NYSDOH) ELAP/NELAP License no. 10854  
State of New Jersey Dept. of Environmental Protection (NJDEP) License no. CT-005  
State of Pennsylvania Registration No. 68-04440  
EPA ID NO. CT-005

#### 4.1.2 Laboratory Requirements

The departments of York Analytical Laboratories, Inc. have been organized to satisfy the needs of the Client and regulatory authorities and to meet the NELAC and international standards ISO 17025 and ISO 9001. York Analytical Laboratories, Inc. is comprised of the following Departments or Groups:

Laboratory Director's Office  
Quality Assurance Group  
Client Services/Sales Groups  
Sample Control Group

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Classical Chemistry Group  
 Organic Preparations Group  
 Atomic Spectroscopy Group  
 Gas Chromatography Group  
 Gas Chromatography/Mass Spectrometry Groups (Volatiles and Semi-Volatiles)  
 Aquatic Toxicity Group  
 Report production/Data Management Group

### 4.1.3 Scope of Management System

The management system covers activities in the laboratory's permanent facility at 120 Research Drive, Stratford, CT 06615. The fields of activities include:

Analysis of environmental samples (water, wastewater, soil, sludge, and air) for Federal and State regulated contaminants.

The laboratory's scope of tests is listed in the our specific licenses and encompasses volatile organics, semi-volatile organics, pesticides, herbicides, PCBs, metals, Aquatic Toxicity and various general chemistry parameters.

### 4.1.4 Potential Conflicts of Interest

York has no potential conflicts of interest since it is independently owned and operated and provides only environmental laboratory analysis services. The ownership of York does not have any other interest that would be considered a potential conflict of interest.

### 4.1.5 Organization

#### A) Management and Technical Personnel


**Policy:**

The laboratory managerial and technical personnel, irrespective of other responsibilities, have the necessary authority and resources needed to meet the mandates assigned to their areas.

**Details:**

Responsibilities are detailed in 4.1.5 (F).



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Departures from the organizational and management policies in this manual can only be approved by the Laboratory Director.

Departures from quality management system procedures can only be approved by the Quality Assurance Officer or the Laboratory Director.

Departures from test methods or technical standard operating procedures (SOPs) can only be approved by the Laboratory Director.

See also section 5.2.

## **B) Undue Pressure**


### **Policy:**

Management and personnel are to be free from any undue internal and external commercial, financial and other pressures that may adversely affect the quality of their work. The integrity of test results is the responsibility of all personnel. Management ensures that employees are never instructed or forced to alter or falsify data.

### **Details:**

The following list provides some guidelines on how employees avoid conflict of interest situations. Employees shall not:

- falsify records, prepare fraudulent reports, or make false claims
- seek or use privileged or confidential company information, or data from any Client, for any purpose beyond the scope of employment
- conduct non-laboratory business on laboratory time, or use company facilities or instrumentation to conduct outside interests in business, unless prior approval has been obtained
- solicit business on their own behalf (rather than the laboratory) from a Client
- be employed by, or affiliated with, organizations whose products or services compete with laboratory products or services
- have employment that negatively affects or interferes with their performance of laboratory duties
- compete with the laboratory in the purchase, sale, or leasing of property or goods
- allow association, family, or friends to influence business decisions to their benefit - decisions must be made on a strictly business basis, always in the best interest of the laboratory
- make any decision that provides gains or benefits to the employee and/or others
- have personal financial dealings with an individual or company that does business with the laboratory which might influence decisions made on the laboratory's behalf

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Firm adherence to this code of values forms the foundation of our credibility. Personnel involved in dishonest activities are subject to a range of disciplinary action including dismissal.

## **C) Client Confidentiality**

### **Policy:**

It is the policy of our laboratory to protect the confidential information and proprietary rights of our Client including the electronic storage and transmission of results.

### **Details and Procedures:**

All employees sign an Employee Confidentiality Agreement. The signed agreement is retained in each employee's Human Resources file.

Test results are only released to the Client. Release to someone other than the Client requires the express permission of the Client, except when the situation contravenes State or Federal Legislation and the results must be provided to the appropriate agency. The release of test results to anyone other than the Client requires the permission of the Client and management. Laboratory reports are reviewed for accuracy and completeness prior to release.


## **D) Operational Integrity**

### **Policy:**

The laboratory will avoid involvement in any activities that would diminish confidence in its competence, impartiality, judgment, or operational integrity.

### **Details and Procedures:**

To ensure confidence in laboratory operations a formal quality assurance program is implemented. Technical competence is ensured through check sample programs. Impartiality is assessed through audits and approvals. Judgment is ensured through the hiring of qualified personnel and by continuously refining, upgrading, and improving his or her skills. Operational integrity is reviewed by management on a regular basis at management review meetings to ensure continued suitability and effectiveness of laboratory policies and procedures. Any problems are acted on immediately through corrective action procedures.

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## **E) Organizational Structure**

### **Policy:**

The organization and management structure of the laboratory and the relationships between management, technical operations, support services, and the quality management system is defined through the aid of an organizational chart.

### **Details:**

Senior management keeps the most current organizational chart on file. An organizational chart is available with this manual as a reference record-ATTACHMENT A and is considered the official record on the date it is marked in the lower right corner.


## **F) Responsibility and Authority**

### **Laboratory Director**

- develops primary goals, operating plans, policies, and short and long range objectives for the laboratory; implements these following Board of Directors' approval
- directs and coordinates activities to achieve profit and return on capital
- establishes organizational structure and delegates authority to subordinates
- leads the laboratory towards objectives, meets with and advises other executives, and reviews results of business operations
- determines action plans to meet the needs of stakeholders
- represents organization to major Clients, government agencies, shareholders, and the public
- is knowledgeable of the scope of all processes under supervision
- provides the necessary resources (personnel, instrumentation, supplies) for the quality assurance program, in order to ensure confidence in the laboratory's results
- ensures instrumentation is maintained and calibrated, reporting all deficiencies (e.g., instrumentation malfunctions) in the appropriate manner
- ensures personnel are trained for the duties they perform - includes substitutes when regular personnel are absent
- maintains current job descriptions
- maintains records and manages all aspects of testing activities

### **Quality Assurance Officer (QAO)**

- ensures that the Quality Management System is established, implemented and maintained in accordance with the ISO 9001, ISO 17025 and NELAC standards
- manages the internal audit program
- coordinates laboratory accreditation activities
- handles the maintenance and distribution of the Quality Manual and associated documents

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- maintains a master list of current versions of quality documentation
- trains personnel on Quality Management System activities
- monitors the Quality Management System
- reports on the performance of the Quality Management System to senior management for review and as a basis for improvement of the Quality Management System
- supervises the laboratory's double-blind proficiency testing program

#### **Group Leaders**


- responds to York Client Services Group inquiries and provides professional advice
- hires personnel
- orientates new personnel
- determines technical training needs of personnel
- conducts employee performance reviews
- schedules vacation and coverage
- ensures that all health and safety regulations are followed
- ensures that all Human Rights Legislation are complied with
- prioritizes workload
- facilitates operational concerns in their area
- ensures accurate and consistent testing procedures through the validation of all current procedures and by developing, validating and implementing new procedures
- coordinates purchasing requests
- ensures that the operational needs are within budget and advising management of any discrepancies

#### **Analysts and Technicians**

- maintains records of all quality activities as documented in SOPs and test methods
- handles samples and performing analyses according to SOPs and test methods
- provide input and assists in preparation of SOPs and test methods
- maintain and calibrate instrumentation and instrumentation
- reports deficiencies or malfunctions to the Group Leader
- identifies and records nonconformities on *Corrective Action Reports*
- identifies and recording potential nonconformities on *Preventive Action Requests*
- corrects nonconformities and potential nonconformities
- improves laboratory and/or quality activities on a continuous basis

#### **Client Services Managers**

- provides vision and direction for analysis activities
- Responds to Clients' and provides professional advice
- develops and reviews proposals/Quotations
- Reviews Quality Assurance Project Plans for Clients
- monitors the progress of Work-in-Process

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- reviews reports for selected Clients
- oversees, standard pricing, customized quotations, and invoicing for tests performed
- controls the flow of communication between the Client and the laboratory

#### **Administrative/Data Management Personnel**

- performs work functions and keeps records as per approved SOPs and/or laboratory policies
- generate final reports, invoices and data packages for transmittal to Clients
- assist in preparation of SOPs
- identifies and records nonconformities on *Corrective Action Reports*
- identifies and records potential nonconformities on *Preventive Action Requests*
- corrects nonconformities and potential nonconformities
- improves laboratory and/or quality activities on a continuous basis

### **G) Laboratory Supervision**

#### **Policy:**

Adequate supervision is provided in each area of the laboratory for all testing and calibration personnel, including trainees, by persons familiar with the methods and procedures.

#### **Details:**

Adequate supervision is ensured through designated supervisors as well as through documentation such as this Quality Manual, test methods and SOPs. A thorough orientation and training program is adhered to for all new employees. Ongoing training for regular personnel is required.


### **H) Technical Management**

#### **Policy:**

A Group Leader is assigned to each major technical department of the laboratory. They have overall responsibility for the technical operations and the provision of resources needed to ensure the required quality and production of laboratory operations.

#### **Details:**

While the Group Leader may at times delegate duties to other personnel, the Group Leader is accountable for any nonconforming activities.

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## **I) Quality Assurance Officer**

### **Policy:**

The Quality Assurance Officer is appointed by the highest level of management. The Quality Assurance Officer, who, irrespective of other duties and responsibilities, has defined responsibility and authority for ensuring that the management system related to quality is implemented and followed. The Quality Assurance Officer has direct access to the highest level of management where decisions are taken on laboratory policy or resources.

### **Details:**

This statement notifies all laboratory personnel that Teresa Weikel is the Quality Assurance Officer as authorized by the Laboratory Director. Any change in this position requires the reissue of this section to all holders of controlled copies of the Quality Manual. The following signature also serves as approval for this Quality Manual and affirms senior management's commitment to the policies and procedures set forth in this manual.

## **J) Managerial Substitutions**

### **Policy:**

Deputies for key personnel are appointed to fulfill the key personnel's duties in their absence.

### **Details:**


In the absence of the Quality Assurance Officer, the Laboratory Director will assume his/her responsibilities.

In the absence of the Group Leader, the Laboratory Director or other Group Leader will assume his/her responsibilities.

Management is responsible for ensuring that current and/or increased workload requirements are met. This includes making adjustments as a result of employee absence. Only fully trained employees are utilized to fulfill the duties of personnel who are absent. If sufficient human resources are not available, management will identify the best possible solution to meet operational requirements.

## **K) Awareness**

### **Policy:**

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Management ensures that its personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of the objectives of the management system.

**Details:**

Supervisors review the details of each employee's job description with the appropriate employee and how the overall Quality Policy Statement (Section 4.2.2) relates to their activities to achieve the objectives of the management system.


## 4.1.6 Communication Processes

**Policy and Details:**

Top management ensures that appropriate communication processes are established within the laboratory and that communication takes place regarding the effectiveness of the management system.

## Revision History

Revision 2.0	04/30/2010	First Issue of Rewritten Quality Manual
Revision 2.1	11/14/2011	Changed QA Officer name to Teresa Weikel

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## 4.2 Management System

### 4.2.1 Policies and Procedures

#### **Policy:**

The Quality Management System is established, implemented, and maintained by management. It is applicable to all the fields of testing and activities in which the laboratory is involved and undertakes. All policies, systems, programs, procedures and instructions are documented to the extent necessary to enable the laboratory to assure the quality of results generated. These documents are communicated to, understood by, available to, and implemented by the appropriate personnel.

#### **Details:**

The purpose of our Quality Management System is to ensure that all services and products satisfy the Client's requirements and have been designed, manufactured, and delivered under controlled conditions.


The effectiveness of the Quality Management System is assessed in several ways:

- by a program of planned internal audits, covering all aspects of the operation of the quality management system
- by regular management reviews of the suitability and effectiveness of the quality management system
- by analysis of potential and actual problems as shown by Client complaints and supplier and subcontractor assessments
- by other methods approved from time to time by the Laboratory Director

This Quality Manual and associated documents (including procedures) and records serves as the quality plan for the laboratory. Other documents and records include:

- standard operating procedures
- quality control plans in test methods
- organizational charts
- proposals and Quality Assurance Project Plans (QAPP)
- project management schemes



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## 4.2.2 Quality Policy Statement

### Policy:

The policies and objectives for laboratory operations are documented in this Quality Manual. The overall objectives are set out in the Quality Policy Statement and reviewed during management review. The Quality Policy Statement is issued under the authority of the Laboratory Director on the effective date.

### Quality Policy Statement:

To ensure accurate and timely environmental laboratory analysis services and to continuously meet or exceed the stated or implied expectations of our Clients through day-to-day interactions.

Effective Date: April 30, 2010

a) *Management commitment to good professional practice and quality of services provided to the Client:* analyses and calibrations are always carried out in accordance with stated standardized methods and Clients' requirements. Requests to perform tests that may jeopardize an objective result or have a low validity are rejected.

b) *Standards of service include:*

- Client Satisfaction
- Quality
- Timeliness

Excellence in the workplace is promoted by providing all employees with the knowledge, training, and tools necessary to allow for the completion of accurate and timely work.


c) *Purpose of management system related to quality:* to manage our business by meeting the needs of our Clients.

d) *Personnel:* familiarize themselves with quality documentation and implement the policies and procedures in their work.

e) *Management is committed to complying with NELAC, ISO 17025 and ISO 9001 international standards and to continually improve the effectiveness of the management system:* the objective of this Quality Manual is to document the compliant policies and associated procedures that are integrated into our daily activities. Continual improvements are established, implemented, and integrated into the management system.

Additional objectives include:

- to establish the level of the laboratory's performance

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- to make test method changes to improve performance
- to participate in proficiency testing or quality evaluation programs with peer laboratories
- to ensure that all personnel are trained to a level of familiarity with the quality management system appropriate to the individual's degree of responsibility
- to improve and validate laboratory methodologies by participation in method validation collaborative tests
- to establish and report on quality savings

### 4.2.3 Commitment to the Management System

**Policy:**

Top management is committed to the development and implementation of the management system and continually improving its effectiveness.

**Details:**

The results of the management system are regularly reviewed during management review (see Section 4.15) and continual improvements are made as outlined in Section 4.10 – Improvements.

### 4.2.4 Communication of Requirements

**Policy:**

Top management communicates to the organization the importance of meeting Client requirements as well as statutory and regulatory requirements.


**Details:**

In general, the underlying message in all oral and written management communications involves meeting the aforementioned requirements. Meeting Client requirements ensures that ongoing business relationships secure the contracts that keep everyone employed. Meeting statutory and regulatory requirements ensures that laboratory operations will not be disrupted and the organization can continue to meet Client needs.

### 4.2.5 Quality Manual

**Policy:**

This Quality Manual outlines the structure of the documentation used in the quality management system. This Quality Manual makes reference to supporting procedures including technical procedures and is maintained up to date.

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#### **Details:**

This quality management system is structured in three tiers of documentation. The tiers are as follows:


1. Quality Manual
2. Standard Operating Procedures and Test Methods
3. Records

For most Clients, this Quality Manual and the associated documents form a general Quality Plan. If necessary, specific Quality Assurance Project Plans (QAPP) will be prepared on a 'per-Client' basis. These QAPPs will modify the general requirements stated in the Manual and associated documents.

All of the above documents are controlled documents in yellow only.

The following records and directive documents are referenced in the Quality Manual, but maintained separately:

- organizational chart (section 4.1.5.E)
- copies of the Quality Policy Statement posted in the laboratory (section 4.2.2)
- identification of resources and management review (section 4.15.1)
- job descriptions (section 5.2.4)
- statistical techniques (section 5.9)
- test reports (section 4.13.2 and 5.10)
- identification of the laboratory's approved signatures (section 5.10.2)
- laboratory's scope of tests (section 4.1.3)
- instrumentation inventory and records (sections 5.5.4 and 5.5.5)
- calibration status indicators (section 5.5.8)
- reference standards inventory (section 5.6.3)
- verification records (section 5.9)
- quality control plan / criteria for workmanship (section 5.4.1)
- corrective action records (section 4.11)
- preventive action records (section 4.12)
- client complaint records (section 4.8.1)
- audit schedule and records (section 4.14.3)
- procurement and subcontracting records (sections 4.6 and 4.5.4)
- training records (section 5.2.5)
- master list of documentation (section 4.3.2)
- confidentiality agreements (section 4.1.5 C)
- contract review (section 4.4.2)
- validation of test methods (section 5.4.5)
- facility floor plan (section 5.3.1)

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## 4.2.6 Technical Management and the Quality Assurance Officer

The roles and responsibilities for technical management (Group Leaders) and the Quality Assurance Officer are outlined in section 4.1.5 (F) of this manual.

Technical management (Group Leaders) ensures that section 5 of this manual is implemented and maintained. The Quality Assurance Officer ensures that section 4 of this manual is implemented and maintained.


## 4.2.7 Maintenance

### Policy and Details:

Top management ensures that the integrity of the management system is maintained when changes to the management system are planned and implemented.

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## 4.3 Document Control

### 4.3.1 Policies and Procedures

#### Policy:

The SOP# ADMINDOC043010 is used to control all quality management system documents. These may include documents of external origin, such as regulations, standards, other normative documents, test and/or calibration methods, as well as drawings, specifications, instructions, and manuals.

#### Details:

Document means any information or instructions including policy statements, procedures, specifications, calibration tables, charts, text books, posters, notices, memoranda, software, drawings, and plans. These may be in various media, whether hard copy or electronic and they may be digital, analog, photographic or written.

The documents to be controlled include:

- Quality Manual
- Standard Operating Procedures
- Forms
- Standards


The control of data related to testing and calibration is covered in section 5.4.7. The control of records is covered in section 4.13.

### 4.3.2 Document Approval and Issue

#### 4.3.2.1 Review / Approval / Master List

##### Policy and Details:

All documents issued to personnel in the laboratory as part of the quality management system are reviewed and approved for use by authorized personnel prior to issue (i.e., reviewed by personnel knowledgeable in the documented activity and then approved by management). A master list identifying the current revision status and distribution of documents in the quality management system is readily available in order to preclude the use of invalid and/or obsolete documents (see SOP# ADMINDOC043010). A revision history of documents is also maintained. Documents are formally reviewed on a biennial basis to ensure their continuing suitability. APPENDIX B contains a current Master List of Documents.

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#### 4.3.2.2 Availability and Obsolete Documents

##### Policy and Details:

The master list includes all current controlled documents. The master list document is organized with the following information:

- Description
- SOP Number
- Date of Issue (effective date of each procedure)
- Revision Number
- Date of Revision (effective date of each current revision)

Controlled documents are approved before issue.

The SOP# ADMINDOC043010 for document control ensures that:

- authorized editions of appropriate documents are available at all locations where operations essential to the effective functioning of the laboratory are performed
- documents are periodically reviewed and where necessary revised to ensure continuing suitability and compliance with applicable requirements
- invalid or obsolete documents are promptly removed from all points of issue or use to assure against unintended use
- obsolete documents retained for either legal or knowledge preservation purposes are suitably marked (i.e., stamped "OBSOLETE" and dated)

#### 4.3.2.3 Identification

##### Policy and Details:

All quality management system documentation is identified by:


- date of issue and/or revision number
- page numbering
- total number of pages (e.g., page 5 of 5)
- issuing authority (i.e., approval signature)

### 4.3.3 Document Changes

#### 4.3.3.1 Review / Approval

##### Policy:

Changes to documents are reviewed and approved by the same function (i.e., personnel or position) that performed the original review unless specifically designated otherwise.

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**Details:**

Developments in policies and procedures require documents to be changed from time to time. Changes to documents receive the same level of review and approval as the originals.

The Quality Manual is reviewed annually by the Quality Assurance Officer. Records are kept of this review.

Test methods and SOPs are reviewed on a biennial basis. Procedures for this are outlined in SOP# ADMINDOC043010.

Obsolete documents are withdrawn, but are retained for archive purposes and clearly labeled as obsolete.

#### **4.3.3.2 Identification of Changes**

**Policy:**

The nature of document changes is identified in the document.

**Details:**

As outlined in SOP# ADMINDOC043010.

In general, the nature of changes is described in the document. Revision history is recorded at the end of the document.

#### **4.3.3.3 Amendments by Hand**

**Policy and Details:**

Hand-written amendments are clearly marked, initialed, and dated by the Laboratory Director and/or the QA/QC Officer on all controlled yellow copies.


#### **4.3.3.4 Computerized Documents**

**Policy and Details:**

The SOP# ADMINDOC043010 details how changes in documents maintained in computerized systems are made and controlled.

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Revision 2.1	06/29/2012	Modified Master List information, and hand amendments

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## 4.4 Review of Requests and Contracts

### 4.4.1 Policies and Procedures

#### **Policy:**

The SOP AMINCONTRACT043010 is used to review requests or contracts. This procedure ensures that:

- a) the Client requirements including the methods to be used are adequately defined, documented and understood (see section 5.4.2)
- b) the laboratory has the licensing, capability and resources to meet the requirements
- c) the appropriate testing method is selected and capable of meeting the Client's requirements or data quality objectives (see section 5.4.2)

Any differences between the request and the contract are resolved before any work commences. Each contract must be acceptable by both the laboratory and the Client.

#### **Details:**

The request and contract review is conducted in a practical and efficient manner, and the effect of financial, legal, and time schedule aspects are taken into account.

The review of capability establishes that the laboratory possesses the necessary physical, personnel, and information resources, and that the laboratory's personnel have the skills and expertise necessary for the performance of the tests in question. The review may also encompass results of earlier participation in inter-laboratory comparisons or proficiency testing and/or the running of trial test using samples or items of known value in order to determine uncertainties of measurement, limits of detection, and confidence limits.


The contract review ensures that each Client's requirements are adequately defined and documented before the service or product is ordered or dispatched. This should ensure that any order, once accepted, can be completed without delay, and that the Client's requirements including delivery date, technical specification, and cost can be met.

If the contract review highlights any ambiguities or uncertainties then the Client will be contacted and the problem resolved before the order is accepted.

The SOP AMINCONTRACT043010 also describes the activities that take place should there be a subsequent amendment to a Client's order.

Typical types of contracts include:



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- approved service quotations
- confidentiality agreements
- non-disclosure agreements
- sample submission requests
- memorandum of agreement
- memorandum of understanding
- research proposals and contracts
- verbal orders (oral agreements)
- activity plans

## 4.4.2 Records of Review

### Policy:

Records of request and contract review, including significant changes, are maintained. Records of pertinent discussions with a Client relating to the Client's requirements or the work during the period of execution of the contract are also maintained.

### Details:

For review of routine and other simple tasks, the date and the identification (e.g., initials) of the person in the laboratory responsible for carrying out the contracted work are considered adequate. For repetitive routine tasks, the review need be made only at the initial enquiry stage or on grant of the contract for on-going routine work performed under a general agreement with the Client, provided that the Client's requirements remain unchanged. For new, complex or advanced testing tasks, a more comprehensive record is maintained.

## 4.4.3 Review of Subcontracted Work

### Policy:

Request and contract review also includes work that is subcontracted by the laboratory.


### Details:

Subcontractor laboratories are reviewed as described in section 4.5.

## 4.4.4 Notification of Client

### Policy and Details:

Clients are informed of deviations from the contract. This is typically communicated to the Client prior to the performing the deviation.

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## 4.4.5 Contract Amendment

### Policy and Details:

If a contract needs to be amended after the work has commenced, the same contract review process is repeated and any amendments are communicated to all affected personnel.

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## 4.5 Subcontracting of Analyses and Calibrations

### 4.5.1 Subcontractor Competence

#### Policy:

Work that must be subcontracted due to:

- unforeseen circumstances
- workload
- large contracts
- contracts requiring some extra technical expertise
- Tests not performed in-house

is subcontracted to a technically competent laboratory.

#### Details:

The subcontracted laboratory demonstrates technical competence by possession or receipt of one or more of the following:


- recognized technical accreditation- NYSDOH NELAC or other NELAC accreditation body
- registration under the ISO 9001 standard
- satisfactory performance of appropriate quality control check samples, certified reference material, in-house reference material or replicate analysis
- Review of the subcontractor's quality management system by our QA Officer

It is the responsibility of the Quality Assurance Officer to assess and approve the competence level of subcontractor laboratories.

### 4.5.2 Client Approval

#### Policy:

Clients are advised of work (or any portion thereof) that is being subcontracted to another laboratory and their approval is obtained (preferably in writing). Upon log-in at the lab, a Subcontract Notification Form is generated by Sample Control and e-mailed immediately to the Client.

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**Details:**

Clients are advised of subcontracted work through fee schedules or any type of contract listed in section 4.4.1.

### 4.5.3 Assurance of Subcontractor Competence

**Policy:**

The laboratory is responsible to the Client for the subcontractor's work. Technical competence of subcontractor laboratories is demonstrated through various records.

**Note** – there may be circumstances where the Client specifies which subcontractor is to be used. In such cases we may not be able to demonstrate the competence of the subcontractor and therefore are not responsible for the results.

**Details:**

Records of subcontractor competence may include, but are not limited to, the following:

- accreditation certificates or documentation
- registration certificates
- check sample results
- audit results
- approval by the Quality Assurance Officer

### 4.5.4 Subcontractor Register

**Policy:**


A register of all subcontractors performing tests is maintained.

**Details:**

The approved register of subcontractors and all relevant records are maintained by the Quality Assurance Officer.

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## 4.6 Purchasing Services and Supplies

### 4.6.1 Policies and Procedures

**Policy:**

The SOP ADMINPURCHASESING043010 is used to select and purchase services and supplies. The SOP ADMINPURCHASESING043010 is used for procurement, reception, and storage of supplies.

**Details:**

Consumable materials are stored according to the appropriate test method, SOP, or work instruction.

### 4.6.2 Specifications

**Policy:**

Only services and supplies of the required quality are used. These quality requirements are detailed in laboratory SOPs under the “*Materials Required*” section and will identify the appropriate minimum specifications when necessary.


**Details:**

Packing slips are checked against package content labels and matched with the Purchase Order if accepted. Once accepted, the packing slip is dated and initialed as evidence of compliance. Certificates of analysis (COA) are maintained on file after the COA is checked to ensure the received item meets minimum specifications.

Chemicals are purchased with manufacturer’s certificates where possible. Uncertified chemicals are purchased from ISO 9000 registered companies. Whatever the source, the laboratory verifies the quality of the standards by comparing the new batch of standards to the old. Due regard is paid to the manufacturer’s recommendations on storage and shelf life.

Reagents are generally purchased from manufacturers who have a quality management system based on ISO 9000. The grade of any reagent used (including water) is stated in the method together with guidance on any particular precautions to be observed in its preparation or use.

Where no independent assurance of the quality of procured goods or services is available or the supplier’s evidence is insufficient the laboratory ensures that purchased goods and services comply with specified requirements. Where possible and practical the laboratory

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ensures that goods are inspected, calibrated, or are otherwise in compliance with any standard specification relevant to the calibrations or tests concerned.

### 4.6.3 Purchasing Documents

**Policy:**

Purchasing requests are recorded on the Purchase Order form and contain data describing the product ordered. The Purchase Order is reviewed and approved for technical content prior to release.

**Details:**

The description may include type, class, grade, precise identification, specifications, drawings, inspection instructions, other technical data including approval of test results, quality required and quality management system standard under which they were produced.

