FINAL WORK PLAN FOR CHARACTERIZATION AND DESIGN OF INTERIM REMEDIAL MEASURE FOR THE OIL-TAR SEPARATOR AREA FOR THE RG&E WEST STATION FORMER MGP SITE, ROCHESTER, NEW YORK

SITE #: V00593-8
INDEX #: B8-0535-98-07

Prepared for:

Rochester Gas and Electric Corporation
89 East Avenue
Rochester, NY 14649

Prepared by:
Ish Inc.
804 Salem Woods Drive, Suite 201B
Raleigh, NC 27615
and
META Environmental, Inc.
49 Clarendon Street
Watertown, MA 02472

February/March 2006

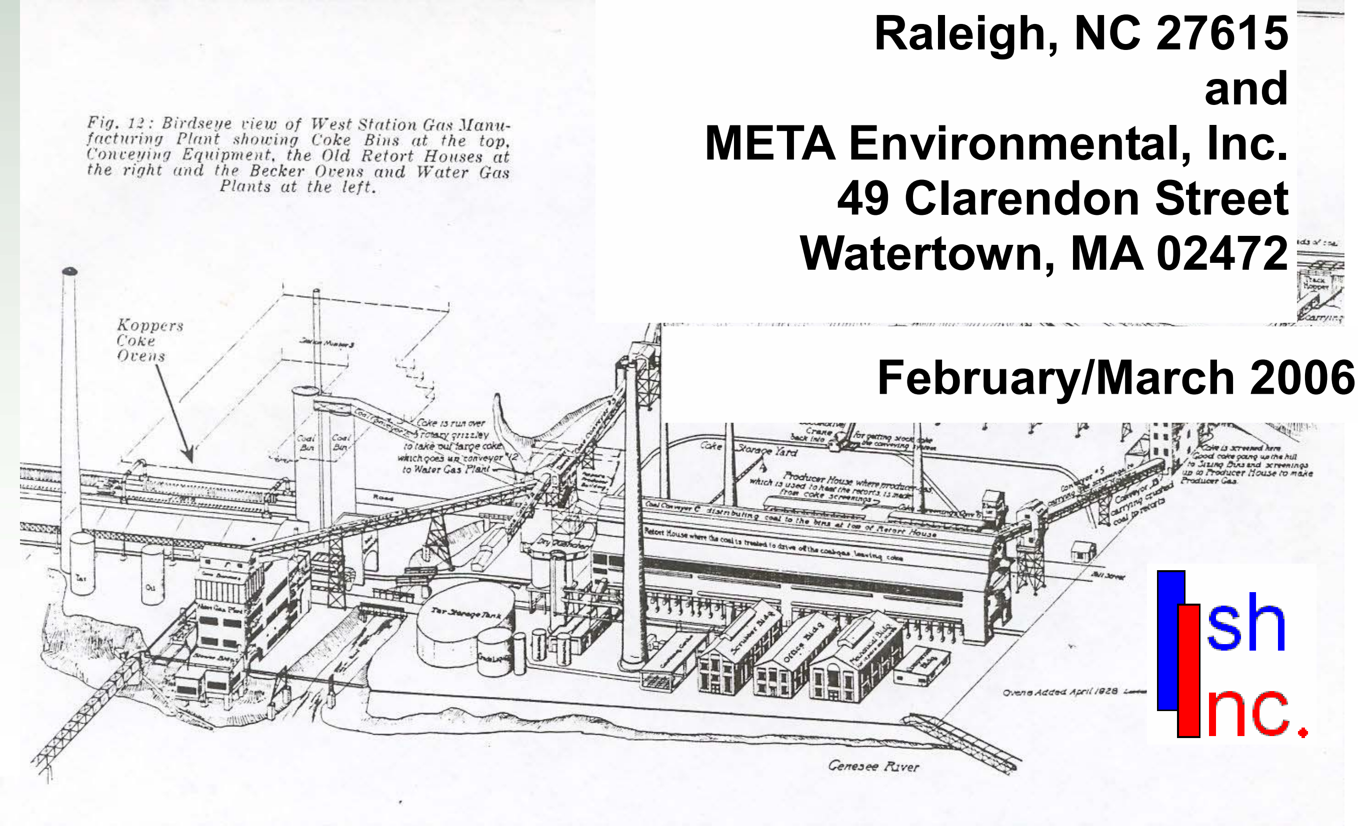

Fig. 12: Birdseye view of West Station Gas Manufacturing Plant showing Coke Bins at the top, Conveying Equipment, the Old Retort Houses at the right and the Becker Ovens and Water Gas Plants at the left.

New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau C, 11th Floor
625 Broadway, Albany, New York 12233-7017
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Denise M. Sheehan
Commissioner

March 14, 2006

Via E-Mail and Regular Mail

Daniel M. Kennedy, Project Manager
Rochester Gas and Electric
Environmental Affairs
89 East Avenue
Rochester, New York 14649-0001

Dear Mr. Kennedy:

RE: RG&E MGP Site, West Station Site # V00593-8, Rochester, New York
Final Work Plan for Characterization and Design of IRM for the Oil-Tar
Separator Area prepared by Ish Inc, dated March 8, 2006.

The New York State Department of Environmental Conservation (NYSDEC), hereafter “The Department” and the New York State Department of Health (NYSDOH) have reviewed the above referenced submittal, and is approved for implementation. RG&E shall proceed with implementation of this investigation and begin field work within sixty (60) days of the date of this approval. RG&E should also submit to the Department a final comprehensive project schedule pursuant to the Work Plan within thirty (30) days of this letter, for review and approval. Further, prior to the commencement of the investigation the public will be notified through a Site Fact Sheet, which is in the process of being prepared.

If you have any questions, please contact me at (518) 402-9665 or by e-mail, at sfpriore@gw.dec.state.ny.us.

Sincerely,
Salvatore F. Priore
Salvatore F. Priore, P.E.
Project Manager,
RG&E MGP Sites
Remedial Bureau C
Division of Environmental Remediation

SFP/sfp
cc: M. Forcucci- DOH Buffalo
M. VanValkenberg-DOH Troy
J . Albert- Monroe County Health Dept.

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Prepared for:

Rochester Gas & Electric Corporation
89 East Avenue
Rochester, NY 14614

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February 2006

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1
INTRODUCTION

Rochester Gas & Electric Corporation (RG&E) retained Ish Inc. to develop this work plan with the objective of further characterizing the presence of coal tar like non-aqueous phase liquid (NAPL) in the area of a reported former oil/tar separator that was associated with the West Station former MGP site. The goal of the additional characterization is to assess if the former oil/tar separator is a source of coal tar-like material that was observed along the shoreline sediment of the Genesee River (located generally southeast of the central water treatment facility building (CTF) associated with the former Beebee Station electric generation plant) documented in a report entitled *Observation Report, River Bank Survey, Former West Station MGP Site, Rochester, New York, Index #: B-0535-98-07, Site No.: V00593-8* (2004 River Bank Observation Report) prepared by Ish Inc. dated January 2004. This Work Plan describes the characterization program to be implemented in the oil-tar separator target area at the West Station former manufactured gas plant (MGP) site located at 254 Mill Street in Rochester, Monroe County, New York. This characterization effort will generate information needed to develop a detailed design for an IRM source removal action from the target area, as needed based on the findings of the further characterization. It is important to note that limited information is available at this time on the presence of source material or the extent of impacts in the target area and this characterization is designed to understand and gather that information.

The West Station former MGP was constructed in 1916 and 1917 and operated until 1954. A coal-fired electric generating station was built adjacent to the former West Station MGP between 1900 and 1910 and operated until 1999. The coal-fired power plant is physically still present today, but is not in operation for electricity production.

1.1 CHARACTERIZATION IN TARGET AREA FOR NAPL

The proposed subsurface characterization for the oil-tar separator area will be completed by carrying out the field and analytical work as stated below. The characterization work will be limited to identifying and establishing the presence, if any, of NAPL in the oil-tar separator area. Following completion of the characterization activities a data package will be prepared that presents the data collected and a summary on the extent of NAPL and/or source material in the target area for developing a detailed work plan for the IRM as needed. Upon consultation with the Department on the findings of the characterization data, RG&E will submit a detailed work plan for NYSDEC approval as an Interim Remedial Measure for the oil-tar separator target area as needed.

In addition, RG&E is also planning to prepare and submit a Site wide Remedial Investigation (RI) work plan for the remaining portion of the West Station former MGP site, including the sediments in the river, for review and approval by NYSDEC. Schedule and objectives for this site wide RI work plan will be discussed with NYSDEC.

The specific objectives of this characterization work plan for the IRM are to:

(1) Determine and identify the presence of NAPL, if any, in the subsurface in the oil-tar separator target study area and assess if the former oil-tar separator is a source of coal tar-like material that was observed along the shoreline sediment and,

(2) Design a detailed work plan for an IRM as a source removal action for NAPL in the oil-tar separator area as needed based on the findings of the characterization.