The completion of the Purchase Order is the responsibility of the originator.

### 4.6.4 Approved Suppliers

**Policy:**

Suppliers of critical services are evaluated and approved before use. An approved supplier list is maintained.

**Details:**


Audits or tender evaluation is conducted to qualify suppliers of critical services prior to use. The criteria for evaluation may include, but is not limited to the following:

- references
- accreditation
- formal recognition

The records are maintained by purchasing personnel. SOPs detail the acceptable vendors for all materials.

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## 4.7 Service to the Client

### 4.7.1 Service

#### **Policy:**

Client requests are clarified for the Clients or their representatives. Furthermore the Client or their representative will be afforded the right to monitor the performance of the laboratory in relation to the work performed, provided that the laboratory ensures confidentiality to other Clients.

#### **Details and Procedures:**

Service to the Client includes:

- Affording the Client or the Client's representative reasonable access to relevant areas of the laboratory for the witnessing of work performed for the Client; it is understood that such access should not conflict with rules of confidentiality of work for other Clients or with safety.
- Preparing, packaging, and dispatching of test data needed by the Client for verification purposes.
- Maintaining of open contacts. The Client values advice and guidance in technical matters, and opinions and interpretations based on results. Contact with the Client, especially in large assignments, should be maintained throughout the work by Client Services personnel. The laboratory should inform the Client of any delays or major deviations or issues encountered during the performance of the tests.


### 4.7.2 Feedback

#### **Policy and Details:**

The laboratory seeks feedback from the Client. Positive and negative feedback can be obtained passively through ongoing communications with the Client (e.g., review of test reports with Clients) or actively through Client satisfaction surveys. The feedback is used to improve the quality management system, testing activities, and Client service.

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## 4.8 Complaints

### 4.8.1 Policies and Procedures

**Policy:**

The SOP ADMINCOMPLAINTS 04302010 is used for resolving complaints received from Clients or other parties. Records are maintained of all complaints and follow-up.

**Details:**

Records of complaints include the following information:

- details of the complaint
- investigation
- corrective action
- follow-up verification


See also section 4.11.

All personnel are responsible for recording and responding to complaints.

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## 4.9 Control of Nonconforming Analyses

### 4.9.1 Procedures to Control Nonconforming Work

**Policy:**

The SOP ADMINNONCONFORM 04302010 is used to control any aspect of testing, or the results of this work, when they do not conform with the test methods, SOPs or the agreed to requirements of the Client.

**Details:**

The procedure ensures that:

- Responsibilities and authorities for the management of nonconforming work are designated and actions (including halting of work and withholding of test reports as necessary) are defined and taken into consideration when nonconforming work is identified
- an evaluation of the significance of the nonconforming work is made
- correction is taken immediately, together with any decision about the acceptability of the nonconforming work
- where necessary, the Client is notified and the work is recalled
- the responsibility for authorizing the resumption of work is defined


Identification of nonconforming work or problems with the quality management system or with testing activities can occur at various locations within the quality management system and technical operations such as:

- Client complaints
- quality control
- instrument calibration
- checking of consumable materials
- staff observations or supervision
- test report review
- management reviews
- internal or external audits

### 4.9.2 Root Cause Analysis

**Policy:**

Where evaluation indicates that nonconforming work could recur or that there is doubt about the compliance of the laboratory's operations with its own policies and procedures, the corrective action procedures given in 4.11 are followed to identify the root cause(s) of the problem and to eliminate cause(s).

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**Details:**


The SOP ADMINCORRACTION043010 outlines the recording of the root cause analysis for investigating nonconforming work.

Situations warranting corrective action investigation include:

- failure to comply with test method including all applicable procedures necessary to ensure the integrity and representative nature of the sample
- presentation of uncertain knowledge as to compliance with test methods including all applicable procedures necessary to ensure the integrity and representative nature of the sample
- failure or suspected failure in method performance as demonstrated by results provided by quality control samples
- lack of relevant evidence provided by quality audit, proficiency testing, or Client feedback
- lack of relevant evidence provided by data validation
- neglect to check the inherent property of the sample that compromises the testing

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## 4.10 Improvements

### 4.10.1 Policies and Procedures

#### **Policy:**

The laboratory continually improves the effectiveness of its management system through the use of the quality policy, quality objectives, audit results, analysis of data, corrective actions, and management review.

#### **Details:**

The laboratory has implemented a continual improvement philosophy within the management system. Every employee in the laboratory is encouraged to suggest new ideas for improving services, processes, systems, productivity, and the working environment.

Opportunities for improvement of operations and processes are identified by managers on a continual basis from ongoing feedback on operations and through management reviews. Opportunities for improvement of services are identified by anyone within the organization including Sales, Marketing and Client Services.


Inputs for improvement opportunities are obtained from the following sources:

- Client satisfaction surveys and any other Client feedback
- market research and analysis
- employees, suppliers, and other interested parties
- internal and external audits of the management system
- records of service nonconformities
- data from process and service characteristics and their trends

Opportunities for improvement may also be identified on a special project basis. The following are listed only as examples:

- improving usefulness of bench space
- reducing excessive inspection/analysis
- reducing excessive handling and storage
- reducing test/calibration failures

Opportunities for improvement from daily feedback on operational performance (i.e., internal audits, Client feedback, test/calibration failures) are evaluated by the Laboratory Director or Quality Assurance Officer. Typically, they are implemented through the corrective and preventive action system.


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Opportunities for improvement from analysis of longer-term data and trends are evaluated and implemented through the management review process. They are prioritized with respect to their relevance for achieving quality objectives. When opportunities for improvement are no longer supported by the current policy and objectives, management will establish new quality objectives, and possibly change the policy. The process for this evaluation is described in Section 4.15. Longer-term improvement projects are initiated through the management review process, as well as the corrective and preventive action system.

Service improvement opportunities are evaluated by management. They are implemented through the supervisor of the laboratory who ensures that the improvements are validated as outlined in Section 5.4 of this manual and appropriate level of quality control is performed on an ongoing basis.

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## 4.11 Corrective Action

### 4.11.1 General

**Policy:**

The SOP ADMINCORRACTION043010 is utilized for implementing corrective action when nonconforming work or departures from policies and procedures in the quality management system or technical operations have been identified. The procedure requires that appropriate authority be designated for the implementation of corrective actions. The procedure includes cause analysis, selection and implementation of corrective action, and monitoring of actions.

**Details:**

Problems with the quality management system or technical operations of the laboratory may be identified through a variety of activities, such as control of nonconforming work, internal or external audits, management reviews, feed-back from Clients, or staff observations.

Corrective action investigations are documented and required changes to operational procedures are implemented. The corrective action request (CAR), investigation and resolution are recorded on a CAR form.

### 4.11.2 Cause Analysis

**Policy:**

Corrective action always begins with an investigation to determine root cause(s) of the problem (see SOP ADMINCORRACTION043010).


**Details:**

Potential causes of the problem could include Client requirements, the samples, sample specifications, methods and procedures, personnel skills and training, consumable materials, or instrumentation and its calibration.

### 4.11.3 Selection and Implementation of Corrective Actions

**Policy and Details:**

After determining the cause(s) of the problem, potential corrective actions are identified. The most likely action(s) (this includes practical and/or reasonable) are selected and implemented to eliminate the problem and to prevent recurrence. It should be noted that any corrective actions taken to eliminate the cause(s) of nonconformities or other

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departures are to a degree appropriate to address the magnitude of the problem and commensurate with the risks encountered (Note – in plain language, this means determine whether the benefit outweighs the cost). Controls are applied to prevent recurrence. The laboratory documents and implements the required changes resulting from corrective action investigations.

#### 4.11.4 Monitoring of Corrective Action

**Policy:**

After implementing the corrective action(s), the laboratory monitors the results to ensure that the actions taken have been effective in overcoming the problems originally identified.

**Details:**

Monitoring is assigned to an appropriate individual such as the originator of the CAR or the originator's manager. Changes resulting from corrective action are documented.

#### 4.11.5 Additional Audits

**Policy:**


Where the identification of nonconformities or departures casts doubts on compliance of policies, procedures, regulations, international quality standards, the appropriate areas of activity are promptly audited in accordance with section 4.14.

**Details:**

Special audits follow the implementation of corrective actions to confirm their effectiveness. A special audit is only necessary when a serious issue or risk to the business is identified. Special audits are carried out by trained and qualified personnel who are [\[whenever resources permit\]](#) independent of the activity to be audited. See section 4.14 for more details.

### Revision History

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## 4.12 Preventive Action

### 4.12.1 Preventive Action Identification

**Policy:**

Opportunities for needed improvement and potential sources of nonconformities, either technical or with the quality management system shall be identified. If action is required, action plans are developed, implemented and monitored, to reduce the likelihood of occurrence of such nonconformities and to take advantage of the improvement opportunities.

**Details:**

Records of preventive action include the following information:

- details of potential nonconformities
- investigation
- preventive action
- follow-up verification

These records are maintained in the Preventive Action Request (PAR) form/binder.

### 4.12.2 Preventive Action Plans

**Policy:**

The preventive action procedure includes the initiation of such actions and application of controls to ensure that they are effective.


**Details:**

Preventive action may result from the review of operational procedures and analysis of data. Analysis of data includes trend analysis, analysis of proficiency testing results, and risk analysis.

The SOP ADMINPREVACTION043010 is utilized to implement opportunities for needed improvement and prevent potential sources of nonconformities.

## Revision History

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## 4.13 Control of Records

The York Quality Assurance Program has been developed to provide analytical results of known quality. To demonstrate that quality has been achieved, York maintains a record management system that includes documents pertinent to the analytical performance of the laboratory. Laboratory records are maintained in two broad categories.

- Documents which are specific to a project or a group of samples within an ongoing project, such as chain-of-custody, and raw analytical data.
- Documents which demonstrate overall laboratory operation, such as instrument log books and control charts. These records will directly affect the data for a specific project, but in general their applicability is not limited to one project.

This procedure addresses identification, collection, indexing, access, file, store, maintain, protect, backup, and disposal of quality and technical records. To outline procedures for the protection and backup of data/records held on computers.

### 4.13.1 General

This procedure applies to all quality and technical records. Quality records include audit reports, management review, corrective action requests, and preventive action requests. Technical records include observations, calculations, derived data, calibration records, personnel records, and test reports.

#### 4.13.1.1 Procedures

**Policy:**


The SOP ADMINRECORDS043010 is used to identify, collect, index, access, file, store, maintain, protect, backup, and dispose quality and technical records. Quality records include reports from internal audits and management reviews as well as corrective and preventive action records.

**Details:**

Records are available to demonstrate conformance to requirements and effective operation of the Quality Management System. Quality records from suppliers are also controlled.

All records, (electronic and hard copy) including test reports, are safely stored and held secure in locked areas, and in confidence to the Client. Records are maintained in the designated archival area for **five (5)** years.



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#### 4.13.1.2 PROJECT RECORDS

Separate files are maintained for each project. Filing of records for a specific project shall be by the unique project identification number assigned by the laboratory for that project. Within a project file, categories of information are filed separately. Upon completion of all projects (SDGs), the file contents are scanned to an unalterable image file (.pdf) and archived removable hard disk media. Such media are held for a period of 5 years. Paper copy is maintained for three months after data submission. Following is a brief discussion of each item that is maintained for each project file.

##### A - Correspondence

All correspondence pertinent to the analytical program shall be maintained. This includes letters to and from clients and internal memorandums. Correspondence should be filed chronologically.

##### B - Chain-of-Custody

Chain-of-custody records shall be maintained by the laboratory. The chain-of-custody forms should be filed for samples as received and should be placed in the project file immediately after they are signed by Sample Control personnel.

##### C - Request for Analysis


Analysis requests provided by the field personnel are maintained in this file. Also, any changes or additions to the analytical program should be documented in this file.

##### D - Calibration Records

In general, calibration records are maintained with laboratory operation records. However, if an analytical program requires a calibration which is performed solely for a project, the records shall be maintained in this file. If calibration is performed as an integral part of the analytical process, the calibration records should be maintained with the analytical data.

##### E - Analytical Data

Analytical data files should be complete for a group of samples. The file should contain raw analytical data, processing of the data and/or data reduction, and any data validation. It should be possible to use data files to completely demonstrate that the data have been adequately obtained, processed, and reviewed.

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#### G - Quality Control Samples

If quality control samples, such as field blanks, are processed for a specific project, the data shall be maintained with the project file. The results of quality control samples processed on a general basis are included in the laboratory operations files. Statistical evaluation of quality control sample data for a project shall also be maintained in this file.

If quality control samples are processed as an integral part of a group of samples such that the data cannot be readily separated, the quality control sample data can be stored with the analytical data.

#### H - Data Reports

Complete copies of all reports issued by the laboratory are accessible on the Network and are not stored with the project files.

#### I - Project-Specific Requirements

If a project requires analytical procedures other than what is adopted in the York Quality Assurance Program, the requirements shall be included in this file. Specific requirements may be due to government regulations, specific contracts, or project need. Changes from stated practice can be, for example, frequency of QC sample analysis, test method, statistical data evaluation, and reporting format.


If it is necessary to adopt a new analytical procedure, a procedure different than conventionally used, or alter an existing procedure, the method used for the project must be documented. If the analytical procedure is developed by York as part of the analytical program, the procedure shall be documented and included. If an existing procedure is altered, the Analyst or Group Leader shall prepare a memorandum to the project file stating what the changes were and the justification for change.

#### J - Nonconformance

Nonconformances and subsequent corrective actions which are specific to a project are included in this file. The record should be in the form of a memorandum (or copy of other records discussed in this manual) with the nonconformance stated, how it was corrected, and the approval for the correction. A separate file for each incidence is not required, the file should be maintained chronologically.

#### K - QA Plan

If a specific Quality Assurance Project Plan, and revisions, are prepared for a project, they shall be stored in this file.

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## L - Miscellaneous

The miscellaneous file includes all records not applicable to the previous categories.

### 4.13.1.3 GENERAL LABORATORY OPERATIONS RECORDS

General laboratory records document overall laboratory performance and operations. These records are filed separately from project records and will be maintained so they can be referenced to project records if necessary. Examples of general records pertinent to project records are instrument log books and computer software verifications.

There are two types of general laboratory records:

- . Documents which demonstrate laboratory performance

- . Reference documents for laboratory operations

Records which demonstrate laboratory performance shall be filed in categories in a manner similar to project files. Reference documents are not indexed and their usage is not controlled.

Many of the laboratory operations records are in daily use, such as the Master Log Book, instrument calibration logs, and control charts. It is not intended that the records be stored daily while they are in use. However, when individual log books, etc. are filled, they shall be placed in the files.

Following is a brief discussion of the General Lab Operations records:


#### A - Sample Log Books

The Sample Log Books chronologically record all samples entering the laboratory, independent of project designation.

#### B - Instrument Calibration Logs

All calibration performed independent of a specific project shall be recorded by instrument. A separate file should be maintained for each instrument subject to calibration. These files are scanned and archived at the network by instrument and date.

#### C - Instrument Maintenance Logs

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Separate maintenance files should be kept for each instrument incorporated in the preventive maintenance program. The file shall include records of maintenance performed in-house or by outside groups.

#### D - Performance Evaluation Records

Laboratory participation in Performance Evaluation Programs shall be documented in this category. If performance standards are analyzed as part of the overall quality control sample program, the results should be included in Category G.

#### E - Certification Program (NY, CT, NJ , PA) Records

If the laboratory participates in certification programs, such as the NVLAP, ELAP, etc. program, the results shall be maintained in this category. Records should include all correspondence, analytical data, agency results, etc.

#### F - Control Charts

Control charts are generated and maintained on the Element LIMS.

#### G- Purchased Material Certificates

All information which verifies that purchased materials meet the requirements of the laboratory should be maintained. Certification may be supplied by a vendor or from in-house verification analysis. Separate files should be kept for chemicals, gases, water, glassware, etc.


#### 4.13.1.4 RECORD CONTROL

The individual responsible for the records management system is part of the Data Management Group. This person shall:

- Initiate new project files including project index
- Add new records to existing files, initiate new files within a category, and update the index
- Assist laboratory personnel in withdrawing and returning records.

To maintain control of hard copy records within the laboratory, a Records Accession LOG is maintained. The LOG indicates:

- Project from which file is borrowed
- Date and person borrowing record

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- Date returned to the record system

The dating format for records is MM/DD/YYYY.

#### **4.13.2.1 Record Integrity**

##### **Policy:**

All records are to be legible and shall be retained in such a way that they are readily retrievable in facilities that provide a suitable environment to prevent damage or deterioration and to prevent loss.

##### **Details:**

The retention time for records is set at **five** years.

Records may be in the form of any type of media, such as hard copy or electronic media.

#### **4.13.2.2 Record Security**

##### **Policy:**

All records are held secure and in confidence.

##### **Details:**

Access to records is secured through limited access areas and computer access via user defined privileges.

#### **4.13.2.3 Record Backup**

##### **Policy:**

The SOP ADMINRECORDS043010 is followed to protect and backup data/records held on computers at all times and to prevent unauthorized access to or amendment of data/records on computers.


##### **Details:**

Data is password protected.

Backups ensure integrity and availability of data / information in the event of a system / power failure.

### **4.13.3 Technical Records**

#### **4.13.3.1 Record Information**

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**Policy:**

Original observations, calculations, derived data and sufficient information to establish an audit trail, calibration records, personnel records and a copy of each test report issued are retained for five years.

The records for each test shall contain sufficient information to facilitate, if possible, identification of factors affecting the test uncertainty and to enable the test or calibration to be repeated under conditions as close as possible to the original. The records include the identity of personnel responsible for sampling, performing of each test and/or calibration and checking of results.

**Details:**

Technical records are accumulations of data (see 5.4.7) and information that result from carrying out tests and/or calibrations and which indicate whether specified quality or process parameters are achieved. They may include forms, contracts, work sheets, work books, note books, instrument printouts, magnetic media, check sheets, work notes, control graphs, test reports, calibration certificates, Client's notes, papers and feedback, and test reports to Clients.

The records for each test contain sufficient information to permit its repetition. Records include:

- date of sampling
- sample receipt
- sample handling, storage, and disposal
- identification of personnel
- analyst proficiency
- instrumentation identification and performance
- calibration records
- media performance, where appropriate
- test batch # or lot #, where appropriate
- results
- reports (mailed, e-mailed, faxed)
- review


**Note** – the above records may be stored in separate locations. They are cross-referenced for easy retrieval.

### 4.13.3.2 Recording

**Policy:**

Observations, data, and calculations are clearly and permanently recorded and identifiable to the specific job at the time they are made.

**Details:**

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Handwritten records must be legible and made with indelible ink immediately after an observation, after data is collected and/or after calculations are made.

#### **4.13.3.3 Corrections to Records**

**Policy:**


Changes to test data are made so as not to obscure or delete the previous data entry.

**Details:**

Mistakes are crossed out and the correct value entered alongside. Mistakes are not erased, made illegible, or deleted. All alterations to records are signed or initialed by the person making the correction. In the case of computer-collected data, similar measures are taken to avoid loss or change of original data.

## **Revision History**

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## 4.14 Internal Audits

### 4.14.1 Internal Audit Program

**Policy:**

The internal audit program involves periodic audits conducted according to a predetermined schedule for each year. This program is defined on an annual basis and conducted as outlined in this section with further details found in SOP ADMININTAUDIT043010. All elements of this Quality Manual will be audited each year and all relevant laboratory records are available to personnel conducting the audit. These audits are performed to verify operations continue to comply with the requirements of this Quality Manual and are effective.

**Details:**

The Quality Manual, test procedures, and laboratory results are verified for compliance. It is the responsibility of the Quality Assurance Officer to plan and organize audits as required by the schedule and requested by management. Audits are carried out by trained and qualified personnel who are independent of the activity to be audited. Personnel are not to audit their own activities except when it can be demonstrated that an effective audit will be carried out (see also 4.11.5). Audits are performed through the aid of a checklist prepared in advance to minimize the possibility of overlooking any details during the audit.

Generally, the types of audits include:

- quality management system
- processes and procedures
- services and reports

### 4.14.2 Corrective Action


**Policy:**

When audit findings cast doubt on the effectiveness of the operations or on the correctness or validity of test or calibration results, timely corrective action is taken and Clients are notified if investigations show that laboratory results may have been affected.

**Details:**

Nonconformities that can be resolved easily are to be corrected immediately, ideally during the audit. Records are made on the audit checklist. Nonconformities that require a more involved resolution are recorded on a CAR and resolved as described in section 4.11.



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Corrective actions and Client modifications must be kept on record for each audit deviation that casts doubt as described in this section.

### 4.14.3 Records and Management

**Policy:**

Records are made of the activity being audited, the audit findings, and corrective actions that arise. Management ensures that corrective actions are discharged within an appropriate and agreed timeline.

**Details:**

A report is prepared by the auditors and distributed to those audited and/or the area manager/supervisor within an appropriate and agreed timeline. The audit report may include the following sections, as appropriate:

- audit objective and scope
- area or section audited
- personnel involved – auditors and auditees
- date of audit
- reference documents
- observations including nonconformities and commendations
- opening and closing meetings
- recommendations
- audit report distribution

The appropriate manager is responsible for ensuring that corrective actions are sufficiently recorded. Follow-up is performed by the auditor and recorded when corrective action is complete and deemed effective. The audit records are kept in the laboratory.

### 4.14.4 Follow-up Audits

**Policy:**


Follow-up audits are performed to verify and record the implementation and effectiveness of the corrective action taken.

**Details:**

The follow-up audit is performed at a mutually acceptable time between the area implementing corrective action and the auditor. This time is determined when the CAR is issued.

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## 4.15 Management Reviews

### 4.15.1 Review of Quality Management System and Testing

**Policy:**

Top management periodically (at least annually) and in accordance with a predetermined schedule and SOP ADMINMGMTREV043010, conduct a review of the laboratory's quality management system and testing activities to ensure their continuing suitability and effectiveness and to introduce any necessary changes or improvements.

**Details:**

The review takes account of:

- suitability of policies and procedures
- reports from managerial and supervisory personnel
- the outcome of recent internal audits
- corrective and preventive actions
- assessments by external bodies
- results of inter-laboratory comparisons or proficiency tests
- changes in the volume and type of work undertaken
- feedback from Clients, including complaints and Client satisfaction surveys
- recommendations for improvement
- other relevant factors, such as quality control activities, resources and personnel training

A minimum period for conducting a management review is once a year. Results of the review feed into the laboratory planning system and include goals, objectives and action plans for the coming year.


A management review can be supplemented by consideration of related subjects at regular management meetings.

### 4.15.2 Findings, Actions, and Records

**Policy and Details:**

Findings from management reviews and the actions that arise are recorded in the minutes of the meeting. Management will ensure that the actions are discharged within an appropriate and agreed upon timeline.

## Revision History

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## 4.16 Data Integrity Plan

### 4.16.1 Purpose

The purpose of the Data Integrity Plan is four-fold:

- (a) to describe the laboratory's data integrity system,
- (b) to emphasize the paramount importance of ethics in the performance of all analytical work,
- (c) to obtain the commitment of laboratory staff to the principle that all analyses shall be performed in a controlled and documented manner, and
- (d) to ensure that laboratory staff consistently meet the specific ethical requirements defined in this data integrity plan.

### 4.16.2 Scope

This procedure applies to all analyses and activities performed within the laboratory's scope of accreditation.

### 4.16.3 Responsibilities


Senior managers support and provide initial data integrity training and on-going annual training to laboratory managers and staff. Senior managers ensure that only staff who sign the ethics agreement are allowed to work in the laboratory.

The QAO shall maintain records of ethics/data integrity training and data integrity monitoring.

### 4.16.4 Procedure

#### *Ethics Training*

Ethics training is a required part of new employee orientation and is provided on an annual basis for all laboratory managers and staff by senior laboratory management. Initial training during orientation includes the overall organizational mission and its relationship to the absolute need for honesty and full disclosure in all analytical reporting and record-keeping. Resources where applicable ethics policy and law can be found are made available and copies are distributed. Examples are described that illustrate unethical behavior and ethical behavior related to laboratory data manipulation.

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Laboratory standard operating procedures are reviewed with respect to proper procedure, data qualifiers, and adequacy of record keeping. Management will disclose that reports and the data generated to support them are subject to routine in-depth review.

The organizations response to infractions of the data integrity plan will be discussed and the trainee shall understand that infractions will be investigated in a detailed way. The consequences to an employee found to be in violation of the data integrity plan may result in immediate termination, debarment, and/or civil/criminal prosecution. Confidentiality is assured during this process.

***Employee attendance or participation is documented.***

#### *Ethics Agreement*

Following initial ethics training and on-going annual training for laboratory managers and staff, trainees shall sign a written ethics agreement. Senior managers who provide the training shall also sign the agreement. The agreement states that the signers will not engage in any unethical practices with respect to data integrity nor will they tolerate improper behavior in others if it is observed or suspected. By signing, senior managers acknowledge their duties in upholding the spirit and intent of the data integrity system and in effectively implementing the specific requirements of the plan.


#### *Monitoring*

Data integrity monitoring is accomplished by periodic data package and manual integration reviews by the QAO and/or Laboratory Director, annual internal audits, and monthly QC sample tracking. Therefore the QAO, shall have an in-depth understanding of typical inappropriate analytical behavior and be trained in the data integrity system. Refer to the laboratory's SOP for data review.

Blind known reference samples may be submitted for analysis as real samples by the QAO, (blind to the analyst) as part of any project or event. Data and results of the reference sample are reviewed by the QAO to verify that all data integrity requirements are met.

#### *Documentation*

All data integrity incidents must be documented, including investigative findings and disciplinary actions. Corrective actions are recorded. Confidentiality is critical and maintained by use of locked filing cabinets and password protected electronic files. If client disclosure is determined to be necessary by senior laboratory management, then such disclosures and outcomes are recorded.

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All data integrity documents, plans, SOPs, personal records and records of investigations shall be maintained for a period of five years. Documents are subject to the document control system and records are subject to the records management system as described in the laboratory's quality manual and related SOPs.

#### 4.16.5 References

##### Internal

York Data Integrity and Ethics Training SOP (ADMIN Ethics 040102)

York Internal Quality Audit SOP (ADMIN Audit 043010)

York Manual Integration Review SOP (ADMIN ManIntReview 043010)

##### External

NELAC Quality Systems, Chapter 5, Sections 5.4.2.3, 5.4.2.6, and 5.4.15, June 5, 2003 and Module 2, Sections 4.2.8.4, 4.2.8.1, 5.2.7, and 4.16, August 24, 2009.

#### Revision History

Revision No.	Date	Responsible Person	Description of Change
1	12/26/12		Initial Release

**4.16.6 Annual Review** (The review is to be documented if the Quality Manual has not been revised in the past 12 months)

_____ Signature	_____ Title	_____ Date
_____ Signature	_____ Title	_____ Date
_____ Signature	_____ Title	_____ Date
_____ Signature	_____ Title	_____ Date
_____ Signature	_____ Title	_____ Date

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## 5.0 Technical Requirements

### 5.1 General

#### 5.1.1 Correctness and Reliability

**Policy and Details:**

Correctness and reliability of the tests and/or calibrations performed have many contributing factors including:

- human factors (see section 5.2)
- accommodation and environmental conditions (see section 5.3)
- test and calibration methods and method validation (see section 5.4)
- instrumentation (see section 5.5)
- measurement traceability (see section 5.6)
- sampling (see section 5.7)
- handling of test and calibration items (see section 5.8)

#### 5.1.2 Measurement Uncertainty

**Policy:**

When developing test and calibration methods and procedures, total measurement uncertainty must be accounted for in the training and qualification of personnel, and in the selection and calibration of instrumentation.

**Details:**

The extent to which the factors contribute to total measurement uncertainty differs between (types of) tests and between (types of) calibrations.

See section 5.4.6 for more details.

### Revision History

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## 5.2 Personnel

York recognizes that all laboratory personnel affect data quality. This manual has been prepared so that staff members will be cognizant of the procedures adopted by York for the production of analytical data, and so they will be aware of their responsibilities.

Staff are properly trained and qualified for their positions and specific procedures.

### 5.2.1 Competence and Qualification

#### **Policy:**

Management ensures the competency of all personnel charged with analysis and those evaluating results and signing test reports. Appropriate supervision is provided for employees undergoing training. Personnel performing specific tasks are qualified on the basis of appropriate education, training, experience and/or demonstrated skills, as required.

In addition, personnel responsible for the opinions and interpretations included in test reports also have:

- relevant knowledge of the technology used for the analysis, materials
- knowledge of the general requirements expressed in the legislation and standards
- an understanding of the significance of deviations found with regard to the normal use of the data

#### **Details:**

Management defines the minimum levels of qualification and experience necessary for all posts within the laboratory. In some technical areas it may be required that the personnel performing certain tasks be certified. The laboratory is responsible for fulfilling specified certification requirements of personnel. The requirements for personnel certification might be regulatory, might be included in the standards for the specific technical field, or required by the client.

Continued competence is monitored and where this is not achieved, the need to retrain personnel is considered. Where a method or technique is not in regular use, verification of personnel performance prior to testing may be necessary.

### 5.2.2 Training Policies and Procedures

#### **Policy:**

Management will formulate the goals with respect to the education and the skills of the laboratory personnel. The training program is relevant to the present and anticipated tasks

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of the laboratory. SOP# [QSP 5-2-1](#) is utilized to identify training needs and providing the necessary training for personnel. The effectiveness of the training actions taken is evaluated.

**Details:**

The skills and knowledge are defined in the job description for each job function as described in section 5.2.4. Management compares the job description to the skills and knowledge of the new incumbent to determine the training needs.

Training in the laboratory must include all methods or parts of methods and techniques that personnel are asked to perform. Minimally, the analyst must demonstrate competency (Initial Demonstration of Capability) through observation by management and verification using replicate and/or check samples. For technicians who perform only parts of the method, confirmation of competency may be verified by observation only. Re-verification of all personnel must be performed annually on all methods or techniques pertinent to their job description.

In some cases it may be appropriate to define competence related to a particular technique or instrument rather than methods. If so, it will be necessary to define for each method, the necessary technique-based competence required together with any additional requirements.

### 5.2.3 Employees

**Policy:**

Competent permanent or part-time employees are employed in the laboratory. No contract labor is used. The Managing Director ensures that all technical employees, and key support personnel are supervised and work in accordance to the policies and procedures of this Quality Manual.

**Details:**

Testing must be either performed or supervised by an experienced person qualified to degree level. Personnel have relevant practical work experience and training before being allowed to perform accredited work.

### 5.2.4 Job Descriptions

**Policy:**

Current job descriptions for managerial, technical and key support personnel involved in laboratory analyses are maintained centrally on the Network with appropriate access.

**Details:**

Minimum contents of job descriptions include:



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- the duty of performing preparation/analysis
- the act of planning analyses and evaluation of results
- the responsibility of developing and validating new methods as / when requested
- expertise and experience
- qualifications and training programs
- managerial duties if applicable

Job descriptions are dated and signed to demonstrate that each incumbent has read it and is in agreement. They are maintained current on the Network.

## 5.2.5 Authorized Personnel

### Policy:

Management authorizes specific personnel to perform particular types of analysis, to issue test reports, to give opinions and interpretations and to operate particular types of instrumentation. Records of the relevant competence, educational and professional qualifications, training, skills and experience of all technical personnel and contracted personnel are maintained. This information is readily available and includes the date on which authorization and/or competence was confirmed and the criteria on which the authorization is based and the confirming authority.

### Details:

The purpose of these records is to provide evidence that personnel have been adequately trained and their competence to perform particular tests has been assessed. In some cases it may be pertinent to state any particular limitations to competence. The records are maintained in a registry of skills and include:

- academic and professional qualifications
- external and internal courses attended
- relevant on-the-job training and retraining as necessary (i.e., demonstration of capability)
- skills and experience (i.e., resume-maintained in employee administration file)
- relevant authorizations

Records are held centrally in the Employee Training Records Log.

## Revision History

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## 5.3 Accommodation and Environmental Conditions

### 5.3.1 Facility

**Policy:**

Laboratory facilities are appropriate to attain correct performance of all analyses. This may include, but not limited to, energy sources, lighting, heating, ventilation and any other environmental conditions.

Appropriate care is taken to ensure that the environment does not invalidate the results or adversely affect the required quality of any measurement. The technical requirements for accommodation and environmental conditions that can affect the results of tests and calibrations are documented.

**Details:**

This section deals with the test areas in the laboratory and premises for support such as sample receipt and storage. Central laboratory supplies and services, such as water purification systems, air supply, vacuum source, and sample storage, are appropriate to facilitate proper performance of analyses.

### 5.3.2 Monitoring

**Policy:**

Critical environmental conditions are monitored, controlled and recorded as required by the relevant specifications, methods, and procedures or where they may influence the quality of the results. Due attention is paid, for example, to the potential for cross contamination by methylene chloride, acetone and hexanes which are used in the Extractions processes, as appropriate to the technical activities concerned. Analyses are stopped when the environmental conditions jeopardize the results. O

**Details:**

Laboratories are ventilated to reduce the levels of contamination, lower humidity, and control temperature. Laboratories' test areas are air-conditioned. The relative humidity in test areas is 45-50 and the temperature is 20-25 °C. Volatiles analyses are conducted in a separate laboratory where the air conditioning system produces a positive pressure in the laboratory and the air intake (economizer) is disabled. In addition, samples for volatiles are stored in a separate Sample Control room in their own refrigerators to minimize potential for cross contamination.

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Bench tops and floors are made of impervious, smooth easily cleaned materials. There is at least two linear meters workspace per analyst while working. Walls and ceilings are made of materials that are smooth and easily cleaned.

### 5.3.3 Separation of Incompatible Activities

**Policy:**

Effective separation between neighboring areas is made when the activities are incompatible. Measures are taken to prevent cross-contamination.

**Details:**

Reference materials and certified reference materials must be kept separated from samples (log-in and storage). Sample log-in and storage must be segregated, in separate areas from the testing laboratory, and include proper sanitation to exclude the possibility of cross-contamination. Segregation of activities is achieved through time and space allocations.

An example of space segregation would be for a trace volatiles analysis. Physical separation of the trace volatiles analysis from Extractions using solvents is achieved through the use of separate rooms.

An example of time segregation would be the coordination of activities at different times. It may be appropriate to perform work on “cleaner” samples first before starting “dirtier” type samples.

### 5.3.4 Controlled Access

**Policy:**

Access to and use of areas affecting quality of the analyses is defined and controlled.

**Details:**

Access to the laboratory is restricted to authorized personnel. The authorized personnel are made aware of the following items:

- the intended use of the area
- the restrictions imposed on working within such areas
- the reasons for imposing the restrictions

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### 5.3.5 Good Housekeeping

**Policy:**


Measures are taken to ensure good housekeeping in the laboratory. Special procedures are prepared when necessary.

**Details:**

Controlled use of cleaning and pest control materials is exercised. The laboratory complies with the local health and safety requirements.

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## 5.4 Tests and Calibration Methods and Method Validation

### 5.4.1 General

#### Policy:

Methods and procedures used for all analyses are appropriate as per:

- courier handling, transport, storage, and preparation of items to be tested
- an estimation of the measurement of uncertainty as well as statistical techniques for analysis of test data where appropriate

Instructions on the use and operation of all relevant instrumentation and on the handling and preparation of items for testing are available. All instructions, standards, manuals and reference data relevant to the work of the laboratory are maintained current and readily available to personnel. Deviation from SOP and test methods must be documented, technically justified, authorized, and accepted by the client.

#### Details:

There are SOPs for sample handling, transport, storage, preparation, QA/QC procedures, and standards for approving / rejecting results. These may be combined with or separate from the method. The content of a test method or SOP generally includes:

- scope
- description of test items
- holding times
- quantities to be tested
- materials and instrumentation required
- physical environmental conditions required (temperatures, pH requirements)
- description of procedures
- sample identification
- method of recording observations and results
- safety measures
- waste management/pollution prevention
- documentation
- method for data analysis and presentation
- sensitivity of method
- quality control plan

National or state standards or other recognized specifications that contain sufficient and concise information on how to perform the analyses are not necessarily supplemented or rewritten as an internal procedure when they are written in a way that can be used as published by laboratory staff. Consideration may need to be given to providing additional documentation for optional steps in the method.

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## 5.4.2 Selection of Methods

### Policy:

Preparation and analysis methods meet the needs of the client and are appropriate for the analysis undertaken. Preference is given to reference methods published as international, Federal, or State standards. The laboratory ensures that the latest edition of a standard is used unless it is not appropriate or possible to do so. When necessary, the standard is supplemented with additional details to ensure consistent application.

### Details:

Methods that have been published either in international, Federal, or State standards, or by reputable technical organizations, or in relevant scientific texts or journals, or as specified by the manufacturer are selected when the client does not specify the method to be used. These methods may be adopted from the Environmental Protection Agency, ASTM, Standard Methods for the Examination of Water and Wastewater, Various State agencies, etc.

The ability of the laboratory to achieve satisfactory performance against documented performance characteristics is verified before samples are analyzed.

Laboratory-developed methods or methods adopted by the laboratory may also be used if they are appropriate for the intended use and if they are validated. The client is informed as to the method chosen. The laboratory confirms that it can properly operate standardized methods before introducing the samples for analysis.

The client is informed when the method proposed by the client is considered to be inappropriate or out of date.

## 5.4.3 Laboratory-Developed Methods

### Policy:

Introduction of test methods developed internally is a planned activity and is assigned to qualified personnel equipped with adequate resources. Plans are updated as development proceeds and ensure effective communication among all personnel involved.

### Details:

Methods developed in-house are validated and authorized before use. Where available, Certified Reference Materials (CRMs) are used to determine any systemic bias, or where possible results are compared with other techniques, preferably based on different principles of analysis. Determination of uncertainty must be part of this validation process and is essential for ongoing quality control.

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## 5.4.4 Non-Standard Methods

### Policy:

Utilization of non-standard methods is subject to agreement with the client and includes a clear specification of the client's requirements and the purpose of the test. The developed method is validated appropriately before use.

### Details:

Discussion and agreement for the use of non-standard methods is recorded as part of contract review procedures (see section 4.4).

All non-standard and new tests are validated for their intended purpose. Qualitative test methods must be validated to demonstrate estimated sensitivity and specificity, relative accuracy to official methods (if appropriate), positive and negative deviation, limit of detection, matrix effect, repeatability, and reproducibility.

Quantitative test methods are validated to demonstrate specificity, sensitivity, relative accuracy, positive and negative deviation, repeatability, reproducibility, and limit of determination.

For new methods where procedures are developing rapidly, especially for emergency situations, it may be necessary to circumvent normal validation procedures. Minimally, this must be a demonstrated recovery in replicate.

New test and/or calibration methods are documented prior to providing test and/or calibration results to clients and contain at least the following information:

- appropriate identification
- scope
- description of the type of item to be tested or calibrated
- parameters or quantities to be determined
- apparatus and instrumentation, including technical performance requirements
- reference standards and reference materials required
- environmental conditions required and any stabilization period needed
- description of the procedure, including:
  - affixing identification marks, handling, transporting, storing and preparing of items
  - ensuring checks are made before the work is started
  - checking that the instrumentation is working properly and, where required, calibrating and adjusting the instrumentation before each use
  - listing method of recording the observations and results
  - indicating any safety measures to be observed
- criteria and/or requirements for approval/rejection (quality control plan)

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- data to be recorded and method of analysis and presentation
- uncertainty or procedure for estimating uncertainty

## 5.4.5 Validation of Methods

### 5.4.5.1 Performance Characteristics

#### **Policy:**

Validation of a method establishes, by systematic laboratory studies, that the performance characteristics of the method meet the specifications related to the intended use of the test results.

#### **Details:**

The performance characteristics of a validation plan includes, as applicable:

- selectivity and specificity
- range
- linearity
- sensitivity
- limit of detection
- limit of quantitation
- ruggedness
- accuracy
- precision
- reporting limit
- repeatability
- reproducibility
- recovery
- confirmation techniques
- criteria for the number of samples tested to validate method as per defined scope of method
- action levels where defined by regulation
- quality control incorporating statistics as applicable
- interpretation of population results as applicable

Performance characteristics that are selected take into account the intended use of the method, whether for screening, confirmatory analysis, or quantitation.

The design, verification of the method and documentation procedures for validation are planned and conducted by qualified personnel, equipped with adequate resources.

This section lists a few acceptable validation procedures. The choice of the procedure depends on the extent of the deviation from the published method.



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Validation of methodology is a value judgment in which the performance parameters of the method are compared with the requirements for the test data. A prerequisite for a valid method is that data produced by the method must attain a state of statistical control. Such a state is obtained when the mean value of a large number of individual values tends to approach a limiting value called the limiting mean.

Methods may be validated by one or more alternative procedures. Some of these procedures are described below. Apparent differences can be analyzed statistically to confirm their significance. In all cases, the reasons for choosing one or more alternatives must be documented.

- analysis of standard reference materials (SRM) that are identical or almost identical to the test samples
- in the absence of suitable SRMs, analysis of reference materials that are similar in all respect to the test samples; the use and validity of this reference material must be documented
- using an alternative method to measure the same parameter provides a very high level of confidence if results are confirmed
- recovery studies by the addition of a known concentration of the parameter of interest to some of the replicates being measured

The parameters to be determined include:

- the scope of the method and any known interference
- detection limit
- the range of concentration where the method is valid
- precision and bias
- intra-laboratory variations
- inter-laboratory variations

Judgment is required to determine if some or all of the above is required. Requirements will depend largely on the extent of deviation from the original method.

Developments in methodology and techniques require methods to be changed from time to time. The difference in performance between revised and obsolete methods is established so that it is possible to compare old and new data.

Where a change in method involves only minor adjustments, such as sample size, or different reagents, the amended method is validated and the changes brought to the attention of the accreditation body at the next accreditation audit. Where the proposed change involves technology or methodology, the laboratory seeks the approval of the accreditation body.

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Records are kept on all validation activities. The records include any of the performance characteristics chosen, reference procedures or guidance documents followed to validate the method or custom validation procedure, and a final confirmation (memo to file) that the method validation results are acceptable for continued use of the method. An example statement would be “This memo serves as record that the validation of the XYZ Test Method has been approved for use by [name and title of approver]”.

#### **5.4.5.2 Fit for Use**

##### **Policy:**

The laboratory validates non-standardized methods, laboratory-designed/developed methods, standardized methods used outside their intended range, and amplifications of standard methods to confirm that the methods are fit for the intended use. The validation is as extensive as is necessary to meet the needs in the given application or field of application (may include procedures for sampling, handling, and transportation). The laboratory records the results obtained, the procedure used for the validation, and a statement as to whether the method is fit for the intended use.

##### **Details and Procedure:**

Validation records are kept as in section 5.4.5.1. Included in these records is the validation procedure. The procedure used for the validation is likely to vary between different methods. Therefore, the procedures included in the laboratory records are not as detailed as a typical SOP, but are sufficient enough to re-create how the method was validated.

The techniques used for the determination of the performance of a method, are one of, or a combination of, the following:

- calibration using reference standards or reference materials
- comparison of results achieved with other methods
- inter-laboratory comparisons
- systematic assessment of the factors influencing the result
- assessment of the uncertainty of the results based on scientific understanding of the theoretical principles of the method and practical experience

When changes are made in the validated non-standard method, the influence of such changes carried out is documented and if appropriate a new validation is performed.

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### 5.4.5.3 Client's Needs

**Policy:**

The range and accuracy of the values obtainable from validated methods (e.g., the uncertainty of the results, detection limit, selectivity of the method, linearity, limit of repeatability and/or reproducibility, robustness against external influences and/or cross-sensitivity against interference from the matrix of the sample/test object) as assessed for the intended use is relevant to the client's needs.

**Details:**

Validation includes the specification of the requirements, determination of the characteristics of the methods, the comparison of the requirements with the values of the characteristics of the method, and a statement on the validity.

As method development proceeds, regular review is required to verify that the needs of the client are still being fulfilled. Changing requirements requiring modifications to the development plan are approved and authorized.

Validation is always a balance between costs, risks, and technical possibilities.

## 5.4.6 Uncertainty of Measurement

### 5.4.6.1 Calibration

**Policy:**

Physical and chemical standards and instrumentation are calibrated or characterized internally and by subcontractors where appropriate.

**Details and Procedures:**

Repeatability and reproducibility data are components of measurement uncertainty and are determined as a first step towards producing estimates of this parameter. The uncertainty of measurement is available on the certificate of analysis or calibration certificate from a subcontractor.

**Note** – in-house calibrations include procedures for uncertainty of measurement estimates where this is common practice.

#### 5.4.6.1.1 CALIBRATION PRACTICES

Instruments and instrumentation used at York are controlled by a formal calibration program. The program verifies that instrumentation is of the proper type, range, accuracy, and precision to provide data compatible with specified requirements. All instruments and instrumentation which measure a quantity, or whose performance is

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expected at a stated level, are subject to calibration. Calibration may be performed by York personnel using reference standards, or externally by calibration agencies or instrumentation manufacturers.

This section of the Quality Manual prescribes the practices used by York to implement a calibration program. Specifics are not provided herein because the requirements for the calibration of instruments and instrumentation are dependent upon the type and expected performance of individual instruments and instrumentation. Such details are provided in the specific SOPs. Implementation is the responsibility of the Group Leaders and Analysts. The Quality Assurance Officer shall review the implementation of the program as discussed in previously.

Two types of calibration are discussed in this section:

- Operational calibration which is routinely performed as part of instrument usage, such as the development of initial calibration curves for GC, GC/MS, etc. Operational calibration is generally performed for instrument systems.
- Periodic calibration which is performed at prescribed intervals for instrumentation, such as balances.


#### 5.4.6.1.2 CALIBRATION SYSTEM

The following is a discussion of the elements comprising the calibration system.

#### 5.4.6.1.3 Calibration Procedures

Written procedures are developed by York within the requirements of this manual for all instruments and instrumentation subject to calibration. Whenever possible, recognized procedures, such as those published by ASTM or the USEPA, or procedures provided by manufacturers are adopted. If established procedures are not available, a procedure shall be developed considering the type of instrumentation, stability characteristics of the instrumentation, required accuracy, and the effect of operational error on the quantities measured. As a minimum, the procedures shall include:

- Instrumentation to be calibrated
- Reference standards used for calibration

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- Calibration technique and sequential actions
- Acceptable performance ranges
- Frequency of calibration
- Calibration documentation format

#### 5.4.6.1.4 Instrumentation Identification

Instrumentation that is subject to calibration shall be uniquely identified so that calibration records can be designated with a specific instrument. Instrumentation identification can be by manufacturer's serial number, York inventory control number, or a unique number assigned by York.

#### 5.4.6.1.5 Calibration Frequency

Instruments and instrumentation shall be calibrated at prescribed intervals and/or as part of the operational use of the instrumentation. Frequency shall be based on the type of instrumentation, inherent stability, manufacturer's recommendations, values provided in recognized standards, intended use, effect of error upon the measurement process, and prior experience.

#### 5.4.6.1.6 Calibration Reference Standards

Two types of reference standards are used within the York laboratory for calibration:

- Physical standards, such as weights for calibrating balances and certified thermometers for calibrating working thermometers and ovens, which are generally used for periodic calibration.
- Chemical standards such as Standard Reference Materials (SRMs) provided by the National Bureau of Standards NIST or NIST-traceable standards which are primarily used for operational calibration.

Whenever possible, physical reference standards shall have known relationships to nationally recognized standards (e.g., NIST) or accepted values of natural physical constants. If national standards do not exist, the basis for the reference standards shall be documented.

Whenever possible, chemical references standards shall be directly traceable to NIST SRMs and/or EPA. If SRMs are not available, compounds of certified high purity will be used to prepare calibration standards.

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#### 5.4.6.1.7 Calibration Failure

Instrumentation that fails calibration or becomes inoperable during use shall be removed from service and segregated to prevent inadvertent use, or shall be tagged to indicate it is out of calibration. Such instrumentation shall be repaired and satisfactorily recalibrated before reuse

Scheduled calibration of instrumentation does not relieve the laboratory staff of the responsibility for using properly functioning instrumentation. If an instrumentation malfunction is suspected, the instrumentation shall be tagged and removed from service and recalibrated. If it fails recalibration, the above process shall apply.

#### 5.4.6.1.8 Calibration Records

Records shall be prepared and maintained for each piece of instrumentation subject to calibration. Records demonstrating accuracy of reference standards shall also be maintained.

Records for periodically calibrated instrumentation shall include, as appropriate:

- Identification number of instrumentation and type of instrumentation.
- Calibration frequency and acceptable tolerances.
- Identification of calibration procedure used.
- Date calibration was performed.
- Identity of York personnel and/or external agencies performing the calibration.
- Reference standards used for calibration.
- Calibration date.
- Certificates or statements of calibration provided by manufacturers and external agencies, and traceability to national standards.
- Information regarding calibration acceptance or failure and any repair of failed instrumentation.

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Records for periodically calibrated instrumentation shall be maintained in the Laboratory Operation Records. Records for each instrument/instrumentation and physical reference standard shall be kept in a separate folder. The title sheet for each file shall be a summary of calibrations performed. It is recommended that an index precede the instrumentation files which lists in matrix form all instrumentation and physical standards, calibration frequency, and dates for upcoming calibration. The use of a calibration due date matrix provides ready reference so that calibration can be maintained by the Group Leaders.

For instruments and instrumentation that are calibrated on an operational basis, calibration generally consists of determining instrumental response against compounds of known composition and concentration or the preparation of a standard response curve (either linear or average response factor) of the same compound at different concentrations. Records of these calibrations are maintained in several ways:

- The calibration data for all GC, GC/MS, ICP/ICPMS, Ion Chromatography is kept in a uniquely numbered QUALITY BATCH (QB) file. These files include all initial calibrations and continuing calibrations, as well as method blanks, spikes, duplicates and control (LCS) data. The nomenclature for these files follows this example:
  - For a volatiles run on April 1, 2010 on Volatiles GC/MS # 1, the batch QA/QC data is placed in a QB file identified as QBV1040110A. The A represents the first batch of the day. If two batches are run, a B is affixed, etc.
  - This unique QB number appears on all sample headers to allow for cross referencing all QA data for a particular batch to each sample.
- A log book for each parameter documents all calibration and QA data for each wet chemistry, gravimetric or spectrophotometric analysis.

For operational calibration, the following is recommended:

As above, calibration data must be included in a batch file system. If samples from different projects are processed together, calibration data is included in a batch folder.

- The specific SOPs detail:
- Calibration instructions (curve preparation, linear ranges, etc.).
- Procedures for chemical standards preparations.

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#### 5.4.6.1.9 OPERATIONAL CALIBRATION

Operational calibration is generally performed as part of the analytical procedure. Included may be the analysis of a method blank and the preparation of continuing calibration verification standard or curve. Operational calibration is dependent upon the instrumentation within York, and as previously discussed, the laboratory uses a specific SOP for this purpose.

Following is a brief discussion of the analysis of method blanks and preparation of calibration curves. Guidelines for the major instrument systems within the York laboratory follow:

#### 5.4.6.1.10 General Calibration Procedures

The initial phase of a laboratory testing program requires the selection and certification of the method best suited for an individual parameter. Certification, or verification, is the elimination, or minimizing, of determinate errors which may be due to Analyst's error, the use of less-than-optimum instrumentation, reagents, solvents, or gases. The quality of materials, even though they are AR grade or better, may vary from one source to another. The Analyst must determine, through the use of reagent and/or solvent blanks, if materials are free from interfering substances which could affect the analysis. Other steps in certifying the method include the determination of a method blank and the preparation of a standard calibration curve.

#### 5.4.6.1.11 Method Blank

After determining the individual reagent or solvent blanks, the Analyst defines the method blank to determine if the cumulative blank interferes with the analysis. The method blank is defined by following the procedures step by step, including the addition of all of the reagents and solvents, in the quantity required by the method. If the cumulative blank interferes with the determination, steps must be taken to eliminate or reduce the interference to a level that will permit the combination of solvents and reagents to be used. If the blank interference cannot be eliminated, the magnitude of the interference must be considered when calculating the concentration of specific constituents in the samples analyzed.

A method blank must be determined whenever an analysis is made. The number of blanks is determined by the method of analysis and the number of samples analyzed at a given time, but is typically one per 20 samples or one per batch whichever is less.



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#### 5.4.6.1.12 Preparation of Standard Calibration Curve

Concurrent with the preparation of reagent and method blanks, a standard calibration curve is accomplished by using calibration standards. The process is summarized as:

- Preparation of a standard calibration curve is accomplished by using five calibration standards prepared by mixing the species to be analyzed into the "solvent" that is to be introduced into the instrument.
- The concentration of the calibration standards are chosen to cover the working range of the instrument.
- All sample measurements are made within this working range.
- The calibration curve is prepared by plotting instrument response versus concentration of the species analyzed. Acceptable linearity or RSDs are defined in the analysis specific SOPs.
- Concentrations of the sample prepared with the same procedure are read directly from the calibration curve or average response factor as detailed in the SOPs.

#### 5.4.6.1.13 GC/MS CALIBRATION PROCEDURES

This section outlines the minimum operations necessary to satisfy analytical requirements associated with the determination of various target lists of organics compounds in air, water and soil/sediment samples. The following operations must be performed routinely (as specified in the SOPs) in the laboratory:

- Documentation of GC/MS mass calibration and abundance pattern.
- Documentation of GC/MS response factor stability.
- Internal standard response and retention time monitoring.

#### 6.2.2.1 Tuning and GC/MS Mass Calibration

Prior to initiating data collection, it is necessary to establish that a given GC/MS meets the standard mass spectral abundance criteria. This is accomplished through the analysis of decafluorotriphenylphosphine (DFTPP) for base/neutral and acid

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(BNA) compounds or p-bromofluorobenzene (BFB) for volatile compounds. The ion abundance criteria as listed in the methods or SOPs for each calibration compound should be met before samples, blanks, or standards can be analyzed.

#### DFTPP (decafluorotriphenylphosphine)

Each GC/MS system used for the analysis of semivolatile compounds must be tuned to meet the abundance criteria of the method for a 50 nanogram (ng) injection of DFTPP. DFTPP may be analyzed separately or as part of the calibration standard, and the criteria must be demonstrated each (12) hours of use. Documentation of the calibration must be provided in the form of a bar graph plot and as a mass listing.