1.2 WORK PLAN ORGANIZATION

This Work Plan has three remaining sections. Section 2 contains background information about the site, including summaries of results from previous field investigations. Section 3 presents the approach and activities to be completed for characterization. Section 4 provides the project management approach, and a target duration schedule for implementing the field characterization effort as well as the development of a detailed work plan for the IRM in the oil-tar separator target area.

Appendix A contains the Field Sampling Plan, which details the field procedures to be used for this IRM. The project Quality Assurance Project Plan (QAPP) is presented in Appendix B. The Health & Safety Plan is contained in Appendix C. Appendix D presents the Community Air Monitoring Plan and Appendix E contains the Odor Management Plan.

2
SITE BACKGROUND

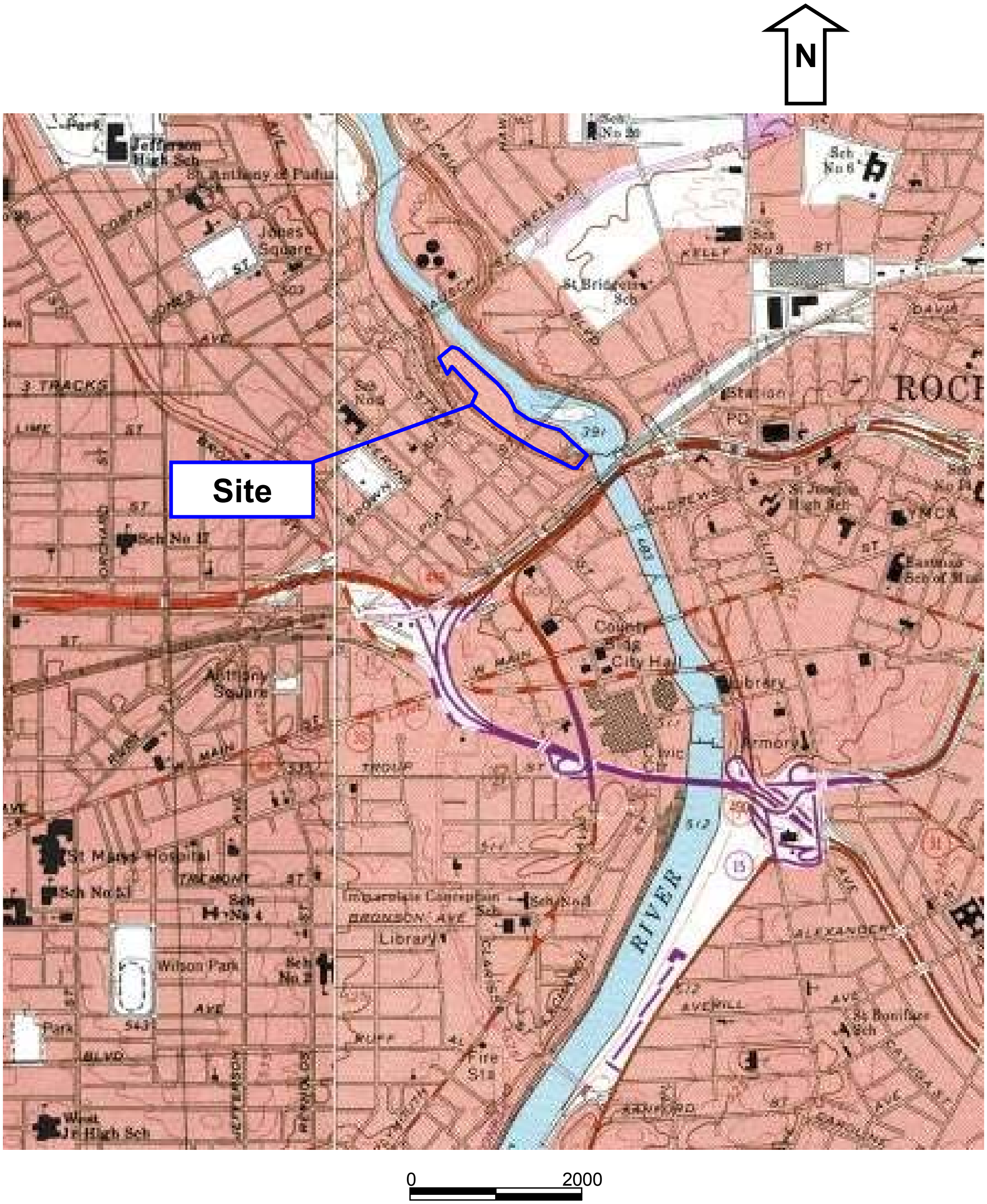
2.1 OPERATIONAL HISTORY

The West Station site property presently owned by RG&E is bounded by Mill Street, Falls Street, and the Genesee River. Figure 2-1 shows the location of the West Station site in the City of Rochester. This parcel of land that is the former MGP site, along with the power plant in the immediate vicinity, has a long history of industrial use. The site base map is shown in Figure 2-2. During a major site characterization performed in 1991 by META/AES, the site was divided into two major portions. The part of the site southeast of the Platt Street Bridge was called the park portion of the West Station site (which was successfully remediated in accordance with VCA Index No. D8-0001-95-10), while the remaining part of the West Station site was referred to as the plant portion. The former MGP was located on the plant portion of the site. Only the oil-tar separator area of the plant portion of the West Station site is targeted for this characterization. A separate Remedial Investigation (RI) work plan will be prepared to address the remaining West Station former MGP site. The approximate historical locations of former structures for the plant portion of the West Station site are shown on Figure 2-3.

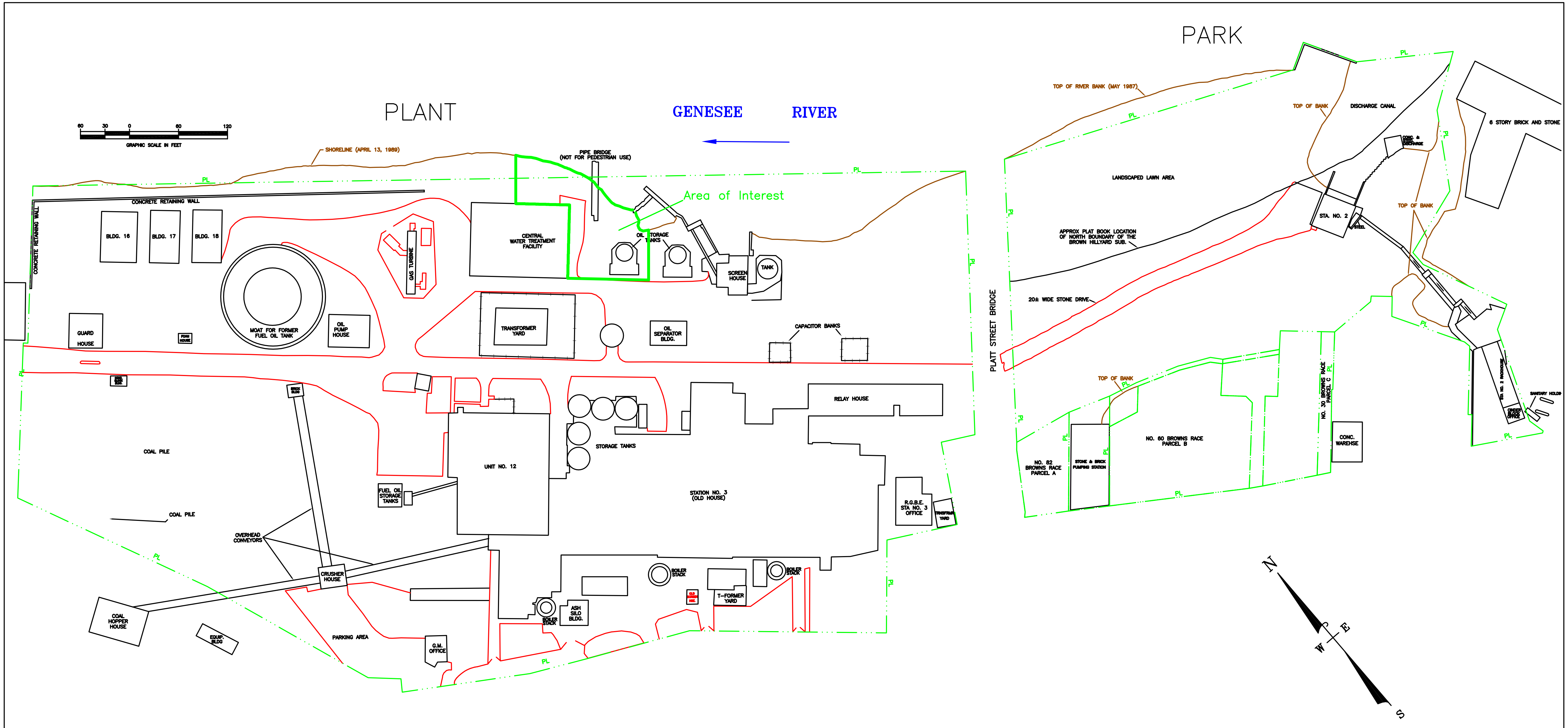
Because of readily available hydropower, by 1875 a number of businesses, such as mills and foundries, occupied the West Station site and adjacent properties. Brown's Race, a man-made channel which conveyed water from above the 90 foot high Upper Falls (just south of the site), provided the hydropower. Water was returned to the river via numerous tail races which flowed from the base of the cliffs to the river. From 1875 to 1915, the many small parcels of land in this area supported a large number of businesses. During the 1890s, utilities, which eventually merged and became RG&E, acquired many of the small parcels of land and established power, steam, and coal gas manufacturing facilities.