#### BFB (p-bromofluorobenzene)

Each GC/MS system used for the analysis of volatile compounds must be tuned to meet the proper abundance criteria for a 50 ng injection of BFB. The criteria should be demonstrated each (12) hours of use. Documentation of the calibration should be provided in the form of a bar graph plot and as a mass listing.

Analysts obtain a system generated GC/MS Tuning and Mass Calibration each time an analytical system is tuned.

#### 5.4.6.1.14 Calibration of the GC/MS System

Prior to the analysis of samples and after tuning criteria have been met, the GC/MS system must be initially calibrated at a minimum of five concentrations to determine the linearity of response utilizing standards. For GC/MS analysis, typical linear ranges are 0.05(SIM) to 200 ng for base neutrals, 5 to 400 ng for certain phenols, and 0.1 to 1,000 ng for volatiles.

Calibration standards are prepared to cover the linear range and are detailed in the SOPs.

#### Semivolatiles (B/N/A)

Initial calibration of semivolatile compounds is recommended at 5 to 140 ng for SCAN analysis with SIM covering the range 0.05 to 2 ng.

#### Pesticides & PCB

Pesticides by GC/ECD are calibrated at five levels from 0.001 ng to 0.2 ng.

PCB's by GC/ECD are calibrated at five levels from 1 ng to 10 ng.

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In all cases reference is made to the specific SOP for preparation directions.

#### Continuing Calibration (GC/MS and GC)

A continuing calibration standard containing all volatile or semivolatile compounds as well as all required internal standards and surrogates, is performed each 12 hours during analysis. This applies to all matrices except air, whose requirements are detailed in EPA methods TO14A/15. Compare the RF data from the standards each 12 hours with the average RF from the initial calibration for a specific instrument. A system performance check must also be made each 12 hours. If the SPCC criteria are met, a comparison of RFs is made for all compounds. This is the same check that is applied during the initial calibration. If the minimum response factors are not met, the system should be evaluated and corrective action should be taken before sample analysis begins. See the specific SOP for criteria.

##### 5.4.6.1.15 Calibration of the Gas Chromatograph

Calibration of the gas chromatograph (GC) for pesticide and polychlorinated biphenyl (PCB) or other organic compound analyses is performed with the standardization of the instrument. A five-point standard curve is utilized.

Response factors are to be calculated for each compound at each concentration level. These RF will be averaged to generate the mean daily RF for each compound over the range of the standard curve. The mean response factor will be used to calculate the sample concentration of the compound of interest. When sample responses exceed the range of the standard curve, the sample will be diluted to fall within range of the standard curve and be reanalyzed. The results of the daily GC standardization will be tabulated and filed with the corresponding sample analyses or batch file.

##### 5.4.6.1.16 Calibration of Inductively Coupled Plasma Spectrometer (ICP) and Inductively Coupled Argon Plasma/Mass Spectrometer (ICP/MS) and Cold Vapor AAS

The ICP and ICP/MS are standardized for the metal of interest by the analysis of a set of calibration standards prepared by diluting a stock solution of known concentration. A single standard is used to calibrate the ICP, three standards are used for ICP/MS, while five working standards of mercury (Cold Vapor AAS) are prepared by dilution of the stock standard. The concentration of the calibration standards is chosen so as to cover the working range of the instrument. Subsequently all sample measurements are made within this working range. Once the working standards are prepared, they are analyzed on the ICP or AAS and the

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instrument response is calibrated to provide a direct readout in micrograms of metal per milliliter of water or parts per million.

Once the instrument has been initially calibrated, the analysis of initial calibration verification (ICV) is performed. Continuing calibration verification (CCV) standards are repeated after every ten samples during sample analysis to verify instrument response during analysis and to confirm the calibration. A typical analysis sequence is presented below:

- . Working standards are prepared by dilution of a stock standard solution of the metal of interest.
- . A calibration curve within the working range of the instrument is established by analysis of five working standards (one for ICP).
- . The working standards (ICV, CCV and blank) are reanalyzed to confirm calibration. If the calibration is not confirmed, within SOP limits, the instrument is recalibrated.
- . The samples are analyzed for the metals of interest.
- . Following completion of the sample analyses, the working standards are reanalyzed to confirm calibration. If calibration is confirmed, the analysis is completed. However, if the calibration is not confirmed, the problem is corrected, and the affected samples are reanalyzed.


#### 5.4.6.1.17 PERIODIC CALIBRATION

Periodic calibration shall be performed for instrumentation such as balances, thermometers, ovens, and furnaces that are required in analytical methods, but which are not routinely calibrated as part of the analytical procedure. Documentation of calibration is kept for each instrumentation item.

Calibration requirements are determined within the York laboratory depending upon the instrumentation used and its operating function. Following are brief example discussions for the calibration of balances and thermometers with examples of calibration data sheets to serve as a guideline for the preparation of laboratory-specific procedures.

#### 5.4.6.1.18 Balances (Example Procedure)

All balances are verified by using weights traceable to the National Bureau of Standards (NIST) on use. Calibration weights shall be Class S or better and shall be

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recertified every year. If balances are calibrated by an external agency, verification of their weights shall be provided.

Calibration of balances shall be over the range in which they are most commonly used. The weights used for calibration of each balance shall be 0.5g, 2.0g, 10.0g, 20.0g, and 100g. Acceptance for balances which are direct reading to 0.01 gram shall be  $\pm 0.01g$ , to 0.0001g shall be  $\pm 0.007g$ , and to 0.00001g shall be  $\pm 0.0007g$ .

#### 5.4.6.1.19 Thermometers (Example Procedure)

Certified, or reference, thermometers shall be maintained for use in calibrating working thermometers including other temperature measurement devices such as thermocouples, probes and infrared temperature sensors. Reference thermometers shall be provided with NIST traceability for initial calibration and shall be recertified every year with instrumentation directly traceable to the NIST. Working thermometers shall be compared with reference thermometers every 12 months. In addition, working thermometers shall be visually inspected by laboratory personnel prior to use.

Calibration temperatures and acceptance criteria shall be based upon the working range of the thermometer and the accuracy required for its use.

### 5.4.6.2 Testing Uncertainties

#### **Policy:**

The SOP ADMINESTUNCERT043010 is utilized to estimate uncertainties of measurement in testing, except when the test methods preclude such rigorous calculations. For most environmental analyses these uncertainties have been established and this procedure will be unnecessary.

In certain cases it is not possible to undertake meteorologically and statistically valid estimations of uncertainty of measurement. In these cases the laboratory attempts to identify all the components of uncertainty and make the best possible estimation, and ensure that the form of reporting does not give an exaggerated impression of accuracy. Reasonable estimation is based on knowledge of the performance of the method and on the measurement scope and makes use of previous experience and validation data.

#### **Details:**

The degree of rigor needed in an estimation of uncertainty of measurement depends on factors such as:

- requirement of the test method
- requirement by the client

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- if there are narrow limits on which decisions on conformity to a specification are based

In cases where a well-recognized test method specifies limits to the values of the major sources of uncertainty of measurement and specifies the form of presentation of calculated results, the laboratory is considered to have satisfied the estimation uncertainty of measurement by following the reporting instructions (see section 5.10).

#### **5.4.6.3 Uncertainty Components**

##### **Policy:**

When estimating the uncertainty of measurement, all uncertainty components that are of importance in the given situation are taken into account using accepted methods of analysis.

##### **Details:**

Sources contributing to the uncertainty include, but are not necessarily limited to, the reference standards and reference materials used, methods and instrumentation used, the environmental conditions, the item being tested or calibrated and the operator.

The predicted long-term behavior of the tested and/or calibrated item is normally not taken into account when estimating the measurement uncertainty.

For further information, see ISO 5725 and the Guide to Expression of Uncertainty in Measurement.

### **5.4.7 Control of Data**

#### **5.4.7.1 Calculations and Data Transfers**

##### **Policy:**

Calculations and data transfers are subject to appropriate checks in a systematic manner.

##### **Details:**

Test data are validated through following SOP QC040402 to determine accuracy of calculations, conversions, and data transfers

- checks for transcription errors, omissions, and mistakes
- checks to determine consistency with normal or expected values

For those analyses where manual data reduction is required, it is performed according to the instructions provided in the test method or SOP.

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#### 5.4.7.2 Computers and Automated Instrumentation

##### Policy:

When computers or automated instrumentation are used for the acquisition, processing, manipulation, recording, reporting, storage or retrieval of test or calibration data, the laboratory ensures that:

- computer software developed by the user is documented in sufficient detail and suitably validated or otherwise checked as being adequate for use
- procedures are established and implemented for protecting the integrity of data; such procedures include, but are not be limited to, integrity and confidentiality of data entry or collection, data storage, data transmission, and data processing (see section 4.13.1.4)
- computers and automated instrumentation are maintained to ensure proper functioning and are provided with the environmental and operating conditions necessary to maintain the integrity of test and calibration data
- data is securely maintained by preventing unauthorized access to, and unauthorized amendment of, computer records

##### Details and Procedures:

Data generated using computer software programs that are interfaced directly to instruments incorporates all dilutions and calculations, thereby eliminating the need for manual data reduction.

Commercially developed software in general use within its designed application range may be considered sufficiently validated. Laboratory software configuration / modifications are validated and documented.

Electronic records, electronic signatures, and handwritten signatures executed to electronic records must be equivalent to proper records and handwritten signatures to paper and are validated by procedures in 21 CFR. Part II (Docket No. 92NO251) RIN0910-AA29; Federal Register: March 20, 1997, Volume 62, Number 54), Rules and Regulations, pages 13429-13466. For further details see:

[http://www.fda.gov/ora/compliance\\_ref/part11/](http://www.fda.gov/ora/compliance_ref/part11/)

## Revision History

Revision 2.0	04/30/2010	First Issue of Rewritten Quality Manual
Revision 2.1	06/29/2012	Modified balance calibration procedure, tolerances.

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## 5.5 Instrumentation

### 5.5.1 Required Instrumentation

**Policy:**

The laboratory is furnished with all items for preparation and analysis required for the correct performance of the analyses. When instrumentation is used outside the laboratory's permanent control, it ensures that the requirements of this Quality Manual are met.

**Details:**

Instrumentation is used in an environment appropriate to its proper performance. All instrumentation required by a test is described in each method, including the instrumentation's tolerances.

### 5.5.2 Required Accuracy

**Policy:**

Instrumentation and software used for testing are capable of achieving the accuracy required and comply with specifications relevant to the tests and/or calibrations concerned. Calibration programs are established for key quantities or values of the instruments where these properties have a significant affect on the results. When received, instrumentation, including that used for sampling, is checked to establish that it meets the laboratory's specification requirements, complies with the relevant standard specifications, and is checked and/or calibrated in accordance with section 5.6 before use.

**Details:**

The procedures for checking newly received instrumentation are as determined by manufacturers' specification and/or those determined by the laboratory during procurement.


### 5.5.3 Authorized Personnel

**Policy:**

Instrumentation is operated by authorized personnel. Up-to-date instructions on the use and maintenance of instrumentation (including any relevant manuals provided by the manufacturer of the instrumentation) are readily available for use by the appropriate laboratory personnel.

**Details:**



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Access to laboratory instrumentation is controlled to ensure that only authorized personnel use instrumentation.

## 5.5.4 Unique Identification

### Policy:

Each item of instrumentation used for testing is uniquely identified as appropriate.

### Details:

Measuring and testing instrumentation is uniquely identified through an asset number of ID. Measuring and testing instrumentation includes any instrument that could affect the quality of test results. Components that can be interchanged between various instruments are tracked in instrumentation logbooks but are not assigned individual asset numbers.

## 5.5.5 Inventory and Maintenance Records

### Policy:

Records are maintained for each item of instrumentation significant to the tests and/or calibrations performed. The records include the following:

- identity of the item of instrumentation (and its software)
- manufacturer's name, type identification, and serial number and/or other unique identification
- checks that instrumentation complies with the specification (see section 5.5.2)
- current location, where appropriate
- the manufacturer's instructions, if available, or reference to their location
- dates, results and copies of reports and certificates of all calibrations, adjustments, acceptance criteria, and due date of next calibration
- maintenance carried out to date and the maintenance plan (includes calibration)
- damage, malfunction, modification or repair to the instrumentation

### Details:

A database is used to capture the above inventory information. The above information related to service and maintenance is kept in individual instrumentation files and/or binders. Other information kept in these files and/or binders may include:

- date received and date placed in service
- condition when received (e.g., new, used, refurbished)
- dates and results of calibration and/or verification and date of next calibration and/or verification
- performance history, where appropriate (e.g., response time, drift, noise level)

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## 5.5.6 Instrumentation Procedures

### Policy:

The laboratory has as an established plan for use and maintenance (including calibration) of measuring instrumentation, and appropriate use of correction factors to ensure proper functioning and in order to prevent contamination or deterioration.

### Details and Procedures:

The procedures for each piece of measuring instrumentation are located in the appropriate room where the instrumentation is located or in the SOP. These procedures detail any information for safe handling, transport, storage, use, and maintenance of measuring instrumentation.

## 5.5.7 Out of Service Instrumentation

### Policy:

Instrumentation that has either been subjected to overloading or mishandling, or gives suspect results, or has been shown to be defective or outside specified limits, is taken out of service, clearly marked, and appropriately stored until it has been repaired and shown by calibration or test to perform correctly.

### Details:

Routine testing work is completely discontinued on instrumentation that even shows minor nonconformances. Not only do we do this for ethical reasons in support of our client, but minor nonconformances are often indicative of major breakdowns in expensive instrumentation. These breakdowns need to be avoided wherever possible.

Out of service instrumentation is clearly marked as outlined in section 5.5.8.

The laboratory examines the effect of the defect or departure from specified limits on previous test and/or calibrations and institutes the “Control of Nonconforming Work” procedure as outlined in section 4.9.

## 5.5.8 Calibration Status

### Policy:

Instrumentation requiring calibration is labeled to indicate the calibration status and/or operational status and the date when re-calibration is due when appropriate.

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**Details:**

Calibration labels have a write-on surface and a pressure sensitive adhesive. The areas that are filled out include the person who performed the calibration, the date it was performed, the date it is due for re-calibration, and the instrumentation's identification number.

<b>CALIBRATION</b>	
BY _____	DATE _____
DUE _____	ID# _____

Measuring instrumentation that has failed calibration or is deemed out of service is labeled with one of the following labels:

<b>CALIBRATION VOID</b>  <b>DO NOT USE</b>
--

<b>OUT OF SERVICE</b>  <b>DO NOT USE</b>
--

A piece of instrumentation that is not calibrated or checked is labeled with the following label:

<b>FOR REFERENCE ONLY</b>
---------------------------

## 5.5.9 Return to Service

**Policy:**

When instrumentation goes outside the direct control of the laboratory for a period, the laboratory ensures that the function and calibration status of the instrumentation are checked and validated and shown to be satisfactory before the instrumentation is returned to service.

**Details and Procedures:**

The procedures used to check and ensure that the function and calibration status of the instrumentation are satisfactory before the instrumentation is returned to service are outlined in the manufacturer's instrumentation manual. Any additional quality control checks are outlined in the applicable section of the appropriate SOP and/or test method.

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## 5.5.10 Periodic Checks

### Policy:

When intermediate checks are needed to maintain confidence in the calibration status of instrumentation, these checks are carried out periodically according to defined procedure.

### Details and Procedures:

As stated in section 5.5.6, the procedures for each piece of measuring instrumentation are located in the appropriate room where the instrumentation is located. SOP# [QSP 5-5-1](#) outlines a general maintenance plan for instrumentation and includes various checks. Internal quality control checks are specified in individual test methods that are located in the appropriate laboratory areas thereby providing procedures for intermediate checks.

## 5.5.11 Correction Factors

### Policy

Calibrations that give rise to a set of correction factors are updated along with all copies of this data (e.g., in computer software).

### Details and Procedures:

The updating of correction factors, including all copies, is assured by following the appropriate test method or SOP. It is the responsibility of the Group Leaders to ensure that all copies are updated.

## 5.5.12 Safeguards against Adjustments

### Policy:

Test instrumentation, including hardware and software, are safeguarded from adjustments that invalidate test and/or calibration results/status.


### Details:

Safeguards against adjustment for laboratory instrumentation include:

- detailed SOPs and manufacturer's manuals on the operation of the instrumentation
- policies permitting only fully trained and competent personnel to operate instrumentation
- access to the laboratory is restricted to authorized personnel

Safeguards against adjustment for software include:

- password protection for important files and packages
- access to the laboratory is restricted to authorized personnel

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## 5.6 Measurement Traceability

### 5.6.1 General

**Policy:**

All measurement and test instrumentation having an effect on the accuracy or validity of tests is calibrated and/or verified before being put into service.

**Details:**

The program includes a system for selecting, using, calibrating, checking, controlling, and maintaining:

- measurement standards
- reference standards used as measurement standards
- measuring and test instrumentation used to perform tests and calibrations

Procedures are documented where appropriate. All measurements that play a defining role in testing accuracy are based directly or indirectly on reference standards, reference materials, certified reference materials, or other standards or materials having appropriate traceability.

Records are maintained for each standard. These records include, as applicable:

- supplier, grade, batch#
- dates of preparation or verification
- measurement of weights, volumes, time intervals, temperatures, and pressures and related calculations
- relevant processes (e.g., pH adjustment, extraction)
- verification results
- identification of personnel involved

Reagents prepared in the laboratory are labelled to identify substance, concentration, solvent (where not water), any special precautions or hazards, restrictions of use, Lot no., and date of preparation and/or expiry. The person responsible for the preparation of the reagent is identified either from the label or from records.

### 5.6.2 Specific Requirements

#### 5.6.2.1 Calibration

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**Policy:**

The program for calibration of instrumentation is designed and operated to ensure that calibration measurements are traceable to the Système International (SI) units of measurement or NIST.

**Details:**

Traceability of measurement is assured by the use of calibration services, internal and from sources that can demonstrate competence, measurement capability and traceability. The calibration certificates issued by these sources show that there is a link to a primary standard traceable to NIST. The calibration certificates contain the measurement results including the measurement uncertainty and/or a statement of compliance with an identified metrological specification (see also section 5.10.4.2).

Calibration vendors accredited to ISO 17025 are considered competent to provide the appropriate calibration services.

The term “identified metrological specification” means that it must be clear from the calibration certificate against which specification the measurements have been compared with, by including the specification or by giving an unambiguous reference to the specification.

When the terms “international standard” or “national standard” are used in connection with traceability, it is assumed that these standards fulfil the properties of primary standards for the realization of SI units.

Maintain certificates of all reference standards, measuring instrumentation, or certified reference material used in ensuring traceability. Where traceability to national standards of measurement is not applicable, the laboratory provides satisfactory evidence of correlation of results, for example by participation in a suitable program of inter-laboratory comparisons or proficiency testing.

Reference standards, such as thermometers and weights, are traceable to a national or international standard (e.g., NIST).

## 5.6.2.2 Testing

### 5.6.2.2.1

**Policy:**

The requirements given in section 5.6.2.1 apply to measuring and test instrumentation with measuring functions used, unless it has been established that the associated calibration uncertainty contributes little to the total uncertainty of the test result. When this situation

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arises, the laboratory ensures that instrumentation used can provide the accuracy of measurement needed.

**Details:**

The extent to which the requirements in section 5.6.2.1 are followed depends on the relative contribution of calibration uncertainty to the total uncertainty. If calibration is the dominant factor, the requirements are strictly followed. If, however, calibration is not one of the major contributors to the total uncertainty, other ways for providing confidence may be used, as given in section 5.6.2.2.2.

#### 5.6.2.2.2

**Policy:**

Where traceability to SI units of measurement is not possible and/or not relevant, other means for providing confidence in the results are applied such as:

- the use of suitable reference materials certified to give a reliable characterization of the material
- mutual-consent standards or methods which are clearly specified and agreed upon by all parties concerned
- participation in a suitable program of inter-laboratory comparisons or proficiency testing

**Details:**

Reliable characterization involves an estimate of recovery.

The laboratory participates in proficiency testing and/or check sample programs. The list of programs is maintained by the Quality Assurance Officer and includes NYSDOH NELAP, CTDOH Proficiency Program, and NJDEP Office of Quality Assurance for TO-15 air.

## 5.6.3 Reference Standards and Reference Materials

### 5.6.3.1 Reference Standards

**Policy:**

Reference standards are obtained or calibrated by a body that can provide traceability as described in section 5.6.2.1. For our use traceability to NIST is acceptable for most applications. Such reference standards of measurement held by the laboratory are used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

**Details:**



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Reference standards are obtained from the National Institute of Standards and Technology (NIST), if applicable.

### 5.6.3.2 Reference Materials

**Policy:**

Where possible, reference materials are traceable to SI units of measurement, or to certified reference materials. Internal reference materials are checked as far as is technically and economically practicable.

**Details:**

Reference materials, including calibration standards, used in chemical measurement are prepared so that the point of measurement is similar or equivalent to that of the samples. The matrix, prior to the addition of the analyte does not have a detectable concentration of the analyte. Reagents used in the preparation of reference materials, including calibration standards are of certified purity.

### 5.6.3.3 Intermediate Checks

**Policy:**

Checks needed to maintain confidence in the calibration status of reference, primary, transfer or working standards and reference materials are carried out according to defined procedures and schedules.

**Details and Procedures:**

The control check standards (Laboratory Control Samples) used to verify the accuracy of all the other standards are prepared independently from all the other standards used to establish the original calibration. These control check standards are prepared from a separate lot # or second source. It is the responsibility of the Group Leader to establish and maintain the individual schedule for each SOP and/or test method.

### 5.6.3.4 Transport and Storage

**Policy:**

The safe handling, transport, storage and use of reference standards and reference materials in order to prevent contamination or deterioration and in order to protect their integrity are defined.

**Details:**

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Proper conditions are established for housing, handling, and care of reference standards/reference materials. All information needed to properly identify references appears on their housing or containers.

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## 5.7 Sample Handling, Receipt and Initiation of Testing

Laboratory analyses are performed to produce data representative of conditions when the sample was obtained. To provide representative samples for analysis, both field and laboratory personnel must satisfactorily perform their activities. Although the purpose of this manual is to define the laboratory Quality Assurance Program, the interrelationship of field and laboratory operations in maintaining sample integrity is briefly discussed because the effect of field operations upon resulting data quality cannot be totally separated from laboratory operations.

### 5.7.1 CHAIN-OF-CUSTODY

An overriding consideration for resulting data is the ability to demonstrate that the samples have been obtained from the locations stated and that they have reached the laboratory without alteration. Evidence of collection, shipment, laboratory receipt and laboratory custody until disposal must be documented to accomplish this. Documentation is accomplished through a chain-of-custody record that records each sample and the individuals responsible for sample collection, shipment, and receipt.

- A sample is considered in custody if it is:
- In a person's actual possession.
- In view after being in physical possession.
- Secured so that no one can tamper with it after having been in physical custody.
- In a secure area, restricted to authorized personnel.

A chain-of-custody form is used by York personnel when shipping samples to subcontractors. This form is also used by all York's clients when submitting samples procured by the client. York does not accept samples collected by any outside or inside source without a correctly prepared chain-of-custody form.

The chain-of-custody form shall be signed by each individual who has the samples in their possession. Preparation of the chain-of-custody shall be as follows:

- The chain-of-custody record shall be initiated in the field by the person collecting the sample, for every sample. Every sample shall be assigned a unique identification number or name that is entered on the chain-of-custody form. Samples can be grouped for shipment and use a common form. The


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form allows for ten samples per page. If more than ten samples are shipped in the same container, more than one chain-of-custody form is required.

- The record shall be completed in the field to indicate project, sampling location, etc.
- If the person collecting the sample does not transport the samples to the laboratory or deliver the sample containers for shipment, the first block for Relinquished By \_\_\_\_, Received By \_\_\_\_ shall be completed in the field.
- The person transporting the samples to the laboratory or delivering them for shipment shall sign the record form as Relinquished By \_\_\_\_.
- If the samples are shipped to the laboratory by commercial carrier, the chain-of-custody form shall be sealed in a watertight zip-lock bag, placed in the shipping container, and the shipping container sealed prior to giving it to the carrier.
- If the samples are directly transported to the laboratory, the chain-of-custody may be kept in possession of the person delivering the samples.
- For samples shipped by commercial carrier, the waybill shall serve as an extension of the chain-of-custody record between the final field Control Group and receipt in the laboratory.
- Upon receipt in the laboratory, the Sample Control Group, or representative, shall open the shipping containers, compare the contents with the chain-of-custody record, and sign and date the record. Any discrepancies shall be noted on the chain-of-custody form. Discrepancies are immediately discussed with the Lab Manager for resolution.
- Chain-of-custody and any shipping records shall be maintained with the records for a specific project, becoming part of the project file.

#### 5.7.2 FIELD COLLECTION AND SHIPMENT

Prior to collecting samples, the collection team must consider the analyses to be performed so that proper sample containers and shipping containers can be assembled and the proper preservatives added to containers. In addition, field logs and record sheets, chain-of-custody forms, and analysis request records must be assembled.

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All records required for documentation of field collection must be completed by the client field team. Several of the documents that affect laboratory operations are discussed herein. The primary documenting record is the chain-of-custody as discussed above.

In addition to initiating the chain-of-custody form, field personnel are responsible for uniquely identifying (required on the chain-of-custody form) and labeling samples, providing proper preservation, and packaging samples to preclude breakage during transit by York couriers or client shipment.

Every sample shall be labeled to identify:

- Unique sample number (ex. 11F0565-01, -02, etc.)
- Sample Description (such as MW-1, etc.)
- Sampling date and time
- Person obtaining sample
- Container types and methods of sample preservation/conditioning
- Analyses required (e.g., VOC 8260B, etc.)

Samples must be placed in containers compatible with the intended analysis and properly preserved. Also, collection of samples must consider the time interval between acquiring the sample and analysis (holding time) so that the sample is representative. The requirements for various analytical parameters with respect to the type of container, quantity of sample, preservation method, and maximum holding time between collection and analysis, quantity of sample, are dictated by the Federal Register, EPA SW-846 or the specific Quality Assurance Project Plan.

Shipping containers are to be sealed prior to shipment, whether shipped by direct transport by field personnel or commercial carrier. The only exception to this is if sufficient holding time exists so that the samples can be held in the field and it is necessary to re-ice the containers prior to or during transport.

As soon as field personnel are ready to hand off samples from the field to the courier, the courier takes custody of them and transfers them into a cooler containing ice or ice packs sufficient to maintain 2-6°C until arrival at the laboratory. Upon receipt, the temperature (as measured by an infrared temperature probe) and condition of the samples is recorded on the Chain-of-Custody form.

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It is imperative that the analyses requested be clearly provided so that analytical requirements are maintained with respect to sample holding times.

### 5.7.3 LABORATORY SAMPLE RECEIPT

The first step in the laboratory receipt of samples is obtaining the proper information. The information is taken by the Client Service, documented and passed on immediately to the Sample Control. The Sample Control Group shall note that the shipment is expected and notify the Lab Manager, Client Service and Group Leaders when samples are received. This is especially important for RUSH requests where coordination is essential to meet project deadlines. The communication is done via the RUSH NOTIFICATION form.