From 1875 to the present, the landscape at and around the West Station site changed significantly. The flats that were below the cliffs along the Genesee River were gradually filled and expanded into what was formerly the river channel. Individual industrial buildings were removed and replaced with RG&E facilities, and existing RG&E facilities were modified or replaced. The tail races used by the historical industries were filled and their use as tail races discontinued.

Figure 2-1
Locus Map



From Rochester West, NY and Rochester East, NY 7.5' USGS Quads.



LEGEND

Existing Structures

Paved Areas

PL Property Line

Note: Drawing based on Figure 1 by Atlantic Environmental Services titled "Soil Gas Locations" dated October 1991. Scale 1"=60'; Project No. 1309-02-21; Drawn by A.C.G.. Atlantic's drawing was based on "A Map Showing Rochester Gas & Electric Corporation's Property No. 3; Situated in Original Lot 48 of the 20,000 Acre Tract Township 1; Short Range Gates; City of Rochester; Monroe County; State of New York" dated June 13, 1989. Scale 1"=40'; Drawing No. 31570-19; Drawn by Thomas M. Sheehan N.Y.S.P.L.S.

Figure from "Work Plan for Characterization and Design of Interim Remedial Measure for the Oil/Tar Separator Area at the RG&E West Station Former MGP Site, Rochester, New York" dated November, 2005

Project: West Station/103039	Client: RG&E	Ish Inc./META

Figure 2-2
Site Base Map

Filename: West Station RI Work Plan	Drawn by: LMG	Approved by: PJD	Date: 12/5/2005

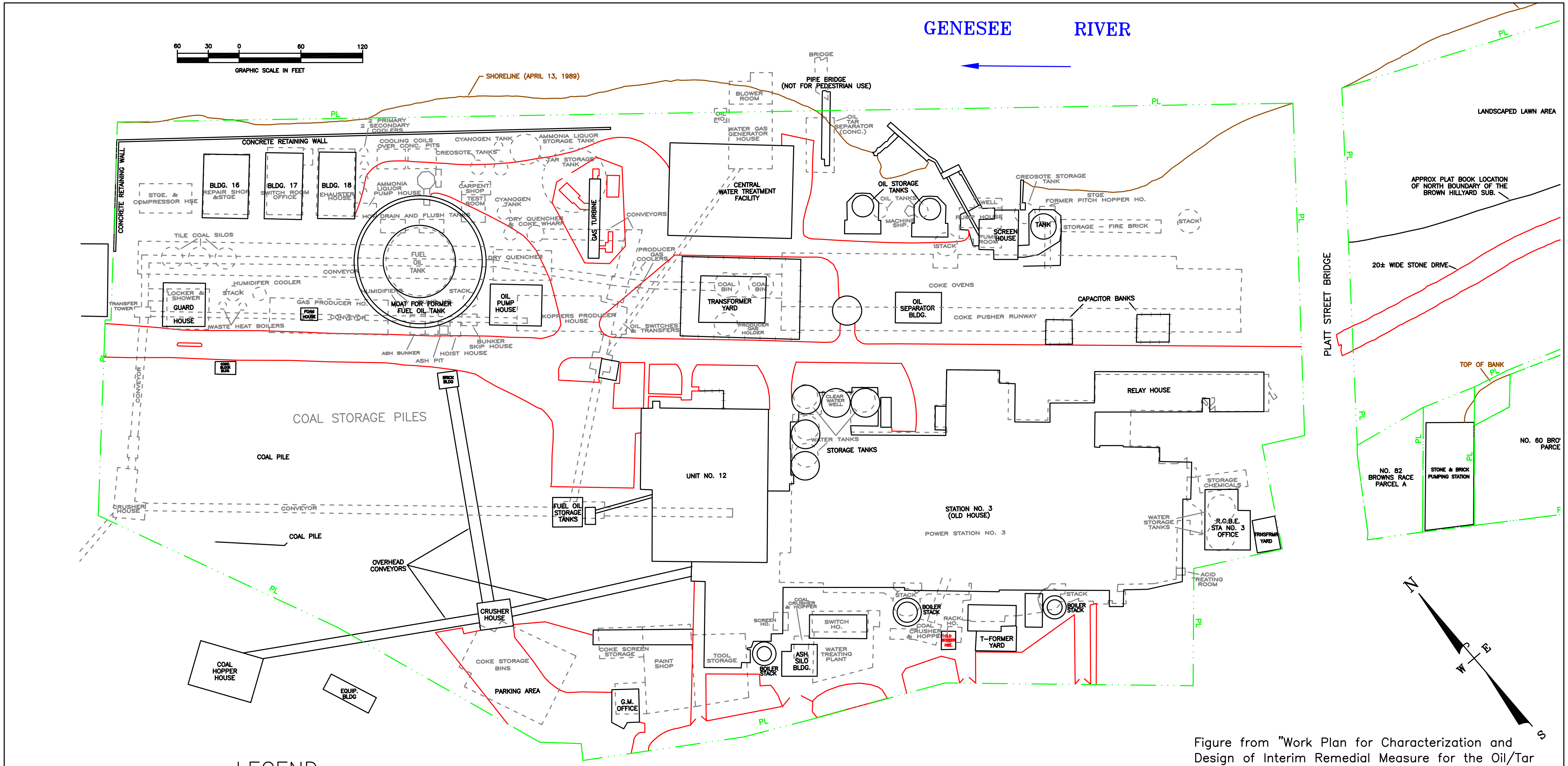


Figure from "Work Plan for Characterization and Design of Interim Remedial Measure for the Oil/Tar Separator Area at the RG&E West Station Former MGP Site, Rochester, New York" dated November, 2005

LEGEND

——— Existing Structures
— — — Historical Structures
——— Paved Areas
—PL— Property Line

Note: Drawing based on Figure 1 by Atlantic Environmental Services titled "Soil Gas Locations" dated October 1991. Scale 1"=60'; Project No. 1309-02-21; Drawn by A.C.G.. Atlantic's drawing was based on "A Map Showing Rochester Gas & Electric Corporation's Property No. 3; Situated in Original Lot 48 of the 20,000 Acre Tract Township 1; Short Range Gates; City of Rochester; Monroe County; State of New York" dated June 13, 1989. Scale 1"=40'; Drawing No. 31570-19; Drawn by Thomas M. Sheehan N.Y.S.P.L.S.

Project: West Station/I03039	Client: RG&E	Ish Inc./META

Figure 2-3
Approximate Historical Locations of
Former Structures on Plant Portion

Filename: West Station RI Work Plan	Drawn by: LMG	Approved by: PJD	Date: 12/5/2005

The approximate historical locations of the former head and tail races are shown on Figure 2-4. In summary, the area of what is currently the RG&E West Station site has undergone almost continual change over the past century. A timeline based on RG&E files and historical site maps, depicting those changes is described briefly below.

In 1875, many businesses bordered Brown's Race, occupying the area between the race and the top edge of the cliff. Grist mills were the most common industry, but foundries, machine shops, and the Rochester Water Works were also present in the area. Approximately a dozen tail races exited the buildings into notches in the cliff and flowed across the flats and into the Genesee River.

From the 1870s to the early 1890s, changes in this area were minor. The configuration of some of the tail races changed, some new buildings were constructed, and the edge of the river channel was partially filled. In some cases, the property ownership changed hands. However the type of industry on the site, primarily mills, remained the same.

By 1900, a precursor company of today's RG&E had obtained land north and south of the Platt Street Bridge. Station No. 2, a hydroelectric plant, was constructed south of the bridge prior to 1900. The RG&E precursor company also owned a parcel north of the Platt Street Bridge and adjacent to the Citizens Light and Power Company. Mills, foundries, and machine shops also continued to operate in the area. The configuration of the tail races associated with these industries was altered during this time and the edge of the river channel was further filled.