Upon sample receipt, the Sample Control Group performs the following:

- 5.7.3.1 Examine all samples and determine sample temperature using an Infrared thermometer. This documents that proper temperature has been maintained during shipment (if applicable). Note this on the Chain-of-Custody. If samples have been damaged during shipment, the remaining samples shall be carefully examined to determine whether they were affected. Any samples affected shall be also considered damaged. It will be noted on the chain-of-custody record that specific samples were damaged and that the samples were removed from the sampling program. Field personnel will be notified as soon as possible that samples were damaged and that they must be resampled, or the testing program changed, and an estimate of the cause of damage.
- 5.7.3.2 Compare samples received against those listed on the chain-of-custody. Note any deviations or problems and clarify with the Lab Manager or Client Service.
- 5.7.3.4 Sign and date the chain-of-custody form and attach any shipping receipts to the chain-of-custody.
- 5.7.3.5 Log the project into the lab LIMS system.
- 5.7.3.6 Open a laboratory project number and pendaflex file which will contain:
  - Project identification number
  - Completed Chain-of-Custody record
  - Shipping receipts

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- Any correspondence related to the project
- WORK ORDER which will include:
  - Client Name
  - Client Project ID
  - Lab Sample numbers
  - Client Sample Identifiers
  - Type of samples (matrix)
  - Date received in laboratory
  - Parameters to be analyzed
  - Project Pricing
  - Any special instructions (such as ASP B deliverables, etc.)

If samples collected by Clients arrive without chain-of-custody or incorrect chain-of-custody records, the following shall be done by the Sample Control Group:

If the chain-of-custody is incorrect, a memorandum to the Client Services is prepared stating the inaccuracy and correction in the form of a Corrective Action (CA). The CA must be signed and dated by the person originating the chain-of-custody and the Sample Control Group. The memorandum will serve as an amendment to the chain-of-custody. If the information on the chain-of-custody form cannot be corrected by the Sample Control Group or the field personnel, the samples affected shall be removed from the sampling program.

If the chain-of-custody is not shipped with the samples, the Client personnel shall be contacted and a memorandum prepared which lists the persons involved in collecting, shipping, and receiving the samples and the times, dates, and events. Each person involved must sign and date this memorandum. The complete memorandum will be maintained in lieu of the chain-of-custody.

#### 5.7.4 LABORATORY STORAGE OF SAMPLES

The primary considerations for sample storage are:

- Maintenance of prescribed temperature, if required, which is typically  $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$
- Extracting and/or analyzing samples within the prescribed holding time for the parameters of interest.

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The requirements for temperatures and holding times shall be met. Placing of samples in the proper storage environment is the responsibility of the Sample Control Group, who should notify the Group Leaders if there are any samples which must be analyzed immediately because of holding time requirements. This is accomplished by issuing a RUSH NOTIFICATION FORM.

#### 5.7.5 INITIATION OF TESTING PROGRAM

As stated previously, the chain-of-custody form is prepared by the client and submitted with the samples to the laboratory. If the analytical program is not defined with the sample shipment, Sample Control shall immediately notify the Client Services who will contact the client to determine/clarify the testing program.

The analytical program or any changes requested shall be re-entered onto the original chain-of-custody form, signed and dated. This record serves as the master analytical request form for samples and the clients' authorization to proceed.

Client Services and the Group Leaders are responsible for prioritizing samples on the basis of holding time and required reporting time into the laboratory sample stream.

#### 5.7.6 SAMPLE DISPOSAL

The LIMS allows us to set a sample status for disposal. These records are then maintained on a sample basis in the database. There are several possibilities for sample disposition:

- . The sample may be completely consumed during analysis.
  - . Samples may be returned to the client or location of sampling for disposal.
  - . The samples may be stored after the analysis. Proper environmental control and holding time must be observed if reanalysis is anticipated. If reanalysis is not anticipated, environmental conditions for storage will not be observed.
- The samples may be transferred to proper drums or waste containers for final disposal by licensed waste disposal firms.

The Sample Control Group shall determine disposition of samples if not specified in the project file.



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In general, York will not maintain samples and extracts longer than thirty (30) days beyond completion of analysis, unless otherwise specified.

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## 5.8 Assuring the Quality of Test and Calibration Results

### 5.8.1 Quality Control / Quality Assurance

#### Policy:

Quality control procedures are utilized to monitor the validity of test results. These procedures are for each test method utilized in the laboratory. The resulting data are recorded so that trends are detectable (and where practicable, statistical techniques are applied to the reviewing of the results). This monitoring is planned and reviewed and may include, but not limited to, the following:

- regular use of certified reference materials and/or internal quality control using secondary reference materials
- participation in inter-laboratory comparisons or proficiency testing programs
- replicate tests or calibrations using the same or different methods
- re-testing or re-calibration of retained items
- correlation of results for different characteristics of an item

#### Details:


The methods utilized from the above list will be appropriate for the type and volume of the work undertaken. Records are maintained of assurance activities and any actions taken.

As a guide, for routine analyses the level of internal quality control is typically 5% of the sample throughput. For more complex procedures, 20% is not unusual and on occasions even 50% may be required. For analyses performed infrequently the use of a reference material containing a certified or known concentration of analyte, followed by replicate analyses of the sample and spiked sample is done. For analyses undertaken more frequently, systematic quality control procedures incorporating the use of control charts and check samples are implemented. These procedures are documented in the SOP for each test method.

Internal quality control schemes using statistics include:

- design of experimental/factorial analysis
- variation/regression analysis
- safety evaluation/risk analysis
- tests of significance
- quality control charts
- statistical sampling inspection

Proficiency testing helps to highlight not only repeatability and reproducibility performance between laboratories, but also systematic errors such as bias. It is important to monitor proficiency testing results as a means of checking quality assurance and take action as necessary.

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The Quality Manager maintains a list of all the current proficiency testing programs the laboratory participates in, monitors the results, and notifies the appropriate personnel of both problematic and successful results.

Technical personnel use certified reference materials and reference materials to evaluate test performance on a daily basis and include daily process control checks. These data are used to evaluate the validity of the test results.

Replicate tests may be used if suitable reference material is available. These materials and proficiency test materials are available for improving repeatability.

Re-testing of test items is performed occasionally at the discretion of the supervisor or when test results seem anomalous.

## 5.8.2 Correction and Prevention

### **Policy and Details:**

Quality control data are analyzed and, where they are found to be outside pre-defined criteria, planned action is taken to correct and to prevent incorrect results from being reported.

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## 5.9 Reporting of Results

### 5.9.1 General

**Policy:**

The results of each test or series of tests are reported accurately, clearly, unambiguously and objectively, and in accordance with any specific instructions in the test or calibration methods.

The results are reported, normally in a Technical Report and include all the information requested by the client and necessary for the interpretation of the test results and all information required by the method used or regulatory body reviewing the data. This information may include what is outlined in section 5.9.2, 5.9.3 and 5.9.4.

In the case of tests performed for internal purposes, and in the case of a written agreement with the client, the results may be reported in a simplified way. The information listed in section 5.9.2 to 5.9.4, and not reported, is kept readily available.

**Details:**

Test reports are issued as either hard copy or by electronic data transfer.

### 5.9.2 Test reports

**Policy:**

Test reports (Technical Reports) include the following information, as appropriate:

- a title (e.g., "Technical Report")
- name and address of laboratory, and location where tests were carried out if different from the address of the laboratory
- unique identification of the test report (such as a project no.), and on each page an identification in order to ensure that the page is recognized as a part of the test report, and a clear identification of the end of the test report
- name and address of the client
- identification of the method(s) used
- description, condition, and unambiguous identification of the sample(s) tested
- date of receipt of samples and date(s) of performance of the analyses
- reference to sampling procedures used by the laboratory or other bodies where these are relevant to the validity or application of the results
- test results with, where appropriate, units of measurement
- the name(s), function(s) and signature(s) or equivalent of person(s) authorizing the test report
- a statement to the effect that the results relate only to the items tested

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**Details:**

Signing authority for test reports is the responsibility of the Managing Director. Records for individuals with signing authority for test reports are approved by the Managing Director and maintained by the Quality Assurance Officer.

Hard copies and electronic copies of test reports include the page number and total number of pages.

A statement is included specifying that the test report is not to be reproduced except in full, without written approval of the laboratory. Data reported to the client contains the appropriate significant digits for each test method. Low level data are identified as being below specified limits by utilizing appropriate flags.

## 5.9.3 Test Reports

### 5.9.3.1

**Policy and Details:**

In addition to the requirements listed in section 5.9.2, test reports include the following, where necessary for the interpretation of results:

- deviations from, additions to, or exclusions from the test method
- where relevant, a statement of compliance/non-compliance with requirements and/or specifications
- where applicable, a statement on the estimated uncertainty of measurement of the test result; information on uncertainty is needed in test reports when it is relevant to the validity or application of the test results, when a client's instruction so requires, or when uncertainty affects compliance to a specification limit
- where appropriate and needed opinions and interpretations (see section 5.9.5)
- additional information required by specific methods, clients, or regulatory authorities.

### 5.9.3.2

**Policy and Details:**

In addition to the requirements listed in sections 5.9.2 and 5.9.3.1, test reports containing the results of sampling include the following, where necessary for the interpretation of test results:

- date of sampling
- unambiguous identification of substance, matrix, material sampled

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- details of any environmental condition during sampling that may affect the interpretation of the test results
- any standard or other specification for the sampling method or procedure, and deviations, additions to or exclusions from the specification concerned

## 5.9.5 Opinions and Interpretations

### Policy:

When opinions and interpretations are included in the test report, the basis upon which the opinions and interpretations have been made is documented. Opinions and interpretations are clearly marked as such in the test report.

**Note** - Opinions and interpretations should not be mixed-up with inspections and product certifications as intended in ISO/IEC 17020 and ISO/IEC Guide 65.

### Details:

Opinions and interpretations included in a test report may comprise, but not be limited to the following:

- opinion on conformity of the results with requirements
- fulfilment of contractual requirements
- recommendations on how to use the results
- guidance to be used for improvements

In many cases it is appropriate to communicate the opinions and interpretations by direct dialogue with the client. This dialogue is documented in writing.

## 5.9.6 Test Results Obtained from Subcontractors

### Policy and Details:

Test reports containing the results of tests performed by subcontractors are clearly identified for the subcontracted results. The subcontractor reports the results either in writing or electronically to our laboratory.

## 5.9.7 Electronic Transmission of Results

### Policy:

In the case of transmission of test results by telephone, facsimile or other electronic or electromagnetic means, the requirements of the policies and procedures of this Quality Manual continue to apply (see also 5.4.7).

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**Details:**

Reports that are “published” electronically contain a digital signature.

## 5.9.8 Format of Reports

**Policy:**

The format of reports is designed to accommodate each type of test carried out and to minimize the possibility of misunderstanding or misuse.

**Details:**

The layout of the test report is such that the presentation of the test data facilitates ease of assimilation by the reader.

The headings are standardized as far as possible.

## 5.9.9 Amendments to Reports

**Policy:**

Material amendments to a test report after issue are made only in the form of a further document, or data transfer, which includes the statement “Revision no. \_\_\_\_”. Such amendments meet all the requirements in this Quality Manual.

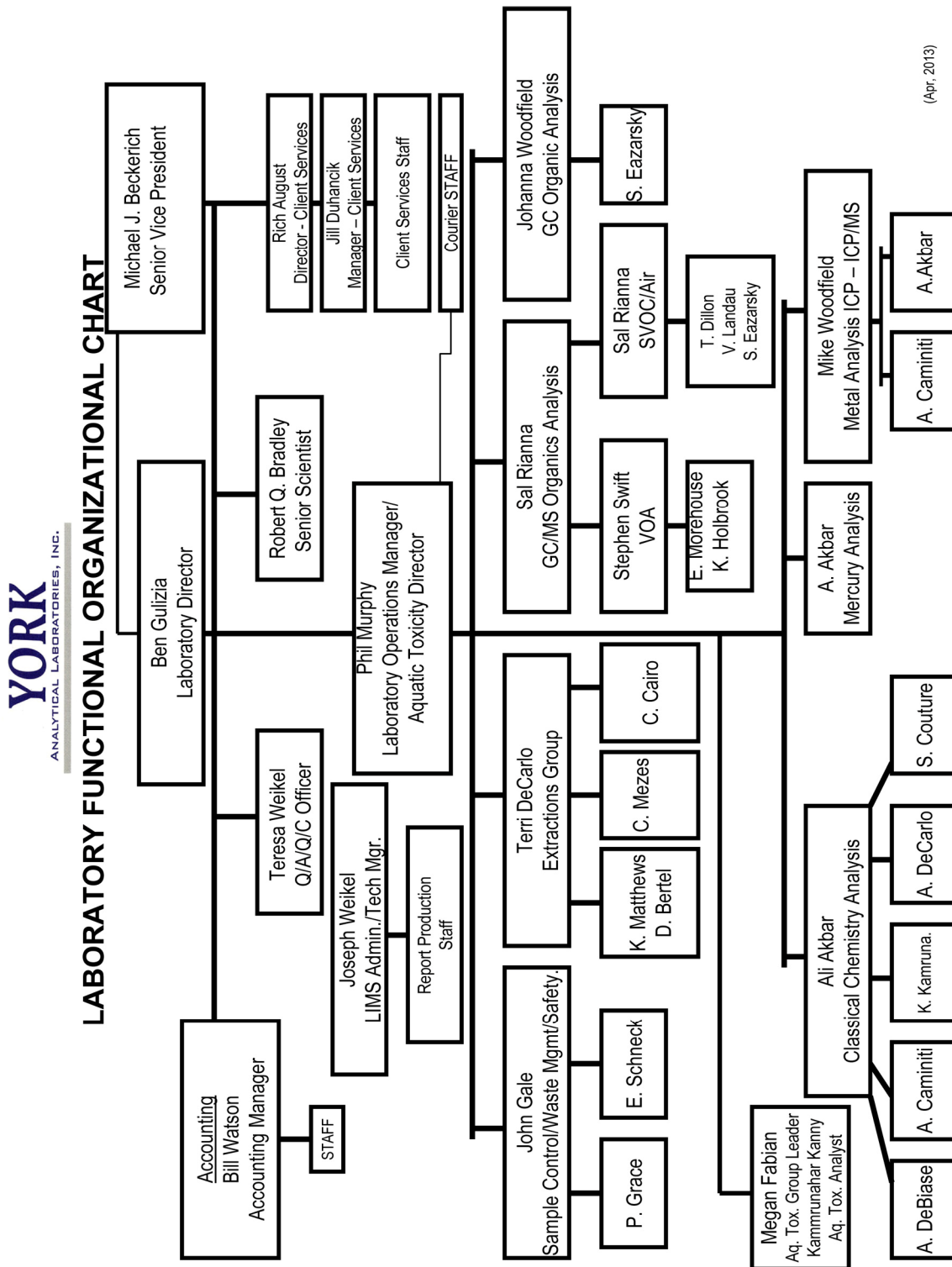
**Details:**

When it is necessary to issue a complete new test report, it is uniquely identified and contains a reference to the original that it replaces.

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**ATTACHMENT A**



(Apr. 2013)



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**ATTACHMENT B**  
**York Analytical Laboratories, Inc**

**MASTER LIST of CONTROLLED DOCUMENTS on 04/01/2013**

Description	SOP No.	Date of Issue	Revision No.	Date of Revision
<b>GC/MS - Air</b>				
1 VOCs in AIR by EPA TO-14A/TO-15	GCMSAIR 111692	11/16/1992	9.2	3/12/2012
2 Cleaning of Summa Canisters	SummaClean111507	11/15/2007	1.0	
3 Calibration of Flow Controllers	FLOWCONT010312	1/3/2012	1.0	
<b>GC/MS - Volatiles</b>				
1 Volatile Organics by GC/MS	GCMSVOC 011700	1/17/2000	2.7	1/9/2012
2 Volatiles in Drinking Water by GC/MS by EPA 524.2	GCMSVOC524.2 011700	1/17/2000	1.9	10/22/2012
3 Soil Sampling by EPA 5035A	GCMSVOC5035060712	6/7/2012	1.0	6/7/2012
<b>GC/MS - Semi-volatiles</b>				
1 Semi-Volatiles using GC/MS by EPA 8270	GCMSSVOC 011700	1/17/2000	2.3	4/4/2012
<b>Gas Chromatography</b>				
1 PCBs using GC/ECD by EPA 8082	GCPCB 011799	1/17/1999	1.5	10/19/2012
2 TPH-DRO Using Solvent Extraction Followed by GC/FID Analysis	TPHDROGC091009	9/10/2009	1.2	11/14/2012
3 Pesticides (Chlorinated) using GC/ECD by EPA 8081	GCPEST011799	1/17/1999	1.4	10/19/2012
4 Herbicides using GC/ECD by EPA 8151	GCHERB011999	1/19/1999	1.3	5/13/2010
5 Organochlorine Pesticides & PCBs in Potable Water using GC/ECD by EPA 505	505GCPEST092010	9/20/2010	1.0	
6 CT-ETPH in Environmental Extracts	GCETPH111704	11/17/2004	1.6	2/29/2012

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<i>Extractions</i>					
1	Preparation/Extraction of Soil Samples for the Analysis of Target Herbicides	EXTSoilherb052600	5/26/2000	1.4	10/22/2012
2	Preparation/Extraction of Aqueous Samples for the Analysis of Target Herbicides	EXTAQHRB052600	5/26/2000	1.2	4/26/2010
3	Extraction of Solid Samples for the Analysis of SVOCs using UltraSonic Extraction	EXTSSVOC052600	5/26/2000	2.1	6/29/2012
4	Extraction of Solid Samples for the Analysis of SVOCs using ASE Extraction	EXTSVOCASE 083106	8/31/2006	1.8	6/29/2012
5	Extraction of Aqueous Samples for Analysis of Semi-Volatile Compounds	EXTAQSVOC052600	5/26/2000	2.4	6/29/2012
6	Extraction of Polyurethane Foam Sampling Media for the Analysis of Target Pesticides and PCBs	EXTSVOCASEPUF043010	4/30/2010	1.0	
7	Extraction Laboratory Glassware Washing Procedure	EXTGP052600	5/26/2000	1.1	4/3/2012
8	Extraction of Solid Samples for Analysis of PCBs using Soxhlet Techniques	EXTPCBSOX102110	10/22/2010	1.0	
9	Extraction of Aqueous and Soil Samples for the Analysis of Massachusetts EPH (MA-EPH)	EXTMAEPHAQASE121207	12/12/2007	2.0	10/22/2009
10	Spike and Surrogate Standard Preparation for Extractables	EXTSVOCStd062912	6/29/2012	1.0	
<i>Metals Analysis/Prep</i>					
1	Analysis of Trace Metals in Environmental Samples using ICP/MS by EPA SW-846 6020 and EPA 200.8	ICPMS 6020 080106	8/1/2006	1.2	11/25/2008
2	Preparation of Standards for Axial ICP Analysis	ICPSTD030495	3/4/1995	1.1	4/7/2000
3	Preparation of Environmental Samples for Trace Metals Analysis by ICP and ICP/MS	METALSPrep030695	3/6/1995	1.2	9/12/2007
4	Analysis of Environmental Sample Digestates Using Axial ICP by EPA SW846 6010B and 200.7	ICP031195	3/11/1995	1.3	9/11/2007
5	Analysis of Trace Metals in Drinking Water Samples using ICP/MS by EPA 200.8	ICPMS200.8080106	8/1/2006	1.0	
6	Digestion and Analysis of Aqueous, Soil, and Sludge Samples for Mercury by Cold Vapor Technique (CV) EPA SW-846 7470 and 7471	Hg 120998	12/10/1998	1.5	10/15/2012
<i>Wet Chemistry/IC</i>					
1	Chemical Oxygen Demand (COD) [SM 5220D]	WC COD 100400	10/4/2000	2.1	9/18/2012
2	TKN, Ammonia and TON [SM 4500-N <sub>org</sub> C, 4500-NH <sub>3</sub> D]	WC TKN 100400	10/4/2000	1.4	9/11/2012

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3	Reactivity-Cyanide [SW-846 Ch 7.3.3]	WC CNR 080800	8/8/2000	1.2	10/16/2012
4	Hexavalent Chromium in Aqueous Samples [SW-846 7196]	WC Cr+6 070900	7/9/2000	1.4	9/11/2012
5	Hexavalent Chromium in Soil Samples [SW-846 7196A, 3060A]	WC Cr+6S 111811	11/18/2011	1.1	9/17/2012
6	Total Cyanide [EPA 335.2]	WC CNT 070900	7/9/2000	1.5	9/17/2012
7	Reactivity-Sulfide [SW-846 Ch 7.3.3]	WC ReacSulf 061296	6/12/1996	1.3	10/19/2012
8	Alkalinity [EPA 310.1]	WC T-Alk 022600	2/26/2000	1.2	10/19/2012
9	Hexane Extractable Material [EPA 1664]	WC HemGrav 110606	11/16/2006	1.5	10/22/2012
10	Ion Chromatography [EPA 300.0]	WC IC 011400	1/14/2000	1.7	12/17/2012
11	Biochemical Oxygen Demand (BOD) [SM 5210B]	WC BOD 011700	1/17/2000	1.4	11/9/2012
12	TSS / VSS in Aqueous Samples [EPA 160.2, 160.4]	WC TSS 040795	4/7/1995	1.3	11/9/2012
13	pH [SW-846 9040C, 9045D]	WC pH 040695	4/6/1995	1.5	10/11/2012
14	T-Phosphorous and Ortho-Phosphate [EPA 365.3, SM 4500]	WC Phos 051000	5/10/2000	1.3	9/22/2012
15	TCLP / SPLP Extraction [SW-846 1311, 1312]	WC TCLPEX 010400	1/4/2000	1.3	10/11/2012
16	Cyanide Amenable to Chlorination [EPA 335.1]	WC CNA 110200	11/4/2000	1.2	9/17/2012
17	Ignitability of Solids	WC IGN 040795	4/7/1995	1.1	4/11/2000
18	Flash Point [SW-846 1010A]	WC FP 040795	4/7/1995	1.4	10/3/2012
19	Methylene Blue Active Substances (MBAS) [SM 5540C]	WC MBAS 042610	4/26/2010	1.1	10/11/2012
20	TS / TDS in Aqueous Samples [SM 2540B, C]	WC TSTDs 042610	4/26/2010	1.1	9/18/2012
21	Color	WC Color 042610	4/26/2010	1.0	
22	Glassware Washing	WC GlassPrep 090299	9/2/1999	2.0	9/2/1999
23	Total Phenols (Low Level) [EPA 420.1]	WC PhenolsLL 102711	10/27/2011	1.3	10/22/2012
24	Total Phenols [EPA 420.1]	WC Phenols 022912	2/29/2012	1.2	10/22/2012

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25	Conductivity [EPA 120.1]	WC Cond 022912	2/29/2012	1.1	10/11/2012
26	Turbidity [EPA 180.1]	WC Turbidity 022912	2/29/2012	1.2	10/11/2012
27	TS, FS, VS and % Moisture in Soil Samples [SM 2540G]	WC TS%M 022912	2/29/2012	1.0	
28	Extractable Organic Halogens in solids [SW-846 9023]	WC EOX 041112	4/11/2012	1.2	11/9/2012
29	Total Organic Carbon in Aqueous Samples [SM 5310C]	WC TOC 041812	4/18/2012	1.1	11/13/2012

<i><b>Aquatic Toxicity</b></i>					
1	Acute Toxicity Test Method for Cyprinodon variegatus by EPA Method 821-R-02-012 / 2004.0	AT ACupV013013	01/30/2013	1.0	01/30/2013
2	Acute Toxicity Test Method for Daphnia pulex by EPA Method 821-R-02-012 / 2021.0	AT DapP013013	01/30/2013	1.0	01/30/2013
3	Acute Toxicity Test Method for Mysidopsis bahia by EPA Method 821-R-02-012 / 2007.0	AT AmysB01313	01/30/2013	1.0	01/30/2013
4	Acute Toxicity Test Method for Pimephales promelas by EPA Method 821-R-02-012/ 2000.0	AT APimP01313	01/30/2013	1.0	01/30/2013
5	Reference Toxicant Test Method using Copper Nitrate Acute- Daphnia pulex EPA Test Method 821-R-02-012/ 2021.0	AT RTADapP012313	01/30/2013	1.0	01/30/2013
6	Reference Toxicant Test Method using Copper Nitrate Acute- Pimephales promelas EPA Test Method 821-R-02-012/ 2000.0	AT RTAPimP013013	01/30/2013	1.0	01/30/2013
7	Reference Toxicant Test Method using Sodium Lauryl Sulfate Acute- Cyprinodon variegatus by EPA Method 821-R-02-012/ 2004.0	AT RTACypV013013	01/30/2013	1.0	01/30/2013
8	Reference Toxicant Test Method using Sodium Lauryl Sulfate Acute- Mysidopsis bahia by EPA Method 821-R-02-012/ 2007.0	AT RTAMysB013013	01/30/2013	1.0	01/30/2013
9	Chronic Toxicity Test Method for Cyprinodon variegatus by EPA Method 821-R-02-014 / 1004.0	AT CCypV013013	01/30/2013	1.0	01/30/2013
10	Chronic Toxicity Test Method for Ceriodaphnia dubia by EPA Method 821-R-02-013 / 1002.0	AT CCer013013	01/30/2013	1.0	01/30/2013
11	Chronic Toxicity Test Method for Mysidopsis bahia by EPA Method 821-R-02-014 1007.0	AT CMysB01313	01/30/2013	1.0	01/30/2013
12	Chronic Toxicity Test Method for Pimephales promelas by EPA Method 821-R-02-013 / 1000.0	AT CPimP01313	01/30/2013	1.0	01/30/2013

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13	Reference Toxicant Test Method using Sodium Chloride Chronic- Ceriodaphnia dubia EPA Test Method 1002.0	AT RTCCer012313	01/30/2013	1.0	01/30/2013
14	Reference Toxicant Test Method using Sodium Chloride Chronic- Pimephales promelas EPA Test Method 1000.0	AT RTCPimP013013	01/30/2013	1.0	01/30/2013
15	Reference Toxicant Test Method using Sodium Lauryl Sulfate Chronic- Cynodon variegatus by EPA Method 821-R-02-014 / 1004.0	AT RTCCypV013013	01/30/2013	1.0	01/30/2013
16	Reference Toxicant Test Method using Sodium Lauryl Sulfate Chronic- Mysidopsis bahia by EPA Method 821-R-02-014 / 1007.0	AT RTCMysB013013	01/30/2013	1.0	01/30/2013

<b>General Laboratory</b>					
1	MDL Studies, Organics	GL MDL 113005	11/30/2005	1.3	3/12/2012
2	Chemical Expiration Dates	GL ExpDt 041812	4/18/2012	1.0	
3	LOQ/LOD Determination and Verification	GL LOQLOD 122812	12/28/2012	1.0	
<b>Sample Control</b>					
1	Sample Control - Sample Receipt, Log-in, Storage, Archival and Disposal	SC011500	1/15/2000	2.1	11/19/2012
2	Sample Collection (drinking water only)	SC 08/09/2000	8/9/2000	1.0	
3	Sample Handling and Chain-of-Custody for Sample Couriers	Couriers091207	9/12/2007	1.0	
<b>Administration</b>					
1	Laboratory Safety and Health	Safety011600	1/16/2000	1.0	
2	Purchasing	ADMINPurchasing 043010	4/18/2012	1.1	
3	QC Review/Evaluation of Data	QC040402	4/4/2002	1.1	4/30/2010
4	Education and Training in Ethics & Legal Responsibilities	Adm040102	4/1/2002	1.1	4/1/2002
5	Training of Personnel	Adm080206	8/6/2006	1.3	1/16/2012
6	Manual Integration of Chromatographic Data	ADMIN Integration 09/11/07	9/11/2007	2.1	2/9/2012

	<b>Quality Manual</b> YORK ANALYTICAL LABORATORIES, INC.		
<b>ATTACHMENTS</b>		<b>Issue date 12/26/2012</b>	

7	Control and Use of Laboratory Notebooks	LABNOTE091107	9/12/2007	1.0	
8	Control of Records	ADMINRECORDS043010	4/30/2010	1.1	11/9/2012
9	Preventive Action	ADMINPREV ACTION043010	4/30/2010	1.0	
10	Control of Nonconforming Work	QSP 4-9-1	4/30/2010	1.0	
11	Management Review	ADMINMGMTREVIEW043010	4/30/2010	1.0	
12	Internal Quality Audit`	ADMINAUDIT043010	4/30/2010	1.0	
13	Estimation of Uncertainty	ADMINESTUNCERT043010	4/30/2010	1.0	
14	Document Control	ADMINDOC043010	4/30/2010	1.2	6/2/2012
15	Corrective Action	ADMINCORRACTION043010	4/30/2010	1.0	
16	Complaints	QSP 4-8-1	4/30/2010	1.0	
17	Review of Chromatographic Data for Detection of Manual Re-Integration Issues	ADMINManINTRReview04302010	4/30/2010	1.0	
18	Additional Policies/Procedures	Additional Policies 05/07/10	5/7/2010	1.1	07/11/2012
19	EDDs and Reports for Client Connect	ADMINEDDRptCC 091610	9/16/2010	1.0	
20	Preparation of CTDEP RCP Deliverables	ADMINRCPDELIVS 080210	8/2/2010	1.0	
<b>Quality Manual</b>					
1	Quality Manual	QM	1/4/1996	2.3	12/26/2012

**ATTACHMENT 3**

**NYSDOH ELAP-CERTIFICATION FOR YORK ANALYTICAL  
LABORATORIES INC.**

NEW YORK STATE DEPARTMENT OF HEALTH  
WADSWORTH CENTER



Expires 12:01 AM April 01, 2014  
Issued April 01, 2013  
Revised October 21, 2013

**CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE**

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

**MR. ROBERT Q. BRADLEY**  
**YORK ANALYTICAL LABORATORIES INC**  
**120 RESEARCH DRIVE**  
**STRATFORD, CT 06615**

**NY Lab Id No: 10854**

*is hereby APPROVED as an Environmental Laboratory in conformance with the  
National Environmental Laboratory Accreditation Conference Standards (2003) for the category  
ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE  
All approved analytes are listed below:*

**Acrylates**

Acrylonitrile	EPA 8260C
Methyl methacrylate	EPA 8260C

**Amines**

1,2-Diphenylhydrazine	EPA 8270D
2-Nitroaniline	EPA 8270D
3-Nitroaniline	EPA 8270D
4-Chloroaniline	EPA 8270D
4-Nitroaniline	EPA 8270D
Aniline	EPA 8270D
Carbazole	EPA 8270D
Diphenylamine	EPA 8270D

**Benzidines**

3,3'-Dichlorobenzidine	EPA 8270D
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**Characteristic Testing**

Corrosivity	EPA 9045D
Ignitability	EPA 1010A
Reactivity	SW-846 Ch7 Sec. 7.3
Synthetic Precipitation Leaching Proc.	EPA 1312
TCLP	EPA 1311

**Chlorinated Hydrocarbon Pesticides**

4,4'-DDD	EPA 8081B
4,4'-DDE	EPA 8081B
4,4'-DDT	EPA 8081B
Aldrin	EPA 8081B

**Chlorinated Hydrocarbon Pesticides**

alpha-BHC	EPA 8081B
alpha-Chlordane	EPA 8081B
Atrazine	EPA 8270D
beta-BHC	EPA 8081B
Chlordane Total	EPA 8081B
delta-BHC	EPA 8081B
Dieldrin	EPA 8081B
Endosulfan I	EPA 8081B
Endosulfan II	EPA 8081B
Endosulfan sulfate	EPA 8081B
Endrin	EPA 8081B
Endrin aldehyde	EPA 8081B
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 8081B
Heptachlor epoxide	EPA 8081B
Lindane	EPA 8081B
Methoxychlor	EPA 8081B
Toxaphene	EPA 8081B

**Chlorinated Hydrocarbons**

1,2,3-Trichlorobenzene	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270D
1,2,4-Trichlorobenzene	EPA 8270D
2-Chloronaphthalene	EPA 8270D
Hexachlorobenzene	EPA 8270D

**Serial No.: 49723**

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**Chlorinated Hydrocarbons**

Hexachlorobutadiene	EPA 8270D
Hexachlorocyclopentadiene	EPA 8270D
Hexachloroethane	EPA 8270D

**Chlorophenoxy Acid Pesticides**

2,4,5-T	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
Dicamba	EPA 8151A

**Haloethers**

4-Bromophenylphenyl ether	EPA 8270D
4-Chlorophenylphenyl ether	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 8270D
Bis(2-chloroethyl)ether	EPA 8270D
Bis(2-chloroisopropyl) ether	EPA 8270D

**Metals I**

Barium, Total	EPA 6010C
	EPA 6020A
Cadmium, Total	EPA 6010C
	EPA 6020A
Calcium, Total	EPA 6010C
Chromium, Total	EPA 6010C
	EPA 6020A
Copper, Total	EPA 6010C
	EPA 6020A

**Metals I**

Iron, Total	EPA 6010C
Lead, Total	EPA 6010C
	EPA 6020A
Magnesium, Total	EPA 6010C
Manganese, Total	EPA 6010C
	EPA 6020A
Nickel, Total	EPA 6010C
	EPA 6020A
Potassium, Total	EPA 6010C
Silver, Total	EPA 6010C
	EPA 6020A
Sodium, Total	EPA 6010C

**Metals II**

Aluminum, Total	EPA 6010C
	EPA 6020A
Antimony, Total	EPA 6010C
	EPA 6020A
Arsenic, Total	EPA 6010C
	EPA 6020A
Beryllium, Total	EPA 6010C
	EPA 6020A
Chromium VI	EPA 7196A
Mercury, Total	EPA 7471B
	EPA 7473
Selenium, Total	EPA 6010C

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**Metals II**

Selenium, Total	EPA 6020A
Vanadium, Total	EPA 6010C
	EPA 6020A
Zinc, Total	EPA 6010C
	EPA 6020A

**Nitrosoamines**

N-Nitrosodimethylamine	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 8270D
N-Nitrosodiphenylamine	EPA 8270D

**Petroleum Hydrocarbons**

Diesel Range Organics	EPA 8015D
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**Phthalate Esters**

Benzyl butyl phthalate	EPA 8270D
Bis(2-ethylhexyl) phthalate	EPA 8270D
Diethyl phthalate	EPA 8270D
Dimethyl phthalate	EPA 8270D
Di-n-butyl phthalate	EPA 8270D
Di-n-octyl phthalate	EPA 8270D

**Polychlorinated Biphenyls**

PCB-1016	EPA 8082A
PCB-1221	EPA 8082A
PCB-1232	EPA 8082A
PCB-1242	EPA 8082A
PCB-1248	EPA 8082A
PCB-1254	EPA 8082A
PCB-1260	EPA 8082A
PCB-1262	EPA 8082A
PCB-1268	EPA 8082A

**Polynuclear Aromatic Hydrocarbons**

Acenaphthene	EPA 8270D
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**Metals III**

Cobalt, Total	EPA 6010C
	EPA 6020A
Molybdenum, Total	EPA 6020A
Thallium, Total	EPA 6010C
	EPA 6020A
Tin, Total	EPA 6020A
Titanium, Total	EPA 6020A

**Miscellaneous**

Boron, Total	EPA 6020A
Cyanide, Total	EPA 9014
Extractable Organic Halides	EPA 9023

**Nitroaromatics and Isophorone**

2,4-Dinitrotoluene	EPA 8270D
2,6-Dinitrotoluene	EPA 8270D
Isophorone	EPA 8270D
Nitrobenzene	EPA 8270D
Pyridine	EPA 8270D

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**Polynuclear Aromatic Hydrocarbons**

Acenaphthylene	EPA 8270D
Anthracene	EPA 8270D
Benzo(a)anthracene	EPA 8270D
Benzo(a)pyrene	EPA 8270D
Benzo(b)fluoranthene	EPA 8270D
Benzo(ghi)perylene	EPA 8270D
Benzo(k)fluoranthene	EPA 8270D
Chrysene	EPA 8270D
Dibenzo(a,h)anthracene	EPA 8270D
Fluoranthene	EPA 8270D
Fluorene	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 8270D
Naphthalene	EPA 8270D
Phenanthrene	EPA 8270D
Pyrene	EPA 8270D

**Priority Pollutant Phenols**

2-Nitrophenol	EPA 8270D
4-Chloro-3-methylphenol	EPA 8270D
4-Methylphenol	EPA 8270D
4-Nitrophenol	EPA 8270D
Pentachlorophenol	EPA 8270D
Phenol	EPA 8270D

**Semi-Volatile Organics**

1,1'-Biphenyl	EPA 8270D
1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
2-Methylnaphthalene	EPA 8270D
Acetophenone	EPA 8270D
Benzaldehyde	EPA 8270D
Benzoic Acid	EPA 8270D
Benzyl alcohol	EPA 8270D
Caprolactam	EPA 8270D
Dibenzofuran	EPA 8270D

**Priority Pollutant Phenols**

2,3,4,6-Tetrachlorophenol	EPA 8270D
2,4,5-Trichlorophenol	EPA 8270D
2,4,6-Trichlorophenol	EPA 8270D
2,4-Dichlorophenol	EPA 8270D
2,4-Dimethylphenol	EPA 8270D
2,4-Dinitrophenol	EPA 8270D
2-Chlorophenol	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 8270D
2-Methylphenol	EPA 8270D

**Volatile Aromatics**

1,2,4-Trichlorobenzene, Volatile	EPA 8260C
1,2-Dichlorobenzene	EPA 8260C
1,3,5-Trimethylbenzene	EPA 8260C
1,3-Dichlorobenzene	EPA 8260C
1,4-Dichlorobenzene	EPA 8260C
2-Chlorotoluene	EPA 8260C

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**Volatile Aromatics**

4-Chlorotoluene	EPA 8260C
Benzene	EPA 8260C
Bromobenzene	EPA 8260C
Chlorobenzene	EPA 8260C
Ethyl benzene	EPA 8260C
Isopropylbenzene	EPA 8260C
Naphthalene, Volatile	EPA 8260C
n-Butylbenzene	EPA 8260C
n-Propylbenzene	EPA 8260C
p-Isopropyltoluene (P-Cymene)	EPA 8260C
sec-Butylbenzene	EPA 8260C
Styrene	EPA 8260C
tert-Butylbenzene	EPA 8260C
Toluene	EPA 8260C
Total Xylenes	EPA 8260C

**Volatile Halocarbons**

1,2-Dibromo-3-chloropropane	EPA 8260C
1,2-Dibromoethane	EPA 8260C
1,2-Dichloroethane	EPA 8260C
1,2-Dichloropropane	EPA 8260C
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260C
2-Chloroethylvinyl ether	EPA 8260C
Bromochloromethane	EPA 8260C
Bromodichloromethane	EPA 8260C
Bromoform	EPA 8260C
Bromomethane	EPA 8260C
Carbon tetrachloride	EPA 8260C
Chloroethane	EPA 8260C
Chloroform	EPA 8260C
Chloromethane	EPA 8260C
cis-1,2-Dichloroethene	EPA 8260C
cis-1,3-Dichloropropene	EPA 8260C
Dibromochloromethane	EPA 8260C
Dibromomethane	EPA 8260C
Dichlorodifluoromethane	EPA 8260C
Hexachlorobutadiene, Volatile	EPA 8260C
Methylene chloride	EPA 8260C
Tetrachloroethene	EPA 8260C
trans-1,2-Dichloroethene	EPA 8260C
trans-1,3-Dichloropropene	EPA 8260C
Trichloroethene	EPA 8260C

**Volatile Halocarbons**

1,1,1,2-Tetrachloroethane	EPA 8260C
1,1,1-Trichloroethane	EPA 8260C
1,1,2,2-Tetrachloroethane	EPA 8260C
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C
1,1,2-Trichloroethane	EPA 8260C
1,1-Dichloroethane	EPA 8260C
1,1-Dichloroethene	EPA 8260C
1,1-Dichloropropene	EPA 8260C
1,2,3-Trichloropropane	EPA 8260C

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ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE  
All approved analytes are listed below:*

**Volatile Halocarbons**

Trichlorofluoromethane	EPA 8260C
Vinyl chloride	EPA 8260C

**Sample Preparation Methods**

EPA 3585
EPA 5035A-H
EPA 5035A-L
EPA 9010C

**Volatile Organics**

1,4-Dioxane	EPA 8260C
2-Butanone (Methylethyl ketone)	EPA 8260C
2-Hexanone	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260C
Acetone	EPA 8260C
Carbon Disulfide	EPA 8260C
Cyclohexane	EPA 8260C
Methyl acetate	EPA 8260C
Methyl cyclohexane	EPA 8260C
Methyl tert-butyl ether	EPA 8260C
tert-butyl alcohol	EPA 8260C
Vinyl acetate	EPA 8260C

**Sample Preparation Methods**

EPA 3005A
EPA 3010A
EPA 3031
EPA 3040A
EPA 3050B
EPA 3060A
EPA 3545A
EPA 3550C
EPA 3580A

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**NEW YORK**

state department of

**HEALTH**

Nirav R. Shah, M.D., M.P.H.  
Commissioner

Sue Kelly  
Executive Deputy Commissioner

LAB ID: 10854

October 21, 2013

MR. ROBERT Q. BRADLEY  
YORK ANALYTICAL LABORATORIES INC  
120 RESEARCH DRIVE  
STRATFORD, CT 06615

Dear Mr. Bradley,

A revised certificate has been generated because of the change(s) listed below.

If the changes to your certification are due to insufficient proficiency tests and/or proficiency test (PT) failures, the expired certificates must be returned to the Environmental Laboratory Approval Program (ELAP) office within 10 days of the date of this letter. In addition, your laboratory must investigate the root cause for any insufficient and/or unsatisfactory proficiency tests.

**In addition, your laboratory must investigate and document the root cause for any insufficient and/or unsatisfactory proficiency tests. If your lab lost accreditation due to two PT failures, you must submit the corrective action response to ELAP for review before accreditation will be re-instated.**

AppCat	Analyte Name Method Name	Comments	Date
SW - NELAC	Titanium, Total EPA 3005A	Raised to Approved	10/17/2013
SW - NELAC	Titanium, Total EPA 3010A	Raised to Approved	10/17/2013
SW - NELAC	Titanium, Total EPA 6020A	Raised to Approved	10/17/2013
SW - NELAC	Titanium, Total EPA 3050B	Raised to Approved	10/17/2013



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**ENVIRONMENTAL ANALYSES POTABLE WATER**  
All approved analytes are listed below:

**Drinking Water Metals I**

Arsenic, Total	EPA 200.8 Rev. 5.4
Barium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Cadmium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Chromium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Copper, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Iron, Total	EPA 200.7 Rev. 4.4
Lead, Total	EPA 200.8 Rev. 5.4
Manganese, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Mercury, Total	EPA 245.1 Rev. 3.0
Selenium, Total	EPA 200.8 Rev. 5.4
Silver, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Zinc, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

**Drinking Water Metals II**

Aluminum, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Antimony, Total	EPA 200.8 Rev. 5.4
Beryllium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

**Drinking Water Metals II**

Molybdenum, Total	EPA 200.8 Rev. 5.4
Nickel, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Thallium, Total	EPA 200.8 Rev. 5.4
Vanadium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

**Drinking Water Metals III**

Calcium, Total	EPA 200.7 Rev. 4.4
Magnesium, Total	EPA 200.7 Rev. 4.4
Potassium, Total	EPA 200.7 Rev. 4.4
Sodium, Total	EPA 200.7 Rev. 4.4

**Drinking Water Non-Metals**

Alkalinity	SM 18-21 2320B (97)
Calcium Hardness	EPA 200.7 Rev. 4.4
Chloride	EPA 300.0 Rev. 2.1
Color	SM 18-21 2120B (01)
Fluoride, Total	EPA 300.0 Rev. 2.1
Nitrate (as N)	EPA 300.0 Rev. 2.1
Nitrite (as N)	EPA 300.0 Rev. 2.1
Orthophosphate (as P)	EPA 300.0 Rev. 2.1
Solids, Total Dissolved	SM 18-21 2540C (97)
Specific Conductance	EPA 120.1 Rev. 1982
Sulfate (as SO <sub>4</sub> )	EPA 300.0 Rev. 2.1

Serial No.: 49896

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NEW YORK STATE DEPARTMENT OF HEALTH  
WADSWORTH CENTER



Expires 12:01 AM April 01, 2014  
Issued April 01, 2013  
Revised December 20, 2013

**CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE**

*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

MR. ROBERT Q. BRADLEY  
YORK ANALYTICAL LABORATORIES INC  
120 RESEARCH DRIVE  
STRATFORD, CT 06615

NY Lab Id No: 10854

is hereby APPROVED as an Environmental Laboratory in conformance with the  
National Environmental Laboratory Accreditation Conference Standards (2003) for the category  
**ENVIRONMENTAL ANALYSES POTABLE WATER**  
All approved analytes are listed below:

**Drinking Water Trihalomethanes**

Bromodichloromethane	EPA 524.2
Bromoform	EPA 524.2
Chloroform	EPA 524.2
Dibromochloromethane	EPA 524.2

**Fuel Additives**

Methyl tert-butyl ether	EPA 524.2
Naphthalene	EPA 524.2

**Volatile Aromatics**

1,2,3-Trichlorobenzene	EPA 524.2
1,2,4-Trichlorobenzene	EPA 524.2
1,2,4-Trimethylbenzene	EPA 524.2
1,2-Dichlorobenzene	EPA 524.2
1,3,5-Trimethylbenzene	EPA 524.2
1,3-Dichlorobenzene	EPA 524.2
1,4-Dichlorobenzene	EPA 524.2
4-Chlorotoluene	EPA 524.2
Benzene	EPA 524.2
Bromobenzene	EPA 524.2
Chlorobenzene	EPA 524.2
Ethyl benzene	EPA 524.2
Hexachlorobutadiene	EPA 524.2
Isopropylbenzene	EPA 524.2
n-Butylbenzene	EPA 524.2
n-Propylbenzene	EPA 524.2
p-Isopropyltoluene (P-Cymene)	EPA 524.2

**Volatile Aromatics**

Styrene	EPA 524.2
tert-Butylbenzene	EPA 524.2
Toluene	EPA 524.2
Total Xylenes	EPA 524.2

**Volatile Halocarbons**

1,1,1,2-Tetrachloroethane	EPA 524.2
1,1,1-Trichloroethane	EPA 524.2
1,1,2,2-Tetrachloroethane	EPA 524.2
1,1,2-Trichloroethane	EPA 524.2
1,1-Dichloroethane	EPA 524.2
1,1-Dichloroethene	EPA 524.2
1,1-Dichloropropene	EPA 524.2
1,2,3-Trichloropropane	EPA 524.2
1,2-Dichloroethane	EPA 524.2
1,2-Dichloropropane	EPA 524.2
1,3-Dichloropropane	EPA 524.2
2,2-Dichloropropane	EPA 524.2
Bromochloromethane	EPA 524.2
Bromomethane	EPA 524.2
Carbon tetrachloride	EPA 524.2
Chloroethane	EPA 524.2
Chloromethane	EPA 524.2
cis-1,2-Dichloroethene	EPA 524.2
cis-1,3-Dichloropropene	EPA 524.2
Dibromomethane	EPA 524.2

Serial No.: 49896

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STRATFORD, CT 06615

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**ENVIRONMENTAL ANALYSES POTABLE WATER**  
All approved analytes are listed below:

**Volatile Halocarbons**

Dichlorodifluoromethane	EPA 524.2
Methylene chloride	EPA 524.2
Tetrachloroethene	EPA 524.2
trans-1,3-Dichloropropene	EPA 524.2
Trichloroethene	EPA 524.2
Trichlorofluoromethane	EPA 524.2
Vinyl chloride	EPA 524.2

STATE OF NEW YORK  
DEPARTMENT OF HEALTH

Serial No.: 49896

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# NEW YORK

state department of

## HEALTH

Nirav R. Shah, M.D., M.P.H.  
Commissioner

Sue Kelly  
Executive Deputy Commissioner

LAB ID: 10854

December 20, 2013

MR. ROBERT Q. BRADLEY  
YORK ANALYTICAL LABORATORIES INC  
120 RESEARCH DRIVE  
STRATFORD, CT 06615

Dear Mr. Bradley,

A revised certificate has been generated because of the change(s) listed below.

If the changes to your certification are due to insufficient proficiency tests and/or proficiency test (PT) failures, the expired certificates must be returned to the Environmental Laboratory Approval Program (ELAP) office within 10 days of the date of this letter. In addition, your laboratory must investigate the root cause for any insufficient and/or unsatisfactory proficiency tests.

**In addition, your laboratory must investigate and document the root cause for any insufficient and/or unsatisfactory proficiency tests. If your lab lost accreditation due to two PT failures, you must submit the corrective action response to ELAP for review before accreditation will be re-instated.**

AppCat	Analyte Name Method Name	Comments	Date
PW - NELAC	trans-1,2-Dichloroethene EPA 524.2	Dropped from Approved	12/05/2013
PW - NELAC	Turbidity EPA 180.1 Rev. 2.0	Dropped from Approved	12/05/2013
PW - NELAC	2-Chlorotoluene EPA 524.2	Dropped from Approved	12/05/2013

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All approved analytes are listed below:*

**Drinking Water Metals I**

Arsenic, Total	EPA 200.8 Rev. 5.4
Barium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Cadmium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Chromium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Copper, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Iron, Total	EPA 200.7 Rev. 4.4
Lead, Total	EPA 200.8 Rev. 5.4
Manganese, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Mercury, Total	EPA 245.1 Rev. 3.0
Selenium, Total	EPA 200.8 Rev. 5.4
Silver, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Zinc, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

**Drinking Water Metals II**

Aluminum, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Antimony, Total	EPA 200.8 Rev. 5.4
Beryllium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

**Drinking Water Metals II**

Molybdenum, Total	EPA 200.8 Rev. 5.4
Nickel, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
Thallium, Total	EPA 200.8 Rev. 5.4
Vanadium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4

**Drinking Water Metals III**

Calcium, Total	EPA 200.7 Rev. 4.4
Magnesium, Total	EPA 200.7 Rev. 4.4
Potassium, Total	EPA 200.7 Rev. 4.4
Sodium, Total	EPA 200.7 Rev. 4.4

**Drinking Water Miscellaneous**

Turbidity	EPA 180.1 Rev. 2.0
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**Drinking Water Non-Metals**

Alkalinity	SM 18-21 2320B (97)
Calcium Hardness	EPA 200.7 Rev. 4.4
Chloride	EPA 300.0 Rev. 2.1
Color	SM 18-21 2120B (01)
Fluoride, Total	EPA 300.0 Rev. 2.1
Nitrate (as N)	EPA 300.0 Rev. 2.1
Nitrite (as N)	EPA 300.0 Rev. 2.1
Orthophosphate (as P)	EPA 300.0 Rev. 2.1
Solids, Total Dissolved	SM 18-21 2540C (97)
Specific Conductance	EPA 120.1 Rev. 1982

Serial No.: 49756

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WADSWORTH CENTER



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120 RESEARCH DRIVE  
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ENVIRONMENTAL ANALYSES POTABLE WATER  
All approved analytes are listed below:*

**Drinking Water Non-Metals**

Sulfate (as SO<sub>4</sub>) EPA 300.0 Rev. 2.1

**Drinking Water Trihalomethanes**

Bromodichloromethane EPA 524.2  
Bromoform EPA 524.2  
Chloroform EPA 524.2  
Dibromochloromethane EPA 524.2

**Fuel Additives**

Methyl tert-butyl ether EPA 524.2  
Naphthalene EPA 524.2

**Volatile Aromatics**

1,2,3-Trichlorobenzene EPA 524.2  
1,2,4-Trichlorobenzene EPA 524.2  
1,2,4-Trimethylbenzene EPA 524.2  
1,2-Dichlorobenzene EPA 524.2  
1,3,5-Trimethylbenzene EPA 524.2  
1,3-Dichlorobenzene EPA 524.2  
1,4-Dichlorobenzene EPA 524.2  
2-Chlorotoluene EPA 524.2  
4-Chlorotoluene EPA 524.2  
Benzene EPA 524.2  
Bromobenzene EPA 524.2  
Chlorobenzene EPA 524.2  
Ethyl benzene EPA 524.2  
Hexachlorobutadiene EPA 524.2

**Volatile Aromatics**

Isopropylbenzene EPA 524.2  
n-Butylbenzene EPA 524.2  
n-Propylbenzene EPA 524.2  
p-Isopropyltoluene (P-Cymene) EPA 524.2  
Styrene EPA 524.2  
tert-Butylbenzene EPA 524.2  
Toluene EPA 524.2  
Total Xylenes EPA 524.2

**Volatile Halocarbons**

1,1,1,2-Tetrachloroethane EPA 524.2  
1,1,1-Trichloroethane EPA 524.2  
1,1,2,2-Tetrachloroethane EPA 524.2  
1,1,2-Trichloroethane EPA 524.2  
1,1-Dichloroethane EPA 524.2  
1,1-Dichloroethene EPA 524.2  
1,1-Dichloropropene EPA 524.2  
1,2,3-Trichloropropane EPA 524.2  
1,2-Dichloroethane EPA 524.2  
1,2-Dichloropropane EPA 524.2  
1,3-Dichloropropane EPA 524.2  
2,2-Dichloropropane EPA 524.2  
Bromochloromethane EPA 524.2  
Bromomethane EPA 524.2  
Carbon tetrachloride EPA 524.2  
Chloroethane EPA 524.2

Serial No.: 49756

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120 RESEARCH DRIVE  
STRATFORD, CT 06615

NY Lab Id No: 10854

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National Environmental Laboratory Accreditation Conference Standards (2003) for the category  
**ENVIRONMENTAL ANALYSES POTABLE WATER**  
All approved analytes are listed below:

**Volatile Halocarbons**

Chloromethane	EPA 524.2
cis-1,2-Dichloroethene	EPA 524.2
cis-1,3-Dichloropropene	EPA 524.2
Dibromomethane	EPA 524.2
Dichlorodifluoromethane	EPA 524.2
Methylene chloride	EPA 524.2
Tetrachloroethene	EPA 524.2
trans-1,2-Dichloroethene	EPA 524.2
trans-1,3-Dichloropropene	EPA 524.2
Trichloroethene	EPA 524.2
Trichlorofluoromethane	EPA 524.2
Vinyl chloride	EPA 524.2

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**ENVIRONMENTAL ANALYSES NON POTABLE WATER**  
All approved analytes are listed below:

**Acrylates**

Acrolein (Propenal)	EPA 624
	EPA 8260C
Acrylonitrile	EPA 624
	EPA 8260C
Methyl methacrylate	EPA 8260C