From 1910 to 1926, major changes took place on the West Station site. During this time, the companies that would become the present day RG&E acquired the majority of the property bounded by Brown's Race, Mill Street, Falls Street, and the Genesee River. Power and gas generating facilities (coal fired steam, coal gas and water gas) were all constructed during this time period. In 1910 much of the area was vacant, but by 1926 the area north of the Platt Street Bridge was completely occupied. Station No. 3, built between 1900 and 1910, was a coal-fired power plant. Surrounding land use remained heavily industrial.

Prior to 1910, the area adjacent to the river and south of the city garbage incinerator was largely vacant, except for the tail races. The 1911 Sanborn map shows an iron gasometer (gas holder) close to the riverbank. Since gas production at West Station MGP site did not begin until 1916, this holder was apparently used for gas generated at the East Station MGP located northeast of the West Station site across the Genesee River, which began gas production in 1872.

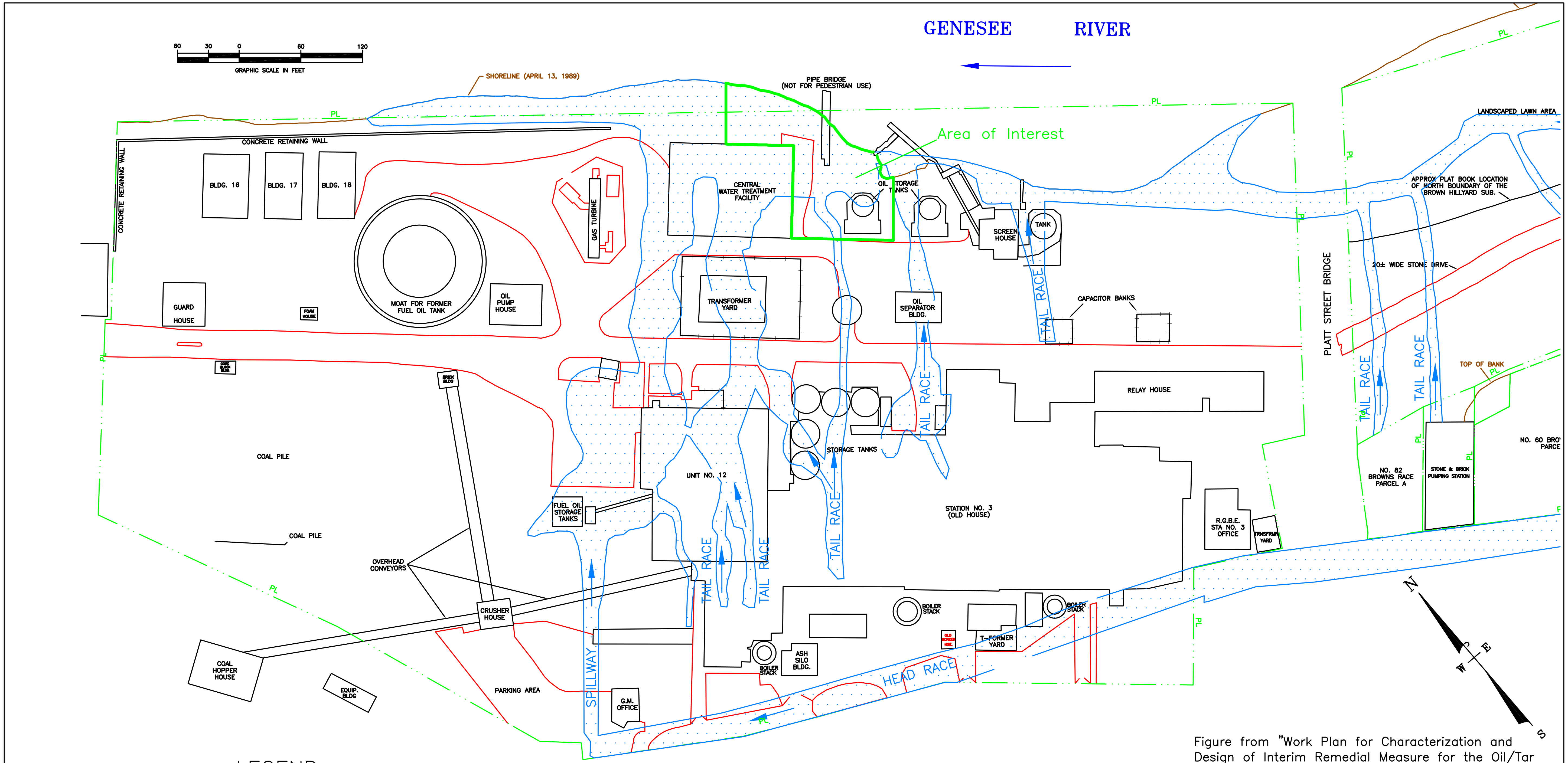


Figure from "Work Plan for Characterization and Design of Interim Remedial Measure for the Oil/Tar Separator Area at the RG&E West Station Former MGP Site, Rochester, New York" dated November, 2005

LEGEND

―― Existing Structures

―― Paved Areas

—PL— Property Line

⬭ Approximate Area of Former Head/Tail Race

Note: Drawing based on Figure 1 by Atlantic Environmental Services titled "Soil Gas Locations" dated October 1991. Scale 1"=60'; Project No. 1309-02-21; Drawn by A.C.G.. Atlantic's drawing was based on "A Map Showing Rochester Gas & Electric Corporation's Property No. 3; Situated in Original Lot 48 of the 20,000 Acre Tract Township 1; Short Range Gates; City of Rochester; Monroe County; State of New York" dated June 13, 1989. Scale 1"=40'; Drawing No. 31570-19; Drawn by Thomas M. Sheehan N.Y.S.P.L.S.

Project: West Station/I03039	Client: RG&E	Ish Inc./META

Figure 2-4
Approximate Historical Locations of
Former Tail Races

Filename: West Station RI Work Plan	Drawn by: LMG	Approved by: PJD	Date: 12/5/2005

In the summer of 1913, a concrete retaining wall was built along the riverbank from the north end of the West Station property to the gasometer, and the area behind the wall was backfilled. In 1916 and 1917, the West Station coal gas plant was constructed on the filled area. The original plant consisted of coal and coke storage and transport facilities, a retort house, a producer gas house, an ammonia still building, an office building, a scrubber house, a decanter, cooling coils, and tar and ammonia liquor storage tanks. A tank labeled "tar storage tank" was on the location previously identified as the iron gasometer. Gas generated at the West Station MGP was transported to the East Station MGP site via a pipe bridge across the Genesee River. The data suggest that limited purification processes, such as tar and ammonia removal, took place at West Station property and further purification of manufactured gas was completed at East Station site. The water gas plant at the West Station site was built in 1923 and occupied the area of riverbank just south of the coal gas plant near the present location of the Central Water Treatment Facility. Both the coal and water gas facilities, which utilized MGP tar storage tanks, a tar separator, and a creosote tank, were possible sources of MGP-related residuals.

An RG&E publication, *Gas Manufacture and Distribution*, was originally published in 1928 and subsequently revised in 1934, 1936, and 1938. These historical pamphlets contain much information about the type and magnitude of the gas manufacturing operation at the former West Station MGP site.

Dated photographs from RG&E's files give a clearer picture of expansion of facilities at West Station. A coke oven building containing the 60 (later 97) Becker-type ovens, was constructed directly south of the existing facilities in 1925 and 1926. The Koppers producer house was also built at this time. Thus, by 1928 the old retort house and the new coke ovens were functioning. There is no evidence of further expansion of gas manufacturing facilities. The 1951 map of the site, the 1935 Plat maps and the 1950 Sanborn map confirm that no further expansion occurred during this time period.

Gas manufacturing continued at the West Station MGP until 1952. From 1952 to 1961 the gas manufacturing facilities were dismantled and a few buildings, such as Numbers 16, 17, and 18, were converted for other purposes. The water gas house was still present on the 1971 Sanborn map. It was subsequently demolished and replaced by the Central Water Treatment Facility in the late 1970s.

2.2 CURRENT SITE DESCRIPTION

The West Station site is located adjacent to the west side of the Genesee River just north of the business district of Rochester, NY between the Genesee River and Mill Street. The surrounding land use is primarily commercial and industrial. The site is bounded to the south and west by cliffs ranging from 60 to 80 feet high. To the east, the opposite bank of the Genesee River is occupied by the Genesee Brewery, Inc. Rochester's downtown business and financial district is approximately 1,000 feet to the south. In addition to a large Eastman Kodak Company office building, several small businesses exist to the west of the site. The land use bordering on the commercial-industrial area just described is primarily urban residential. All of the residences in the City of Rochester are supplied with city water.

Upper Falls is a 90-foot waterfall on the Genesee River, and is located at the southeast corner of the site. The western half of the site is occupied by Beebee Station, a coal-fired power generating facility which was removed from service in 1999.

The site is relatively flat, with an average ground elevation of approximately 412 feet above mean sea level (MSL). The bank of the Genesee River slopes to the river. A narrow flat extends along the bottom of the retaining wall and the steep slope. During high river flow periods, this flat is often under water.