**Amines**

1,2-Diphenylhydrazine	EPA 8270D
2-Nitroaniline	EPA 8270D
3-Nitroaniline	EPA 8270D
4-Chloroaniline	EPA 8270D
4-Nitroaniline	EPA 8270D
Aniline	EPA 8270D
Carbazole	EPA 625
	EPA 8270D
Pyridine	EPA 625
	EPA 8270D

**Benzidines**

3,3'-Dichlorobenzidine	EPA 625
	EPA 8270D
Benzidine	EPA 625
	EPA 8270D

**Chlorinated Hydrocarbon Pesticides**

4,4'-DDD	EPA 608
	EPA 8081B

**Chlorinated Hydrocarbon Pesticides**

4,4'-DDE	EPA 608
	EPA 8081B
4,4'-DDT	EPA 608
	EPA 8081B
Aldrin	EPA 608
	EPA 8081B
alpha-BHC	EPA 608
	EPA 8081B
alpha-Chlordane	EPA 8081B
beta-BHC	EPA 608
	EPA 8081B
Chlordane Total	EPA 608
	EPA 8081B
delta-BHC	EPA 608
	EPA 8081B
Dieldrin	EPA 608
	EPA 8081B
Endosulfan I	EPA 608
	EPA 8081B
Endosulfan II	EPA 608
	EPA 8081B
Endosulfan sulfate	EPA 608
	EPA 8081B
Endrin	EPA 608
	EPA 8081B
Endrin aldehyde	EPA 608

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**Chlorinated Hydrocarbon Pesticides**

Endrin aldehyde	EPA 8081B
Endrin Ketone	EPA 8081B
gamma-Chlordane	EPA 8081B
Heptachlor	EPA 608
	EPA 8081B
Heptachlor epoxide	EPA 608
	EPA 8081B
Lindane	EPA 608
	EPA 8081B
Methoxychlor	EPA 608
	EPA 8081B
Toxaphene	EPA 608
	EPA 8081B

**Chlorinated Hydrocarbons**

1,2,3-Trichlorobenzene	EPA 8260C
1,2,4,5-Tetrachlorobenzene	EPA 8270D
1,2,4-Trichlorobenzene	EPA 625
	EPA 8270D
2-Chloronaphthalene	EPA 625
	EPA 8270D
Hexachlorobenzene	EPA 625
	EPA 8270D
Hexachlorobutadiene	EPA 625
	EPA 8270D
Hexachlorocyclopentadiene	EPA 625

**Chlorinated Hydrocarbons**

Hexachlorocyclopentadiene	EPA 8270D
Hexachloroethane	EPA 625
	EPA 8270D

**Chlorophenoxy Acid Pesticides**

2,4,5-T	EPA 8151A
2,4,5-TP (Silvex)	EPA 8151A
2,4-D	EPA 8151A
Dicamba	EPA 8151A

**Demand**

Biochemical Oxygen Demand	SM 18-21 5210B (01)
Carbonaceous BOD	SM 18-21 5210B (01)
Chemical Oxygen Demand	SM 18-21 5220D (97)

**Fuel Oxygenates**

Di-isopropyl ether	EPA 8260C
Ethanol	EPA 8260C
Methyl tert-butyl ether	EPA 8260C
tert-amyl alcohol	EPA 8260C
tert-amyl methyl ether (TAME)	EPA 8260C
tert-butyl alcohol	EPA 8260C
tert-butyl ethyl ether (ETBE)	EPA 8260C

**Haloethers**

4-Bromophenylphenyl ether	EPA 625
	EPA 8270D
4-Chlorophenylphenyl ether	EPA 625

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**ENVIRONMENTAL ANALYSES NON POTABLE WATER**

All approved analytes are listed below:

**Haloethers**

4-Chlorophenylphenyl ether	EPA 8270D
Bis(2-chloroethoxy)methane	EPA 625
	EPA 8270D
Bis(2-chloroethyl)ether	EPA 625
	EPA 8270D
Bis(2-chloroisopropyl) ether	EPA 625
	EPA 8270D

**Low Level Polynuclear Aromatics**

Acenaphthene Low Level	EPA 8270D
Acenaphthylene Low Level	EPA 8270D
Anthracene Low Level	EPA 8270D
Benzo(a)anthracene Low Level	EPA 8270D
Benzo(a)pyrene Low Level	EPA 8270D
Benzo(b)fluoranthene Low Level	EPA 8270D
Benzo(g,h,i)perylene Low Level	EPA 8270D
Benzo(k)fluoranthene Low Level	EPA 8270D
Chrysene Low Level	EPA 8270D
Dibenzo(a,h)anthracene Low Level	EPA 8270D
Fluoranthene Low Level	EPA 8270D
Fluorene Low Level	EPA 8270D
Indeno(1,2,3-cd)pyrene Low Level	EPA 8270D
Naphthalene Low Level	EPA 8270D
Phenanthrene Low Level	EPA 8270D
Pyrene Low Level	EPA 8270D

**Mineral**

Alkalinity	SM 18-21 2320B (97)
Calcium Hardness	EPA 200.7 Rev. 4.4
Chloride	EPA 300.0 Rev. 2.1
Fluoride, Total	EPA 300.0 Rev. 2.1
Hardness, Total	EPA 200.7 Rev. 4.4
Sulfate (as SO <sub>4</sub> )	EPA 300.0 Rev. 2.1

**Nitroaromatics and Isophorone**

2,4-Dinitrotoluene	EPA 625
	EPA 8270D
2,6-Dinitrotoluene	EPA 625
	EPA 8270D
Isophorone	EPA 625
	EPA 8270D
Nitrobenzene	EPA 625
	EPA 8270D

**Nitrosoamines**

N-Nitrosodimethylamine	EPA 625
	EPA 8270D
N-Nitrosodi-n-propylamine	EPA 625
	EPA 8270D
N-Nitrosodiphenylamine	EPA 625
	EPA 8270D

**Nutrient**

Ammonia (as N)	SM 19-21 4500-NH <sub>3</sub> D or E (97)
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Nutrient		Polychlorinated Biphenyls	
Kjeldahl Nitrogen, Total	SM 19-21 4500-NH3 D or E (97)	PCB-1016	EPA 8082A
Nitrate (as N)	EPA 300.0 Rev. 2.1	PCB-1221	EPA 608
Nitrite (as N)	EPA 300.0 Rev. 2.1		EPA 8082A
Orthophosphate (as P)	EPA 300.0 Rev. 2.1	PCB-1232	EPA 608
Phosphorus, Total	SM 18-21 4500-P E		EPA 8082A
Organophosphate Pesticides		PCB-1242	EPA 608
Atrazine	EPA 8270D		EPA 8082A
Petroleum Hydrocarbons		PCB-1248	EPA 608
Diesel Range Organics	EPA 8015D		EPA 8082A
Phthalate Esters		PCB-1254	EPA 608
Benzyl butyl phthalate	EPA 625		EPA 8082A
	EPA 8270D	PCB-1260	EPA 608
Bis(2-ethylhexyl) phthalate	EPA 625		EPA 8082A
	EPA 8270D	PCB-1262	EPA 8082A
		PCB-1268	EPA 8082A
Diethyl phthalate	EPA 625	Polynuclear Aromatics	
	EPA 8270D	Acenaphthene	EPA 625
Dimethyl phthalate	EPA 625		EPA 8270D
	EPA 8270D	Acenaphthylene	EPA 625
Di-n-butyl phthalate	EPA 625		EPA 8270D
	EPA 8270D	Anthracene	EPA 625
Di-n-octyl phthalate	EPA 625		EPA 8270D
	EPA 8270D	Benzo(a)anthracene	EPA 625
Polychlorinated Biphenyls			EPA 8270D
PCB-1016	EPA 608	Benzo(a)pyrene	EPA 625

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*Issued in accordance with and pursuant to section 502 Public Health Law of New York State*

MR. ROBERT Q. BRADLEY  
YORK ANALYTICAL LABORATORIES INC  
120 RESEARCH DRIVE  
STRATFORD, CT 06615

NY Lab Id No: 10854

is hereby APPROVED as an Environmental Laboratory in conformance with the  
National Environmental Laboratory Accreditation Conference Standards (2003) for the category  
**ENVIRONMENTAL ANALYSES NON POTABLE WATER**  
All approved analytes are listed below:

**Polynuclear Aromatics**

Benzo(a)pyrene	EPA 8270D
Benzo(b)fluoranthene	EPA 625
	EPA 8270D
Benzo(ghi)perylene	EPA 625
	EPA 8270D
Benzo(k)fluoranthene	EPA 625
	EPA 8270D
Chrysene	EPA 625
	EPA 8270D
Dibenzo(a,h)anthracene	EPA 625
	EPA 8270D
Fluoranthene	EPA 625
	EPA 8270D
Fluorene	EPA 625
	EPA 8270D
Indeno(1,2,3-cd)pyrene	EPA 625
	EPA 8270D
Naphthalene	EPA 625
	EPA 8270D
Phenanthrene	EPA 625
	EPA 8270D
Pyrene	EPA 625
	EPA 8270D

**Priority Pollutant Phenols**

2,3,4,6 Tetrachlorophenol	EPA 8270D
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**Priority Pollutant Phenols**

2,4,5-Trichlorophenol	EPA 625
	EPA 8270D
2,4,6-Trichlorophenol	EPA 625
	EPA 8270D
2,4-Dichlorophenol	EPA 625
	EPA 8270D
2,4-Dimethylphenol	EPA 625
	EPA 8270D
2,4-Dinitrophenol	EPA 625
	EPA 8270D
2-Chlorophenol	EPA 625
	EPA 8270D
2-Methyl-4,6-dinitrophenol	EPA 625
	EPA 8270D
2-Methylphenol	EPA 625
	EPA 8270D
2-Nitrophenol	EPA 625
	EPA 8270D
4-Chloro-3-methylphenol	EPA 625
	EPA 8270D
4-Methylphenol	EPA 625
	EPA 8270D
4-Nitrophenol	EPA 625
	EPA 8270D
Cresols, Total	EPA 8270D
Pentachlorophenol	EPA 625

Serial No.: 49757

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NEW YORK STATE DEPARTMENT OF HEALTH  
WADSWORTH CENTER



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**Priority Pollutant Phenols**

Pentachlorophenol	EPA 8270D
Phenol	EPA 625
	EPA 8270D

**Residue**

Settleable Solids	SM 18-21 2540 F (97)
Solids, Total	SM 18-21 2540B (97)
Solids, Total Dissolved	SM 18-21 2540C (97)
Solids, Total Suspended	SM 18-21 2540D (97)

**Semi-Volatile Organics**

1,1'-Biphenyl	EPA 8270D
1,2-Dichlorobenzene, Semi-volatile	EPA 8270D
1,3-Dichlorobenzene, Semi-volatile	EPA 8270D
1,4-Dichlorobenzene, Semi-volatile	EPA 8270D
2-Methylnaphthalene	EPA 8270D
Acetophenone	EPA 8270D
alpha-Terpineol	EPA 625
Benzaldehyde	EPA 8270D
Benzoic Acid	EPA 8270D
Benzyl alcohol	EPA 8270D
Caprolactam	EPA 8270D
Dibenzofuran	EPA 8270D

**Volatile Aromatics**

1,2,4-Trichlorobenzene, Volatile	EPA 8260C
1,2,4-Trimethylbenzene	EPA 8260C

**Volatile Aromatics**

1,2-Dichlorobenzene	EPA 624
	EPA 8260C
1,3,5-Trimethylbenzene	EPA 8260C
1,3-Dichlorobenzene	EPA 624
	EPA 8260C
1,4-Dichlorobenzene	EPA 624
	EPA 8260C
2-Chlorotoluene	EPA 8260C
4-Chlorotoluene	EPA 8260C
Benzene	EPA 624
	EPA 8260C
Bromobenzene	EPA 8260C
Chlorobenzene	EPA 624
	EPA 8260C
Ethyl benzene	EPA 624
	EPA 8260C
Isopropylbenzene	EPA 8260C
Naphthalene, Volatile	EPA 8260C
n-Butylbenzene	EPA 8260C
n-Propylbenzene	EPA 8260C
p-Isopropyltoluene (P-Cymene)	EPA 8260C
sec-Butylbenzene	EPA 8260C
Styrene	EPA 624
	EPA 8260C
tert-Butylbenzene	EPA 8260C
Toluene	EPA 624

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**Volatile Aromatics**

Toluene	EPA 8260C
Total Xylenes	EPA 624
	EPA 8260C

**Volatile Halocarbons**

1,1,1,2-Tetrachloroethane	EPA 8260C
1,1,1-Trichloroethane	EPA 624
	EPA 8260C
1,1,2,2-Tetrachloroethane	EPA 624
	EPA 8260C
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C
1,1,2-Trichloroethane	EPA 624
	EPA 8260C
1,1-Dichloroethane	EPA 624
	EPA 8260C
1,1-Dichloroethene	EPA 624
	EPA 8260C
1,1-Dichloropropene	EPA 8260C
1,2,3-Trichloropropane	EPA 8260C
1,2-Dibromo-3-chloropropane	EPA 8011
	EPA 8260C
1,2-Dibromoethane	EPA 8011
	EPA 8260C
1,2-Dichloroethane	EPA 624
	EPA 8260C
1,2-Dichloropropane	EPA 624

**Volatile Halocarbons**

1,2-Dichloropropane	EPA 8260C
1,3-Dichloropropane	EPA 8260C
2,2-Dichloropropane	EPA 8260C
2-Chloroethylvinyl ether	EPA 624
	EPA 8260C
Bromochloromethane	EPA 8260C
Bromodichloromethane	EPA 624
	EPA 8260C
Bromoform	EPA 624
	EPA 8260C
Bromomethane	EPA 624
	EPA 8260C
Carbon tetrachloride	EPA 624
	EPA 8260C
Chloroethane	EPA 624
	EPA 8260C
Chloroform	EPA 624
	EPA 8260C
Chloromethane	EPA 624
	EPA 8260C
cis-1,2-Dichloroethene	EPA 624
	EPA 8260C
cis-1,3-Dichloropropene	EPA 624
	EPA 8260C
Dibromochloromethane	EPA 624
	EPA 8260C

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**Volatile Halocarbons**

Dibromomethane	EPA 8260C
Dichlorodifluoromethane	EPA 624
	EPA 8260C
Hexachlorobutadiene, Volatile	EPA 8260C
Methylene chloride	EPA 624
	EPA 8260C
Tetrachloroethene	EPA 624
	EPA 8260C
trans-1,2-Dichloroethene	EPA 624
	EPA 8260C
trans-1,3-Dichloropropene	EPA 624
	EPA 8260C
trans-1,4-Dichloro-2-butene	EPA 8260C
Trichloroethene	EPA 624
	EPA 8260C
Trichlorofluoromethane	EPA 624
	EPA 8260C
Vinyl chloride	EPA 624
	EPA 8260C

**Volatiles Organics**

1,4-Dioxane	EPA 8260C
2-Butanone (Methylethyl ketone)	EPA 8260C
2-Hexanone	EPA 8260C
4-Methyl-2-Pentanone	EPA 8260C
Acetone	EPA 8260C

**Volatiles Organics**

Carbon Disulfide	EPA 8260C
Cyclohexane	EPA 8260C
Methyl acetate	EPA 8260C
Methyl cyclohexane	EPA 8260C
Vinyl acetate	EPA 8260C

**Wastewater Metals I**

Barium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Cadmium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Calcium, Total	EPA 200.7 Rev. 4.4
	EPA 6010C
Chromium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Copper, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A
Iron, Total	EPA 200.7 Rev. 4.4

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**Wastewater Metals I**

Iron, Total	EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Lead, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Magnesium, Total	EPA 200.7 Rev. 4.4 EPA 6010C
Manganese, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Nickel, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Potassium, Total	EPA 200.7 Rev. 4.4 EPA 6010C
Silver, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Sodium, Total	EPA 200.7 Rev. 4.4 EPA 6010C

**Wastewater Metals II**

Aluminum, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Antimony, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Arsenic, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Beryllium, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A
Chromium VI	EPA 7196A SM 20-21 3500-Cr B (01)
Mercury, Total	EPA 245.1 Rev. 3.0 EPA 245.2 Rev. 1974 EPA 7470A EPA 7473
Selenium, Total	EPA 200.7 Rev. 4.4 EPA 200.8 Rev. 5.4 EPA 6010C EPA 6020A

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**Wastewater Metals II**

Vanadium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A

Zinc, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A

**Wastewater Metals III**

Cobalt, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A

Molybdenum, Total	EPA 200.8 Rev. 5.4
	EPA 6020A

Thallium, Total	EPA 200.7 Rev. 4.4
	EPA 200.8 Rev. 5.4
	EPA 6010C
	EPA 6020A

Tin, Total	EPA 200.8 Rev. 5.4
	EPA 6020A

Titanium, Total	EPA 200.8 Rev. 5.4
	EPA 6020A

**Wastewater Miscellaneous**

Boron, Total	EPA 200.8 Rev. 5.4
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**Wastewater Miscellaneous**

Boron, Total	EPA 6020A
Bromide	EPA 300.0 Rev. 2.1
Color	SM 18-21 2120B (01)
Cyanide, Total	SM 18-21 4500-CN E (99)

Oil and Grease Total Recoverable (HEM)	EPA 1664A
Organic Carbon, Total	SM 18-21 5310C (00)
Phenols	EPA 420.1 Rev. 1978
Specific Conductance	EPA 120.1 Rev. 1982
Sulfide (as S)	SM 19-21 4500-S F (00)
Surfactant (MBAS)	SM 18-21 5540C (00)
Turbidity	EPA 180.1 Rev. 2.0

**Sample Preparation Methods**

EPA 3005A
EPA 3010A
EPA 3020A
EPA 3510C
EPA 5030C
SM 18-20 4500-CN C
SM 18-21 4500-N Org B or C (97)
SM 18-21 4500-P b.5

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# NEW YORK

state department of

## HEALTH

Nirav R. Shah, M.D., M.P.H.  
Commissioner

Sue Kelly  
Executive Deputy Commissioner

LAB ID: 10854

November 01, 2013

MR. ROBERT Q. BRADLEY  
YORK ANALYTICAL LABORATORIES INC  
120 RESEARCH DRIVE  
STRATFORD, CT 06615

Dear Mr. Bradley,

A revised certificate has been generated because of the change(s) listed below.

If the changes to your certification are due to insufficient proficiency tests and/or proficiency test (PT) failures, the expired certificates must be returned to the Environmental Laboratory Approval Program (ELAP) office within 10 days of the date of this letter. In addition, your laboratory must investigate the root cause for any insufficient and/or unsatisfactory proficiency tests.

**In addition, your laboratory must investigate and document the root cause for any insufficient and/or unsatisfactory proficiency tests. If your lab lost accreditation due to two PT failures, you must submit the corrective action response to ELAP for review before accreditation will be re-instated.**

AppCat	Analyte Name Method Name	Comments	Date
NW - NELAC	Barium, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Manganese, Total EPA 6020A	Raised to Approved	10/29/2013
NW	Magnesium, Total EPA 200.8 Rev. 5.4	Dropped from Approved	11/01/2013
NW - NELAC	Manganese, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Nickel, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Zinc, Total EPA 6020A	Raised to Approved	10/29/2013
NW - NELAC	Iron, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013



**NEW YORK**

state department of

**HEALTH**Nirav R. Shah, M.D., M.P.H.  
CommissionerSue Kelly  
Executive Deputy Commissioner

AppCat	Analyte Name Method Name	Comments	Date
NW - NELAC	Vanadium, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Aluminum, Total EPA 6020A	Raised to Approved	10/29/2013
NW - NELAC	Iron, Total EPA 6020A	Raised to Approved	10/29/2013
PW - NELAC	1,1,2,2-Tetrachloroethane EPA 524.2	Raised to Approved	10/24/2013
NW - NELAC	Aluminum, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Zinc, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Nickel, Total EPA 6020A	Raised to Approved	10/29/2013
NW - NELAC	Cobalt, Total EPA 6020A	Raised to Approved	10/29/2013
NW - NELAC	Cobalt, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Antimony, Total EPA 6020A	Raised to Approved	10/29/2013
NW - NELAC	Silver, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Silver, Total EPA 6020A	Raised to Approved	10/29/2013
NW - NELAC	Antimony, Total EPA 200.8 Rev. 5.4	Raised to Approved	10/31/2013
NW - NELAC	Barium, Total EPA 6020A	Raised to Approved	10/29/2013
NW - NELAC	Vanadium, Total EPA 6020A	Raised to Approved	10/29/2013

## **ATTACHMENT 4**

### **RESUMES OF KEY PERSONNEL INVOLVED WITH THE PROJECT**

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

Mr. Robbins has over nine (9) years experience in geology and hydrogeology, involving such activities as Phase I Environmental Site Assessments, Phase II Environmental Site Assessments, Subsurface Investigations, Remedial Actions, data acquisition, evaluation and contouring, and geotechnical investigations. Mr. Robbins has performed over 400 Phase I Assessments involving residential through heavy industrial properties and over 200 Subsurface Investigations throughout the United States. Mr. Robbins has also designed and implemented over 20 remediation systems for both public and private sectors.

**Representative Occupational Experience**

- ❑ *Environmental Site Assessments*  
Conducted Phase I and II Environmental Site Assessments, analysis of site investigation reports, identifying contamination locations and sources. Soil, soil-vapor and water sampling, analyzing laboratory results for QA/QC, magnetometer and Ground-Penetrating Radar surveys for locating buried drums and underground storage tanks (USTs), estimating UST and other subsurface leaks, monitoring well logging, Project Management, liability assessments and estimating costs to attain compliance.
- ❑ *Remedial Investigation and Feasibility Studies*  
Oversight/planning of site investigations; data analysis, including statistical analysis and geostatistical contouring utilizing SURFER; performance of feasibility studies, including technology evaluations, alternatives development and evaluation and cost estimations.
- ❑ *Due- Diligence Programs*  
Designed and implemented due-diligence programs (ranging from Phase I Assessment to Comprehensive Hydrogeologic Investigations) to assess environmental liabilities for numerous land development clientele.
- ❑ *Delineation of Chlorinated Organic Plumes*  
Supervised the delineation of a dissolved chlorinated organic plume from underground tank loss. Developed a remedial action program in accordance with New York State regulatory guidelines to abate soil and groundwater contamination.
- ❑ *Remedial Action*  
Prepared numerous Remedial Action Plans. Designed and implemented hydrocarbon and chlorinated solvent remediation systems for soil and groundwater.
- ❑ *Pump Test Aquifer Analysis*  
Conducted several pump tests and pump test analysis and field coordination in relation to dewatering permit requirements for Keyspan Energy and the private sector.

**Employment**

2001 - Present

Vice President, Senior Geologist  
Hydro Tech Environmental Corp., Commack, New York

- |             |  |
|-------------|--|
| 2000 – 2001 | Assistant Director, Professional Services<br>Fenley & Nicol Environmental, Inc., Deer Park, New York |
| 1999 – 2000 | Senior Geologist<br>Fenley & Nicol Environmental, Inc. Deer Park, New York                           |
| 1995 – 1999 | Operations Director<br>Advanced Cleanup Technologies, Inc., Farmingdale, New York                    |
| 1992 – 1995 | Project Geologist<br>Advanced Cleanup Technologies, Inc., Roslyn Heights, New York                   |

#### Education

B.S. Geology, State University of New York at Oneonta, 1991

#### Affiliations and Certifications

- American Institute of Professional Geologists
- American Association of Petroleum Geologists
- Long Island Geologist Organization
- Geological Society of America
- American Standards in Testing Materials – E50 Committee Member
- Environmental Assessment Association
- OSHA 40-Hour & 8-Hour, Supervisor

#### Registrations and Certifications

- Certified Professional Geologist (C.P.G. # 10527)
- Certified Environmental Inspector (C.E.I. # 73383)
- GPR Operator's Course, Geophysical Survey Systems, Inc., 1993.

#### Publications/Presentations

- *A Case Study of the Impact of MTBE on the Investigation and Remediation of a Fuel Oil Release*, National Groundwater Focus Conference MTBE in Groundwater: Assessment, Remediation Technologies & Public Policy, Baltimore, MD June 4-5, 2001.
- *Is MTBE in Fuel Oil? Why MTBE Plays a Major Concern on Long Island*, Long Island Business News, February 2001.

# DONALD C. ANNÉ

## SENIOR CHEMIST

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**EDUCATION:** M.S., Chemical Oceanography, Florida Institute of Technology, 1981  
B.A., Earth Sciences, Millersville University of Pennsylvania, 1975

**SPECIAL TRAINING:** Certified 40-Hour OSHA Health and Safety  
Certified 8-Hour OSHA Supervisory Course  
Ground Water Geochemistry (NWWA)  
Ground Water Pollution and Hydrology (Princeton Associates)  
Quality Assurance Programs for Environmental Monitoring Data  
(Stat-A-Matrix)

**PROFESSIONAL AFFILIATIONS:** American Chemical Society (AFS), 1979-Present

### EXPERIENCE SUMMARY:

Mr. Anné has more than 27 years of environmental chemistry experience specializing in data validation, environmental sampling, analytical methodologies, petroleum fingerprinting, laboratory audits, field sampling audits, and preparing Quality Assurance Project Plans and Quality Assurance Manuals. Mr. Anné's experience includes analytical laboratory work with gas chromatography, atomic absorption, infrared spectrometry and wet chemistry methods.

### PROJECT EXPERIENCE:

#### Quality Assurance/Quality Control of Chemical Data

Mr. Anné has more than 20 years experience as a data validator and quality assurance officer. Mr. Anné has validated data for most EPA Regions and under several independent state programs, including the NYSDEC. He has performed laboratory and field audits as well as written Quality Assurance Project Plans. Mr. Anné has written, reviewed, and initiated laboratory Quality Assurance Manuals for laboratories to maintain their regulatory compliance. Typical project experience includes:

- Senior Chemist responsible for data validation. Reviewed chemical data for several projects under the New Jersey ISRA regulations. The clients included industry and utilities.
- Supervising Environmental Scientist responsible for data validation. Reviewed chemical laboratory data for adherence to QA/QC protocols for several key projects, including National Priorities List sites and RCRA Corrective Actions located in EPA Regions I, II, III, IV, V, and IX. Validated analytical data, outlined problems and actions to be taken, and qualified all affected data. Consulted with project managers on data usability, and recommended corrective actions to support project goals. Responded to comments made by regulators regarding data quality.
- Supervising Environmental Scientist recognized by the New York State Department of Environmental Conservation (NYSDEC) to perform third party data validation. Attended NYSDEC workshop on data validation as part of the requirements set forth by NYSDEC. Performed data validation in support of NYSDEC STARS and ASP programs as well as data in support of the NYSDEC Part 360 Regulations for landfills. Validated data for an Albany area municipal landfill.
- Supervising Environmental Scientist responsible for developing and preparing Quality Assurance Project Plans (QAPPs) for several state and federal Superfund sites and federal RCRA corrective action sites. Negotiated with regulators for the acceptance of the QAPPs. The sites were located throughout the eastern United States.

- Environmental Chemist responsible for developing a laboratory QA/QC program which fulfilled requirements of the EPA and agencies from the States of Texas and Louisiana. Implemented and managed the program throughout DOE's SPR Environmental laboratories. Received verbal commendations from EPA and the Texas Water commission on the QA/QC Program.