2.3 SUMMARY OF PREVIOUS INVESTIGATIONS

During the development of this Work Plan, the history of the site was compiled based on maps, photographs, and documents from RG&E files, and from previous site and area investigations. Additional information has been inferred from 1892, 1911, 1950, and 1971 Sanborn Fire Insurance maps.

2.3.1 Previous Studies

A number of previous remedial investigations have been performed at the West Station site, including a 1977 investigation by Rochester Drilling Company, Inc., an investigation in 1985 and 1986 by Empire Soils, a 1991 investigation by META Environmental, Inc. (META) and Atlantic Environmental Services (AES), and a 2003 survey of the riverbank as summarized in the 2004 River Bank Observation Report by Ish Inc. and META. In addition, a preliminary site review for multiple sites, including West Station, was prepared in 1986 by Morrison-Knudsen Engineers, Inc. A brief summary of the findings of the previous work is provided in the following sections.

2.3.1.1 Rochester Drilling Company, Inc. Investigation (1977)

A geotechnical investigation was conducted prior to the construction of the Central Water Treatment Facility (CWTF) building on the site. The CWTF was constructed partially in the footprint of the former carbureted water gas MGP plant at the site. In August 1977, four soil borings were advanced with hollow stem augers in the vicinity of the present CWTF to depths ranging from 22.75 to 33.5 feet below ground surface (bgs). Generally, fill materials were encountered that consisted of brown to black silt, sand, gravel, brick, concrete, cinders, ash, and wood. Petroleum odors were noted at all boring locations. Then, in January and February 1978, an additional 8 borings were advanced with hollow stem augers and rock coring equipment in the vicinity of the CWTF to depths ranging from 35 feet to 60 feet bgs. Generally, fill materials were encountered to depths up to 40 feet bgs that consisted of brown to black silt, sand, gravel, brick, concrete, cinders, ash, and wood.

2.3.1.2 Empire Soils Investigations, Inc. Borings (1985 and 1986)

In November 1985 and February 1986, limited investigation activities were carried out by Empire Soils Investigations, Inc. A total of five borings were drilled as part of a coal pile leachate study to depths ranging from 7.8 to 19.4 feet bgs. The soils in the borings consisted of fill (gray, brown and black silt, sand, gravel, cinders, brick, slag, and wood) overlying a sandy layer (alluvium). The alluvium consisted of gray, tan, and brown fine to coarse sand with some gravel and clay.

2.3.1.3 *Preliminary Site Review, NYS Superfund Site No. 828044,* prepared by Morrison-Knudsen Engineers, Inc. in June 1986

The Morrison-Knudsen report is a description of the hydrology and geology of the area occupied by RG&E properties in the Genesee gorge as well as an historical review of industrial activity within the study area.

2.3.1.4 *Characterization of the Former Manufactured Gas Plant (MGP) at the RG&E West Station Site,* prepared by META Environmental, Inc. and Atlantic Environmental Services, Inc. dated March 1993.

Between September and December 1991, a multi-phase site investigation was performed at West Station by META and AES. As part of this work, soil gas sampling was performed at 76 locations, 42 soils borings were drilled with two locations completed as monitoring wells with 10 locations finished as piezometers, and seven samples of tar-like material (TLM) from the surface of the site were collected. Much of the work was conducted on the Park portion of the site. The locations of soil borings and piezometers installed on the plant portion of the site are shown on Figure 2-5.

The investigation results were consistent with previous information that showed a layer of fill overlying a sandy alluvium unit. The conclusions of the investigation were that the location of a discernable groundwater plume, if present, could not be determined and that MGP residuals existed at various concentrations throughout the areas investigated. Portions of the text from the META/AES site investigation report describing previous work and results of the investigation have been incorporated directly into this Work Plan for simplicity.

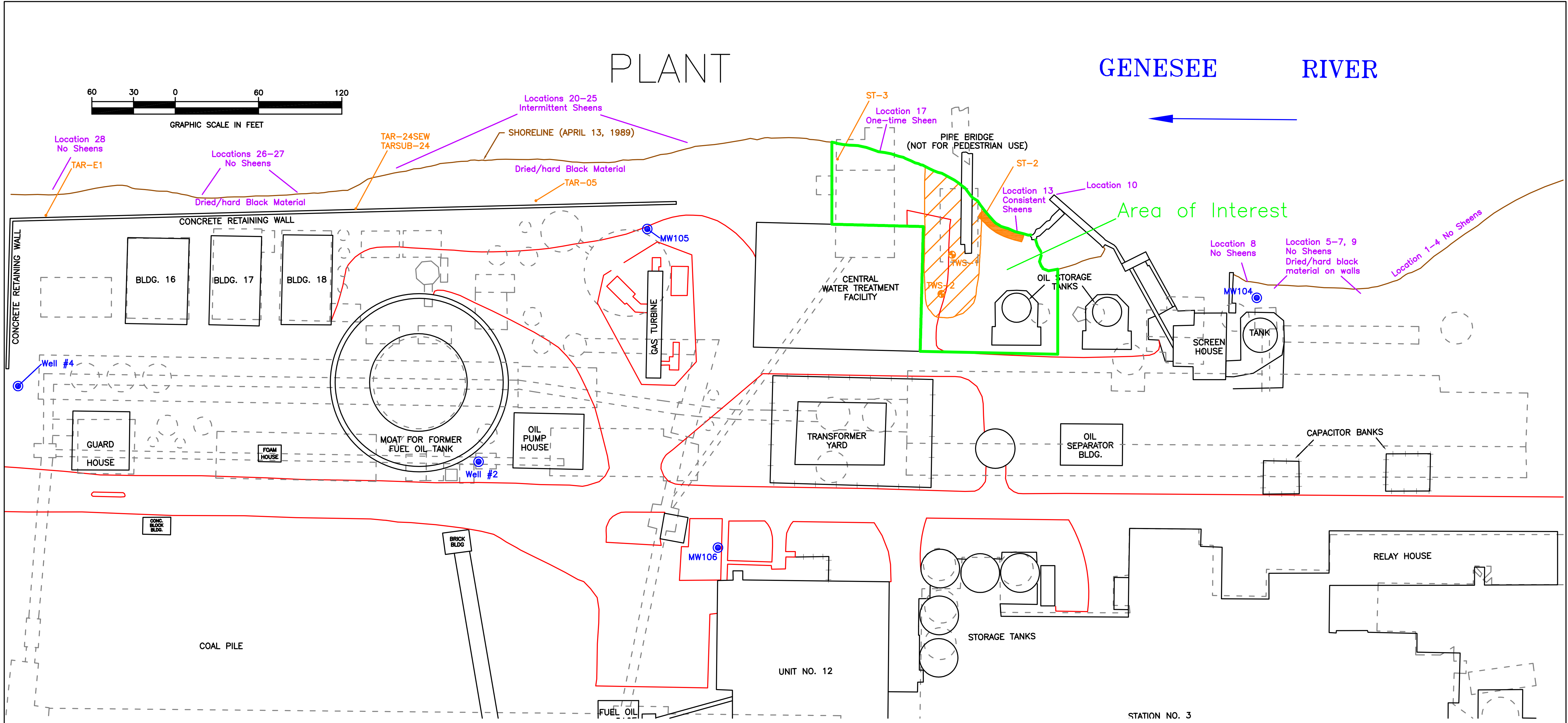
2.3.1.5 *Observation Report, Riverbank Survey, Former West Station MGP Site,* prepared by Ish Inc. dated January 2004

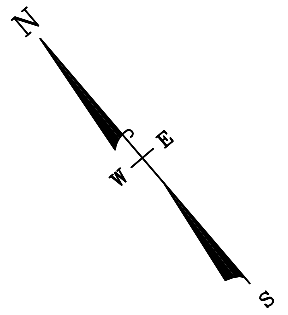
In November 2003, Ish Inc. and META personnel performed a riverbank survey from the northern property boundary south to the Platt Street Bridge. The river sediments immediately off-shore were examined by moving rocks and debris and probing any soft sediment with a hand auger. The sediments were probed approximately every 25 feet or less. NAPL was considered present if sheen developed on the water. The NAPL was identified as former MGP waste if a distinctive coal tar-like odor was noted. At several locations, dried TLM was present. In addition, heavy sheen and NAPL globules were produced in other areas by moving rocks and debris or by augering into the riverbank deposits. A summary of the locations examined and the observations made are shown on Figure 2-5. Based on the results of this survey and previous work at the site, the oil-tar separator area has been selected for this proposed work as shown on Figure 2-5.

2.3.2 Site Geology and Hydrogeology

2.3.2.1 Site Geology

In general, the site lithology consists of fill materials overlying stream alluvium which overlies bedrock. The fill materials include ash, slag, coal, and building rubble, as well as imported natural materials. Bedrock is the Rochester Shale formation, a dark gray, calcareous mudstone with abundant dolomite and limestone units included in the Shale formation. In the area of West Station, the Rochester Shale overlies Irondequoit Limestone. The cliffs which bound the site to the south and west are the Lockport Dolomite formation, a medium gray vuggy dolomite.





LEGEND

—	Existing Structures	●	Existing Well Locations
– – –	Historical Structures	—	Riverbank Survey (Ish Inc./META 2003)
—	Paved Areas	▨	Approximate Areal Extent of Observed Significant Impacts in Area of Interest (META/Atlantic 1991)
⊕	Existing Borings (installed by META/Atlantic in 1991)		
●	TAR and ST (surface tar) sample locations (META/Atlantic 1991)		

Note: Drawing based on Figure 1 by Atlantic Environmental Services titled "Soil Gas Locations" dated October 1991. Scale 1"=60'; Project No. 1309–02–21; Drawn by A.C.G.. Atlantic's drawing was based on "A Map Showing Rochester Gas & Electric Corporation's Property No. 3; Situated in Original Lot 48 of the 20,000 Acre Tract Township 1; Short Range Gates; City of Rochester; Monroe County; State of New York" dated June 13, 1989. Scale 1"=40'; Drawing No. 31570–19; Drawn by Thomas M. Sheehan N.Y.S.P.L.S.

Figure from "Work Plan for Characterization and Design of Interim Remedial Measure for the Oil/Tar Separator Area at the RG&E West Station Former MGP Site, Rochester, New York" dated November, 2005

Project: West Station/103039	Client: RG&E	Ish Inc./META

Figure 2–5
Summary of Previous
Environmental Investigations along
Riverbank and in Area of Interest

Filename:	Drawn by:	Approved by:	Date:
West Station RI Work Plan	LMG	PJD	12/5/2005

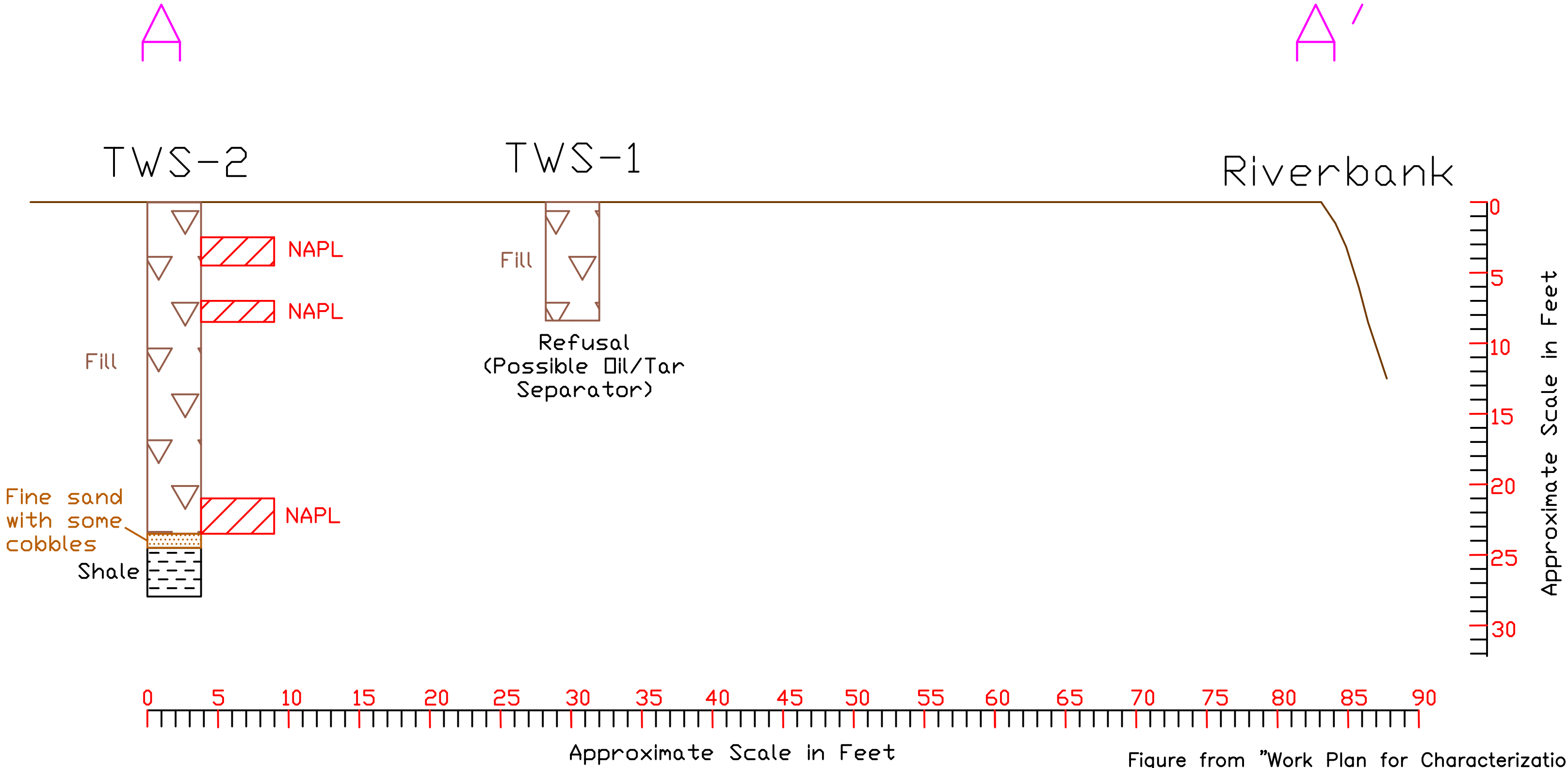
Fill material was encountered in borings drilled on the site during the 1991 site investigation by META/AES. The fill was very heterogeneous in nature, and its composition varied greatly in both horizontal and vertical directions. The only consistent layer of fill was the topsoil, which was a 6 to 8 inch layer of brown, sandy loam. Other common fill materials included, but were not limited to: brick, ash, slag, coke, coke breeze, cinder, coal, building rubble, and TLM. The thickness of the fill was generally between 15 and 30 feet, extending from just below the surface down to the underlying natural alluvium. Based on physical observations including appearance, texture, and odor, the distribution of TLM in the fill was apparently random; it was found at several depths and in varying thicknesses. TLM, based on visual or olfactory evidence, generally was found above the water table.

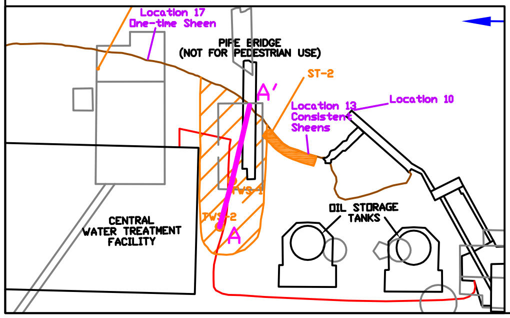
Figure 2-6 shows a geologic representation of the conditions in the oil-tar separator area based on the borings TWS01 and TWS02 installed during 1991 META/AES investigation. In general, naturally occurring alluvium was found underlying the fill material. The texture of the alluvium varied across the site, and often varied within each boring. These alluvium sediments were generally fine to coarse sands with silt and clay components. Silt and clay lenses also were occasionally found. The thickness of alluvium varied from 0 to 15 feet across the site. At the bottom of the alluvium, a layer of angular cobble size rock fragments was often found. These angular rock fragments may correspond to the bottoms of the tail races that once crossed the site in numerous locations.

The uppermost layer of bedrock, Rochester Shale, was encountered at depths ranging from approximately 20 to 40 feet. The Rochester Shale is a dark gray, calcareous mudstone with abundant dolomite and limestone units included within the Shale formation. In many borings, 5 to 10 feet of weathered bedrock was encountered above the competent bedrock. Shale-type bedrock weathers to form clay, which has the appearance of bedrock but the texture and hardness of clay. The top of the weathered bedrock was brown clay, generally dry and compact, which graded to gray as the weathering lessened with depth.

2.3.2.2 Site Hydrogeology

What is known about the site hydrogeology comes from the 1991 META/AES investigation. The site is bordered on the east by the Genesee River. Because the water flow of the Genesee River is controlled at numerous dams in the City of Rochester, there is no established flood stage. Average discharge data was calculated for the 1993 investigation report based on data collected at a gauging station approximately 4,500 feet downstream of West Station (Storet





Note: "NAPL" indicates tar was noted on boring logs in the report for the 1991 META/AES investigation.