### **Environmental Chemistry**

Mr. Anné is experienced in sampling soil, water, air, and wastes in accordance with federal and state guidelines. He has performed field sampling audits and prepared sampling plans for numerous projects in accordance with applicable programmatic requirements. Mr. Anné is familiar with the geochemical aspects of fate and transport of contaminants. Mr. Anné's typical project experience includes:

- Data manager for the Pennwalt Corporation's RCRA Corrective Action RFI Phase I program. The project included quantifying and characterizing soil contamination and hydrogeologic flow systems of 12 SWMUs at a fluorochemicals plant in Thorofare, New Jersey. Validated and prepared QA/QC reports for data generated during the project. Qualified all data in preparation of the final report. Work was performed under the direction of NJDEP.
- Project Chemist in charge of field sampling activities, including coordinating and scheduling all subcontracted laboratory work for more than 25 sites in Connecticut. Trained field teams in sampling techniques for soil, groundwater, and surface water; chain of custody requirements; sampling QA/QC protocols; and analytical requirements. Work was performed under the scrutiny of ConnDEP.
- Field Team Leader for a major hazardous waste drum excavation project. Supervised all field activities including site safety; excavation; removal, sampling, and over packing of drums; staging and sampling of contaminated soil; and preparation of samples. Coordinated excavation and laboratory subcontractors. Work was performed under the scrutiny of ConnDEP.
- Created an environmental monitoring program for the Bryan Mound site of DOE's Strategic Petroleum Reserve for testing ground water and surface water. Developed sampling protocols, frequency of sampling, and lists of target analytes. This program was designed to provide baseline data for pre-spill conditions in the event of a release. The site was under scrutiny by EPA Region V and the Texas Water commission.
- Project Chemist responsible for developing analytical QA/QC program that included sampling and chemical analyses of surface water, groundwater, soil, and sediment matrices as part of a Remedial Investigation/Feasibility Study (RI/FS). The RI/FS involved more than 25 sites throughout the State of Connecticut. Work was under the guidance of ConnDEP.

### **Analytical Chemistry**

Mr. Anné has experience working in both fixed-base and mobile laboratories. His experience includes the use of gas chromatography, atomic absorption spectrometers, infrared spectrometers, and numerous wet chemistry and preparation equipment methods. He has served in the laboratory as an analyst, laboratory advisor, and QA officer. He has interfaced with regulators in the area of analytical chemistry and has experience in petroleum fingerprinting techniques and methods. Typical projects include:

- Performed bench scale experiments for St. Lawrence Zinc in order to obtain the optimum level of Phlotec necessary to treat discharged water to resolve an N.O.V. for the SPDES outfall. The optimum level of Phlotec would precipitate enough dissolved zinc for the water to meet the discharge requirement. Also performed routine analyses of samples after implementing the treatment, to insure that the proper concentration was being used.
- Environmental Chemist in charge of project to design updates for the DOE's laboratories at its SPR facilities. Evaluated IR and FT-IR instrumentation and personal computers to link with existing and future instrumentation. Wrote procedures for the acceptance of an alternative oil & grease method for NPDES permit

monitoring by EPA Region V. Coordinated all site activities necessary for implementing upgrades.

- Environmental Chemist in charge of replacing obsolete total organic carbon (TOC) analyzers for the SPR laboratories. Evaluated state-of-the-art TOC analyzers and recommended replacement TOC analyzer. Negotiated with supplier and wrote technical specification for the bid process required by DOE. Supervised installation and set-up of all new TOC analyzers.
- Analytical Chemist for Berkley Products Company responsible for product development. Analyzed competitor's products and formulated new coatings with equal or better quality. Responsible for solvent operations which included managing the waste solvent recovery operations, solvent formulation, and manufacturing QA/QC. Worked with sales and manufacturing staff to address and resolve client complaints. Received two cash bonuses for suggestions on the manufacture of products which saved the company money.
- Analytical Chemist for the mobile laboratory responsible for sample preparation in support of several projects for a range of clients located in three EPA regions and in conjunction with several state agencies. Extracted, concentrated, and prepared water and soil samples for analyses by GC/FIND, GC/ECD, GC/PID, and GC/MS. Samples were prepared for PCB, pesticide, polynuclear aromatic hydrocarbon, and petroleum hydrocarbon analyses.

**EMPLOYMENT:**

2005- present, Alpha Geoscience  
1998-2005, Alpha Environmental Consultants, Inc.  
1990-1998, McLaren/Hart  
1986-1990, Fred C. Hart Associates  
1985-1986, Boeing Petroleum Services  
1982-1985, Petroleum Operations and Support Services  
1981-1982, Dravo Utility Constructors  
1979-1981, Florida Institute of Technology  
1975-1979, Berkley Products Company

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***Teresa V. Weikel***  
***Quality Assurance Officer***

***As an analytical chemist, Ms. Weikel has had over 10 years of experience in environmental laboratories with specialized expertise in Organics Analysis including organic extractions, Gas Chromatography/Mass Spectrometry and Gas Chromatography methods. She also experienced in metals analysis by ICP, and classical chemistry methods. She has also been heavily involved with QA/QC protocols for all disciplines in the Laboratory. She is fully versed in all NELAC(TNI) and ISO-17025 protocols for Quality Systems.***

In the capacities of Chemist and Senior Chemist at various environmental testing laboratories, she performed and was frequently solely responsible for a wide variety of both organic and inorganic analyses and extractions in varying environmental matrices following EPA, WA State and occasional self-designed methods.

In addition to chemist responsibilities, Ms. Weikel also was responsible for setup and use of specific programs and appropriate record keeping for various government/state certifications, organization and delegation of incoming laboratory work and as a Quality Control Specialist at a biotechnology company, she wrote raw material specifications and standard operating procedures according to FDA document traceability standards.

She has had QA specific training on Internal Audit Procedures and Understanding and Implementing ISO-17025 in laboratories. She is familiar with the requirements of the NELAC 2003 standard.

At York, she holds full responsibility for the in-house Quality Systems.

Her current responsibilities focus on quality systems monitoring and implementation, technical training, data review, SOP preparation and revision, new procedure review and approval, data package review, and ethics training.

**Education:** B.S. Chemistry, Pacific Lutheran University

Tacoma, WA



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## FORM I

### PREVENTIVE MAINTENANCE – LABORATORY EQUIPMENT

Instrument	Activity	Frequency
Gas Chromatographs	Clean injector for capillary column Replace injector septum Check carrier gas connections/filters Check filter flow controller Inspect / replace capillary columns Replace detector due to excessive signal Replace Injection port liner	Weekly Daily As Required As Required As Required As Required Daily
Mass Spectrometers (MS)	Inspect/replace mass analyzer assembly Clean quadruple mass analyzer Replace electron multiplier Inspect/change oil for vacuum pumps Inspect turbomolecular or Diffusion pump Clean vacuum system filter (if equipped) Clean ion source/Retune	As Required Annually As Required Annually Every 3 months Weekly As Required
Mercury Cold Vapor Analyzer	Replace tubing Replace Purge bottle Replace Cell	Monthly Monthly As-needed
Ion Chromatographs (anions)	Replace or flush guard column Replace Analytical Column Perform annual PM servicing of parts	Every 6 months Every 6 months Every 12 months
ICP (Inductively Coupled Plasma), and ICP/MS	Check tubing, waste and gas flow Replace tubing/Empty waste container Change coolant water Check air filters/Change air filters Clean/replace torch Check and clean filters Clean nebulizer chamber area/Replace	Daily Daily Daily Every 2/6 months As needed Every 6 months As needed

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FORM J

CALIBRATION AND CORRECTIVE ACTION – LABORATORY INSTRUMENTATION

Instrument/Analysis	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref. *
<b>GC/MS-Volatiles</b> Including Air	BFB Tuning	Every 12 hours, if necessary	Per Method 8260 and EPA TO-15 for AIR	Perform instrument maintenance, retune instrument	1a, 1b
	Initial Calibration (minimum of 5 standards)	Startup, CCC failure, LCS failure, major maintenance	Low STD @ 0.5 ppb for water, 5.0 ppb for soil $\leq 15\%$ Average RSD or " $r$ " $\geq 0.99$ $CCC \leq 30\%$ and RSD or " $r$ " $\geq 0.99$ Contains all target analytes, min. $R_f \geq 0.05$ If regression used curve must not be forced through origin	Recalibrate as required by method (1) if any of CCC %RSDs or if any one of CCC " $r$ " $< 0.990$ or (2) if $> 20\%$ of remaining analytes have %RSD $> 30$ or " $r$ " $< 0.990$ .	
	Initial Calib. Verification	After initial calibration	All compounds 80-120%; 20% of compounds can be outside of range; no compounds $< 65\%$ $> 135\%$ .	Recalibrate	
	Continuing Calibration Check (CCC)	Every 12 hours prior to analysis of samples	Concentration level near midpoint of curve Contain all target analytes Percent difference must be $\leq 20\%$ for CCC and $\leq 30\%$ for other compounds.	Recalibrate as required by method (1) If %D of any CCC $> 20\%$ (2) If %D of $> 10\%$ of other analytes $> 30\%$	
	Method Blanks	Every 20 samples prior to running samples and after calibration STDs	Matrix and preservative specific Target analytes should be $< RL$ except common contaminants laboratory contaminants. If not, note in narrative.	Locate the source of contamination, correct problem, reanalyze method blank	

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Instrument/Analysis	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref. *
<b>GC/MS-Volatiles</b>	Laboratory Control Samples (LCS)	Every 20 field samples	Prepared using a std source different than initial calibration Concentration level near midpoint of curve Contain representative target analytes Matrix specific Laboratory determined recoveries must be between 70-130% for all compounds-narrative for outliers Can also be used as Cont. Cal. Verification. Up to 10% outside of range acceptable as long as within 40-160%.	Recalculate the percent recoveries, reanalyze the LCS, locate source of problem, reanalyze associated sample	1a
	Surrogates	Minimum of three at retention times across the GC run	Response must be 70-130% of the initial calibration response. Retention times must be +/- 30 seconds of initial calibration retention time	If surrogate outside lab control limits, rerun except when: (1) obvious interference documented by re-run (2) No targets detected	
	Internal Stds	3 must be used	Response must be > ½ the corres. Area in the CCC or 2x that area.		

Instrument/Analysis	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref. *
<b>GC/MS-Semi-Volatiles</b>	DFTPP Tune	Every 12 hours	Per SW-846 Method 8270C	Perform instrument maintenance, retune instrument Recalibrate as required by method.	2a, 2b, 2c, 2d
	Initial Calibration (minimum of 5 standards)	Startup, CCC failure, LCS failure, major maintenance	Low STD @ 5.0 ug/ml SCAN; 0.05 ug/ml SIM 1) Minimum of 5 standards. 2) Full Scan % RSD $\leq 15$ or "r" $\geq 0.990$ for all compounds except CCC's, which must be $\leq 30\%$ RSD or "r" $\geq 0.990$ ; <u>SIM % RSD <math>\leq 30</math> or "r" <math>\geq 0.990</math></u> 3) Must contain all target analytes 4) If SIM is used, laboratory must monitor at least two ions/analyte for all targets, surrogates, and IS's. 5) Minimum RF for all compounds $> 0.05$ .	(1) If any CCC RSD $> 20\%$ or "r" $< 0.99$ (2) If $> 20\%$ of remaining analytes have a RSD $> 30\%$ or "r" $< 0.99$	
	Initial Calib. Verification	After Initial Calib.	1) Compounds must recover within 80-120% 2) Laboratories are allowed to have 20% of compounds out, as long as all compounds within recover 65-135%	Recalibrate system	
	Continuing Calibration Check (CCC)	Every 12 hours prior to analysis of samples	1) Contain all target analytes 2) Percent difference must be $\leq 20\%$ for CCC and $\leq 30\%$ for other compounds.	Recalibrate system	
	Method Blanks	Every 20 samples prior to running samples and after calibration STDs	Matrix specific Target analytes should be $< RL$ except common phthalates, which can be $\leq 3 \times RL$ 1) Every 20 samples or each batch, whichever is more frequent. 2) Concentration level must be near or at the mid-point of the initial calibration. 3) Must contain all target analytes 4) Matrix and preservative specific 5) Laboratory determined percent recovery limits must be between 40-140% for base-neutrals and 30-130% for acid compounds. RPD $\leq 20$ for waters and $\leq 30$ for soils	Locate the source of contamination, correct problem, reextract and reanalyze method blank  Re-extract LCS and samples if $> 20\%$ compounds outside acceptance criteria  For Site Specific MS/MSD note outliers in narrative.	
	Lab Control Sample (LCS) and MS/MSD	One per Extraction batch of $\leq 20$ samples Per matrix			

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Instrument/Analysis	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref. *
<b>GC/ECD Pesticides</b>	Endrin/DDT Breakdown	At beginning of each 12 hour clock	≤ 15% breakdown for each	Perform corrective action on injection port	3a, 2b, 2c, 2d
	Initial Calibration	Startup, CCC failure, LCS failure, major maintenance	1) Minimum of 5 stds for single response pesticides. 2) Low std at RL 3) % RSD must be ≤20% or if linear regression used “r” ≥ 0.990 4) For multi-response pesticides analysis of single std at mid-point of calibration range. 5) If curves are used, curve must NOT be forced through origin. Section 7.5 6) Curves must be verified with independent ICV prior to sample analysis.	Recalibrate after corrective action on injection port or column	
	Continuing Calibration Verification	Prior to samples, every 12-hours or 20 samples, whichever is more frequent, and at the end of the analytical sequence.	Percent difference or drift ≤15%. Verify all analytes fall in retention time windows.	1) Perform instrument maintenance, reanalyze CCAL and/or recalibrate. 2) Reanalyze associated samples if beginning or closing CCAL exhibited low response and associated pesticides not detected in samples. 3) Reanalyze associated samples if beginning or closing CCAL high and associated pesticides were detected in samples.	
	Method Blank	1) Extracted every 20 samples or every batch, whichever is greater. 2) Matrix specific	All target analytes < RL	Locate source of contamination and correct problem. Reanalyze method blank. Re-extract samples if method blank contamination found.	

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Instrument/Analysis	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref. *
<b>GC/ECD Pesticides</b>	Laboratory Control Sample (LCS)	1) Extracted every 20 samples or every batch, whichever is greater. 2) Matrix specific 3) Standard source different from initial calibration source. 4) Concentration level must be near or at the mid-point of the initial calibration. 5) Must contain all single response pesticides.	Laboratory determined percent recovery limits must be between 40-140% except for difficult analytes, which must be between 30-140% recovery.	Reanalyze the LCS If MS/MSD in same batch compare to determine if problem isolated to LCS Re-extract LCS and samples if >10% compounds outside acceptance criteria and no MS/MSD with acceptable criteria Locate & correct problem, reanalyze associated samples	3a, 2b, 2c, 2d
	Site Specific Matrix Spike/Matrix Spike Duplicate	1) Every 20 samples per matrix* 2) Spike concentration in lower part of calibration curve. 3) Must contain all single response pesticides.	Laboratory determined percent recovery limits must be between 30-150% RPD's $\leq$ 30% for single response pesticides.	If compounds out compare to LCS; if LCS recoveries in note in narrative.	
	Surrogates	Minimum of two compounds across retention times of GC run. Recommended compounds Tetrachloro-m-xylene and decachlorobiphenyl.	Recovery limits lab generated and within 30-150% for both compounds on both columns.	1)Note exceedances in narrative. 2) If re-extraction or reanalysis confirms matrix interference or if re-extraction outside holding times report all results. 3) If re-extraction or reanalysis results in criteria and in holding time, report only compliant data.	

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Instrument/Analysis	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref. *
GC/ECD PCBs	Initial Calibration	Startup, CCC failure, LCS failure, major maintenance	1) Minimum of 5 stds (Note 1) 2) Low std at or below reporting limit 3) % RSD must be $\leq 20\%$ or if linear regression used " $r$ " $\geq 0.990$ 4) 5-point cal for PCB-1016/1260. Single point for other Aroclors at mid-point within 12-hrs of sample analysis. If congeners are determined, must use 5-point for each congener. 5) If curves are used, curve must NOT be forced through origin. 6) Curves must be verified with independent ICV prior to sample analysis.	Recalibrate after corrective action on injection port or column	4a, 2b, 2c, 2d
	Continuing Calibration Verification	1) Prior to samples, every 12-hours or 20 samples, whichever is more frequent, and at the end of the analytical sequence. 2) Concentration near mid-point of curve using AR-1016/1260. Congeners; CCAL must include all congeners	Percent difference or drift $\leq 15\%$ . Verify all analytes fall in retention time windows.	1) Perform instrument maintenance, reanalyze CCAL and/or recalibrate. 2) Reanalyze associated samples if beginning or closing CCAL exhibited low response and associated pesticides not detected in samples. 3) Reanalyze associated samples if beginning or closing CCAL high and associated pesticides were detected in samples.	
	Method Blank	1) Extracted every 20 samples or every batch, whichever is greater. 2) Matrix specific	All target PCBs < RL	Locate source of contamination and correct problem. Reanalyze method blank. Re-extract samples if method blank contamination found.	

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Instrument/Analysis	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref. *
GC/ECD PCBs	Laboratory Control Sample (LCS)	1) Extracted every 20 samples or every batch, whichever is greater. 2) Matrix specific 3) Standard source different from initial calibration source. 4) Concentration level must be near or at the mid-point of the initial calibration. 5) Must contain all single response pesticides.	Laboratory determined percent recovery limits must be between 40-140%	1) Report non-conformances in case narrative. 2) If re-extraction performed within holding time, report only compliant data. If re-extraction performed outside holding time report all data.	4a, 2b, 2c, 2d
	Site Specific Matrix Spike/Matrix Spike Duplicate	1) Every 20 samples per matrix* 2) Spike concentration in middle of calibration curve. 3) Must contain PCB 1016/1260	Laboratory determined percent recovery limits must be between 40-140% RPD's $\leq$ 50% for PCB.	If compounds out compare to LCS; if LCS recoveries in note in narrative.	
	Surrogates	Minimum of two compounds across retention times of GC run. Recommended compounds Tetrachloro-m-xylene and decachlorobiphenyl.	Recovery limits lab generated and within 30-150% for both compounds on both columns.	1) Note exceedances in narrative. 2) If re-extraction or reanalysis confirms matrix interference or if re-extraction outside holding times report all results. 3) If re-extraction or reanalysis results in criteria and in holding time, report only compliant data.	



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Instrument/Analysis	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref. *
<b>ICP or ICP/MS Metals</b>	Initial Calibration	1) Daily following instrument profiling and prior to sample analysis. 2) Minimum of calibration blank plus one standard.	Per instrument manufacturer's specification	Recalibrate system	5a,5c
	Initial Calibration Verification (ICV)	1) Daily immediately after calibration and prior to sample analysis. 2) 2 <sup>nd</sup> source standard	ICV $\pm 10\%$ of true value. Must use at least two replicates with RPD $< 5\%$	Re-calibrate/Re-analyze ICV as required by method.	
	Initial Calibration Blank (ICB)	1) Daily immediately after ICV. 2) Matrix matched with standards and samples.	$< \text{Reporting Limit}$	Re-calibrate/Re-analyze ICB as required by method.	
	Low Level Calibration Check Standard	1) Daily prior to sample analysis 2) Std concentration $\leq$ RL for all analytes	Recovery $\pm 30\%$ of true value except for antimony, arsenic, cobalt, and thallium which have a $\pm 50\%$ limit	Recalibrate/Explain in Narrative	
	Continuing Calibration Verification (CCV)	1) Every 10 samples and at end of analytical sequence. 2) Can be same source or second source.	Recovery $\pm 10\%$ of true value, Must use at least two replicates with RPD $< 5\%$	Recalibrate and rerun all samples run after non-compliant CCV	
	Continuing Calibration Blank (CCB)	1) Every 10 samples immediately after CCV. 2) ) Matrix matched with standards and samples.	$< \text{Reporting limit}$	Recalibrate/Re-analyze all samples since last compliant CCV	

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Instrument/Analysis	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref. *
<b>ICP or ICP/MS Metals</b>	Interference Check Standards (ICSA & ICSAB)	1) Daily prior to sample analysis and at the end of the analytical sequence. 2) ICSA and ICSAB containing known amounts of analytes and/or interferences per method.	Recoveries for all analytes $\pm 20\%$ of true value or 2x the RL, whichever is greater. If analyte not present, its true value is zero.	May require adjustment of interelement, correction factors, background correction and/or linear ranges	5a,5c
	Method Blanks	1) Digested every 20 or every batch, whichever is greater. If no digestion, ICB = blank 2) Matrix specific and matrix matched	Target analytes must be $<RL$	Locate source of contamination and correct problem. Reanalyze method blank. Reprepare samples unless all analyte concentration $>10x$ method blank level	
	Laboratory Control Sample (LCS)	1) Every 20 samples or each batch, whichever is more frequent. If samples not digested, ICV = LCS 2) Matrix specific (solid, aqueous, etc)	LCS recoveries $\pm 20\%$ for aqueous media and within vendor control (95% confidence limits) for solids.	Redigest and reanalyze all samples.	
	Site Specific Matrix Spike	Every 20 samples or batch per matrix	Percent recovery limits must be between 75-125%.	If recoveries $>30\%$ and LCS in limits note in narrative If MS recoveries $<30\%$ , reprepare and reanalyze samples	
	Site Specific Matrix Duplicate	Every 20 samples or batch per matrix*	For aqueous samples, if concentration $>5x$ the RL, RPD $<20\%$ . If concentration $<5x$ RL, difference $\pm RL$ . 3) For solids if conc $>5x$ RL, RPD $<35\%$ . If conc. $<5x$ RL, difference $\pm 2x$ RL	If LCS in criteria, narrate outliers	

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Instrument/Analysis	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref. *
<b>Cold Vapor Mercury</b>	Initial Calibration	1) Daily prior to sample analysis. 2) Minimum of calibration blank plus five calibration standards.	Linear curve with “r” $\geq 0.995$ . Can use second order fit if “r” $\geq 0.995$ .	Re-optimize instrument and recalibrate as necessary.	6a
	Initial Calibration Verification (ICV)	1) Daily immediately after calibration and prior to sample analysis. 2) 2 <sup>nd</sup> source std	ICV $\pm 10\%$ of true value.	Re-calibrate/Re-analyze ICV as required by method.	
	Initial Calibration Blank (ICB)	1) Daily immediately after ICV. 2) Matrix matched with standards and samples.	ICB must be < RL	Recalibrate/Narrate	
	Continuing Calibration Verification (CCV)	1) Every 10 samples and at end of analytical sequence. 2) Can be same source or second source.	$\pm 20\%$ of true value	Recalibrate/Re-analyze all samples since last compliant CCV	
	Continuing Calibration Blank (CCB)	1) Every 10 samples immediately after CCV. 2) ) Matrix matched with standards and samples.	CCB must be < RL	Recalibrate/Re-analyze all samples since last compliant CCV, Narrate outliers	
	Method Blanks	1) Digested every 20 or every batch, whichever is greater. 2) Matrix specific and matrix matched	Mercury < RL	Report non-conformances in case narrative. Reprepare samples unless all analyte concentration >10x method blank level	

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<b>Cold Vapor Mercury</b>	Laboratory Control Sample (LCS)	1) Every 20 samples or each batch, whichever is more frequent 2) Standard source can be initial calibration source. 3) Matrix specific (solid, aqueous, etc).	1) Every 20 samples or each batch, whichever is more frequent 2) Standard source can be initial calibration source. 3) Matrix specific (solid, aqueous, etc).	Redigest and reanalyze all samples	6a
	Site Specific Matrix Spike	Every 20 samples or batch per matrix	Percent recovery limits must be between 75-125%.	If recoveries >30% and LCS in limits note in narrative If MS recoveries <30%, reprepare and reanalyze samples	
	Site Specific Matrix Duplicate	Every 20 samples or batch per matrix	1) For aqueous samples RPD $\pm$ 20% if conc. >5x the RL. If conc. < 5x RL, the limit is $\pm$ RL 2) For solids RPD $\pm$ 35% if conc >5x the RL. If conc. < 5x the RL, limit is $\pm$ the RL.	If LCS in criteria, narrate outliers.	

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Instrument/Analysis	Activity	Frequency	Acceptance Criteria	Corrective Action	SOP Ref. *
<b>Ion Chromatograph Anions (Nitrite/Nitrate)</b>	Initial Calibration	1) As needed when operation dictates 2) Minimum of five calibration standards.	Linear curve with "r" $\geq 0.990$ and RSD < 15	Re-optimize instrument and recalibrate as necessary.	7a
	Initial Calibration Verification (ICV)	1) Daily immediately after calibration and prior to sample analysis. 2) 2 <sup>nd</sup> source std	ICV $\pm 10\%$ of true value.	Re-calibrate/Re-analyze ICV as required by method.	
	Initial Calibration Blank (ICB)	1) Daily immediately after ICV.	ICB must be < RL	Recalibrate/Narrate	
	Continuing Calibration Verification (CCV)	1) Every 10 samples and at end of analytical sequence. 2) Can be same source or second source.	$\pm 10\%$ of true value	Recalibrate/Re-analyze all samples since last compliant CCV	
	Continuing Calibration Blank (CCB)	1) Every 10 samples immediately after CCV.	CCB must be < RL	Recalibrate/Re-analyze all samples since last compliant CCV, Narrate outliers	
	Lab Control Sample(LCS)	One per 20 samples	Must revocer within mfg. limits	Rerun, if still out, recalibrate.	
	Matrix Spikes	One per 20 samples	Recovery 90-110%	Narrate outliers	
	Matrix Duplicates	One per 20 samples	RPD < 15% for results > 10x RL	Narrate outliers	

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## Standard Operating Procedure Cross Reference

Analysis/Method	YORK SOP Number-AQUEOUS/Air	YORK SOP Number-SOILS	Table Reference
Volatile Organics 8260	GCMSVOC011700 Rev 1.9 091107	GCMSVOC011700 Rev 1.9 091107	1a
Volatile Organics by EPA TO-15	GCMSAIR111692 Rev.6.0 111709	NA	1b
Semi-Volatile Organics 8270 Scan and SIM	GCMSSVOC011700 Rev 1.9 091107	GCMSSVOC011700 Rev 1.9 091107	2a
Extraction for SVOCs/Pest/PCB- 3545A		EXTSVOCSASE083106 Rev 1.3 102406	2b
Extraction for SVOCs/Pest/PCB- 3550C		EXTSVOCS052600 Rev 1.7 010307	2c
Extraction for SVOCs/Pest/PCB- 3510C	EXTAQSVOC052600 Rev 1.9 022608		2d
Pesticides 8081	GCPEST011700 Rev 1.2 091107	GCPEST011700 Rev 1.2 091107	3a
PCBs 8082	GCPCB011700 Rev 1.3 091107	GCPCB011700 Rev 1.3 091107	4a
Metals 6010B	ICP031195 Rev 1.3 091107	ICP031195 Rev 1.3 091107	5a
Metals 6020B	ICPMS6020 080106 Rev 1.2 11/25/08	ICPMS6020 080106 Rev 1.2 11/25/08	5b
Digestion of Samples for Metals -3010A and 3050B	MetalsPrep030695 Rev 1.2 091207	MetalsPrep030695 Rev 1.2 091207	5c
Mercury 7470A, 7471B	Hg120998 Rev 1.3 091107	Hg120998 Rev 1.3 091107	6a
Anions 300.0/9056	IC011400 Rtev 1.6 101107	IC011400 Rtev 1.6 101107	7a