Figure from "Work Plan for Characterization and Design of Interim Remedial Measure for the Oil/Tar Separator Area at the RG&E West Station Former MGP Site, Rochester, New York" dated November, 2005

Project:	Client:	
103039	RG&E	Ish Inc/META

Figure 2-6
Cross-Section of Geology and NAPL Observations from 1991 META/AES Investigation in the Area of Interest

Filename:	Drawn by:	Approved by:	Date:
WSXSEC	LMG	PJD	12/5/2005

Database, 1952 to 1988). The annual average discharge over that time was 2,930 cubic feet per second (cfs). On a monthly basis, August had the lowest average discharge of 988 cfs and March had the highest at 6,433 cfs. The depth to the water table was approximately 18 to 22 feet during the investigation activities performed in November and December 1991. Although no permeability tests were performed, the coarse nature of much of the fill on site indicates that the permeability should be relatively high. Furthermore, the heterogeneity of the fill, including the permeable layers of TLM, may create locally complicated flow paths throughout much of the site. However, some general observations regarding groundwater flow direction were made.

Water table measurements from 1991 in the park portion of the site south of the Platt Street Bridge indicated a southeasterly groundwater flow direction, which is inconsistent with the northwesterly flow of the Genesee River. The water table aquifer occupies the zone of fill and alluvial deposits above the Rochester Shale. Vertical cracks in the Rochester Shale may provide points of entry for water from the water table aquifer. Weathered shale and clay were found in some of the borings in the park portion of the site, and this may cause localized instances of restricted downward water migration, due to the less permeable nature of the clay. In addition, there used to be numerous tail races that flowed from the base of the cliffs to the river. Water was used for power generation, and the tail races served to return the water to the river. Throughout the park portion of the site south of the Platt Street Bridge, these filled channels may provide localized preferential flow paths for the groundwater.

Water table measurements from 1991 in the plant portion of the site north of the Platt Street Bridge also indicated a groundwater flow direction that is inconsistent with the flow of the Genesee River. There was and still is a man-made retaining wall which bounds this area of the site to the east, and photographs of the construction of that wall indicate that it may be keyed to bedrock. As a result, groundwater flow may be redirected or influenced by the retaining wall. In addition, tail races were historically present in the area of the site north of the bridge as well, and may provide localized channels for preferential flow paths for the groundwater.

Weathered shale and clay were found in all of the borings in the portion of the site north of the Platt Street Bridge, which may indicate the presence of a confining layer or aquiclude in this portion of the site. An aquiclude is a layer of low permeability that tends to strongly restrict downward migration of water and may also influence localized groundwater flow directions.

2.3.3 Summary of Impacts at the Site

The following paragraphs summarize the findings of previous investigations of the oil-tar separator area of the former MGP (subject of this Work Plan) at West Station, and the outstanding data needs are discussed in the following Section.

TLM were found at five locations along the Genesee River bank during a site walkover in 1991, including under the Platt Street Bridge, near the pipe bridge remnant, east of the CWTF building, and below the river bank retaining wall. Also, hardened TLM was observed on some pipes along the river bank retaining wall. Chemical analyses of several TLM samples showed that those samples contained coal tar with varying relative amounts of MAHs and PAHs. The consistencies of the TLM ranged from near solid or extremely viscous to less viscous forms.

TLM and sheens also were found at five locations along the bank of Genesee River during a second riverbank survey conducted in 2003. Specifically, solid or highly viscous TLM was observed below the river bank retaining wall and coating portions of the wall near the former creosote storage tank and screen house. In addition, sheens were produced on the water surface when sediments were probed with a hand auger near the pipe bridge remnant, east of the CWTF building, and east of the retaining wall and former tar storage and creosote storage tanks. Sheen production was generally slight and intermittent, except in the vicinity of the pipe bridge remnant where sheens and odors were easily produced by disturbance of the sediments.

TLM was observed in the subsurface during a site investigation in 1991 near the CWTF in the vicinity of the former "oil-tar separator" and the former "water gas generator house." Heavy NAPL impacts were observed at approximately 2 to 4 feet, at 7 to 8 feet, and at 22 to 24 feet in boring TWS-2, as shown on Figure 2-6.

The MGP residues found during the 1991 investigation by META/AES were scattered and varied in concentration levels. The approximate areal extent of significant MGP impacts found in the oil-tar separator area is shown on Figure 2-5.

3
CHARACTERIZATION FOR IRM DESIGN

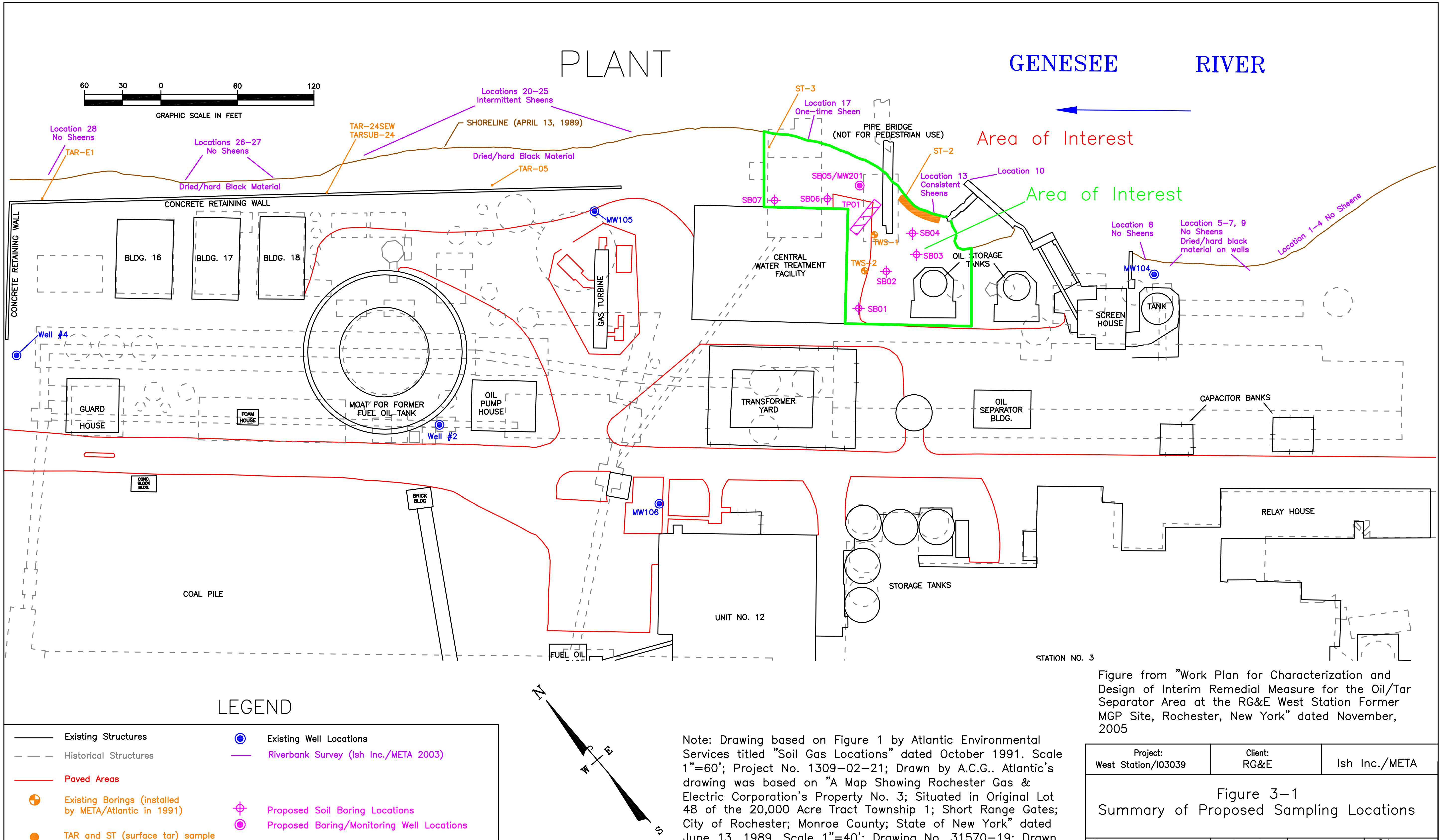
3.1 APPROACH

Identifying the potential source of NAPL that may be originating from the upland portion of the site, specifically from the oil-tar separator area, to Genesee River sediments and developing an interim remedial response will be a challenging undertaking. To accomplish this, the oil-tar separator area characterization will be conducted to identify the presence of NAPL, if any, from the oil-tar separator and in the subsurface on the upland area adjacent to the oil-tar separator, and to establish if the NAPL from these areas could be potentially mobile and constitutes a source material that could be effectively mitigated as an IRM.

3.2 DATA NEEDS

In reviewing the existing data for the site and preparing this work plan, needs for additional characterization work for the oil-tar separator area have been identified. This subsection discusses the data gaps at the site, along with a discussion of recommendations. Each of the field activities is discussed in detail in the following subsection and proposed field sampling locations are shown on Figure 3-1. Please note, the proposed locations are approximate, and the actual locations will be determined in the field based on underground/above ground utilities and/or other physical access limitations.

The areal extent of NAPL in the vicinity of former boring TWS-2 was not established (see Figure 2-5). In addition, the general soil quality (VOCs, SVOCs, cyanide, metals) in the vicinity of the former oil-tar separator, the former water gas plant buildings, and their associated utilities was not measured. The vertical extent of NAPL in the vicinity of the oil-tar separator presently is assumed to be about 24 feet bgs at the approximate interface of fill and native materials. However, this is based on one boring and may not be accurate, requiring further evaluation. In addition, the location, size, construction, and contents of the former oil-tar separator have not been clearly determined.



LEGEND

― Existing Structures	● Existing Well Locations
– – Historical Structures	― Riverbank Survey (Ish Inc./META 2003)
― Paved Areas	
◕ Existing Borings (installed by META/Atlantic in 1991)	⌖ Proposed Soil Boring Locations
	◉ Proposed Boring/Monitoring Well Locations
● TAR and ST (surface tar) sample locations (META/Atlantic 1991)	▨ Proposed Test Pits

Note: Drawing based on Figure 1 by Atlantic Environmental Services titled "Soil Gas Locations" dated October 1991. Scale 1"=60'; Project No. 1309-02-21; Drawn by A.C.G.. Atlantic's drawing was based on "A Map Showing Rochester Gas & Electric Corporation's Property No. 3; Situated in Original Lot 48 of the 20,000 Acre Tract Township 1; Short Range Gates; City of Rochester; Monroe County; State of New York" dated June 13, 1989. Scale 1"=40'; Drawing No. 31570-19; Drawn by Thomas M. Sheehan N.Y.S.P.L.S.

Figure from "Work Plan for Characterization and Design of Interim Remedial Measure for the Oil/Tar Separator Area at the RG&E West Station Former MGP Site, Rochester, New York" dated November, 2005

Project: West Station/103039	Client: RG&E	Ish Inc./META

Figure 3-1
Summary of Proposed Sampling Locations

Filename:	Drawn by:	Approved by:	Date:
West Station RI Work Plan	LMG	PJD	12/5/2005

3.3 CHARACTERIZATION ACTIVITIES FOR THE OIL-TAR SEPARATOR AREA

3.3.1 Field Program

Ish Inc. team will mobilize to the site and provide personnel and equipment for the field sampling and analytical tasks identified in this Section. In addition, Ish Inc. will subcontract the drilling activities to a qualified driller (such as Nothnagle Drilling Company**)** and the chemical analyses of samples work to a qualified laboratory (such as Severn Trent Laboratories).

3.3.1.1 Mobilization

Ish Inc. team members will coordinate initial activities at the Site, including clearing utilities and marking sampling locations. Ish Inc., through Dig Safely New York (formerly UFPO), will contact local utility companies (i.e., telephone, electric, gas, cable, water, sewer, etc.) to provide underground mark outs of utilities prior to undertaking the subsurface investigation. However, given the site history of West Station and the fact that UFPO is not responsible for privately owned utilities, a review of available site maps showing underground utilities will be performed. In addition, the field crew will work closely with RG&E personnel that are knowledgeable of underground site utilities to clear planned sampling locations.

Each proposed sampling location will be evaluated and marked (e.g., with a painted wooden stake) to avoid obvious overhead or underground utilities when identifying sampling locations to complete this task. In addition, locations for temporary storage of waste drums or tanks, as well as the decontamination pad will be identified. Waste storage drums and tanks will be used for purge, development, and decontamination water and soil cuttings. These items will be staged in a secure, accessible area (as directed by the RG&E Project Manager). Staging areas for mobilized equipment and materials will also be identified during this visit. For this proposal, Ish Inc. has assumed that potable water will be made available on-site by RG&E. Ish Inc. staff will utilize either a vehicle or space provided by RG&E as a field office. Ish Inc. staff will work closely with the RG&E Project Manager and facility personnel to ensure optimal coordination of all investigation activities with ongoing RG&E operations.

At the start of field activities, Ish Inc. will mobilize its field team and necessary sampling equipment to the Site. The drilling subcontractor will also mobilize the excavator and drill rig and support equipment at this time. Upon arrival, the driller will construct a temporary decontamination pad in the predetermined location and steam clean equipment to be used in the subsurface investigation.

Parties involved in the drilling and sampling tasks will be made aware of on-site concerns, potential risks, and appropriate mitigation measures at a Site safety meeting at the commencement of field activities and then prior to the start of each workday. Ish Inc. believes communication and safety are key components to make this project successful.

3.3.1.2 Test Pitting

As part of the field investigation, test pit trenches will be excavated to open holes in the ground in the oil-tar separator area and physically examine the subsurface material. Table 3-1 lists one of the test pits locations and rationale and the location is shown on Figure 3-1.

Table 3-1
Test Pit Trench Location and Rationale

Test Pit	Rationale
TP01	To examine subsurface conditions in the area of the former oil-tar separator.

A test pit (TP01) will be excavated perpendicular to the Genesee River bank along the south east wall of the CWTF. This test pit will be used to attempt to locate the former oil/tar separator and investigate its construction and contents, and any associated buried piping. In addition, this test pit will be advanced outside the walls of the oil tar separator (if present) to characterize the soils surrounding that structure regarding the presence of mobile or residual NAPL.

It should be noted that more than one test pit may be installed in this area depending on the findings during excavation of TP01. The goal of the trenching is to locate the former oil-tar separator and determine the nature of its contents and the presence of NAPL in surrounding soils.

The test pits will be excavated to the top of the bedrock or as deep as possible as permitted by the site conditions.

During trenching, the contents of the test pits, the soil lithology, and the dimensions of the test pits will be recorded by the field geologist. In addition, a minimum of one soil sample will be collected from each test pit for VOCs, SVOCs, TAL metals, and total cyanide. Test pits will also be photo-documented.

Upon completion, the test pits will be back-filled with the excavated material, generally returning the contents in the reverse order that they were excavated, to the extent possible. Then, the dimensions of the trenches will be staked along with any pertinent features (such as foundation walls, piping, etc.) and subsequently surveyed.

3.3.1.3 Drilling Program

A drilling program is proposed to generate hydrogeologic, NAPL, soil and groundwater quality data to supplement the information developed during the previous investigations and complete the development of detailed design work plan for IRM for the oil-tar separator area.

3.3.1.3.1 Soil Boring Installation

Continuous sampling will be conducted by advancing a 2-foot long, by 2-inch outer diameter split spoon or if applicable, a 4-foot long Geoprobe macro-core sampling device ahead of either 2.25 or 4.25-inch hollow stem augers (HAS) at a minimum of seven locations (SB01 through SB07). The rationale for these proposed locations is shown in Table 3-2. The soil borings will be advanced to refusal at bedrock, if possible. The general purpose of the borings is to examine subsurface soils and determine if NAPL is present in the overburden material. As discussed later in this Section, a minimum of two borings will be completed as monitoring wells, including SB05 and another boring which will be selected in the field based on observations of NAPL during soil boring advancement.

A minimum of one soil sample will be collected from each boring for VOCs, SVOCs, TAL metals, and total cyanide. Soil borings will be screened for visual, olfactory, and OVA signs of coal tar-type impacts (residues or staining) and readings will be taken at a minimum of every foot. OVA equipment will also be used to continuously monitor for potential air emissions during installation of soil borings and the readings will be documented in the field logbook. Based on the results of the visual, olfactory and instrumental screening, soil samples will be collected for laboratory analysis.

Table 3-2
Soil Boring Locations and Rationales

Boring	Rationale
SB01	To examine soil conditions down to bedrock and determine if NAPL is present in the vicinity of former oil tar separator.
SB02	To examine soil conditions down to bedrock and determine if NAPL is present in the vicinity of former oil tar separator.
SB03	To examine soil conditions down to bedrock and determine if NAPL is present in the vicinity of former oil tar separator.
SB04	To examine soil conditions down to bedrock and determine if NAPL is present in the vicinity of former oil tar separator.
SB05	To examine soil conditions down to bedrock and determine if NAPL is present in the vicinity of former oil tar separator.
SB06	To examine soil conditions down to bedrock northeast of the CWTF, in the former tail race area and determine whether NAPL has accumulated in that potential preferential pathway.
SB07	To examine soil conditions down to bedrock south of the former MGP oil house next to the CWTF to determine if oil has been released to the subsurface.

Soil samples will be logged and classified with respect to the Unified Soil Classification System (USCS) and descriptions of the sample texture, composition, color, consistency, percent recovery, and moisture content will be recorded as outlined in the FSP. In addition, odors will be noted with particular attention to soil descriptions where the presence of NAPL is observed.

Following completion, each boring will be properly abandoned by tremie-grouting to grade with a cement-bentonite grout mixture. Soil cuttings generated during the drilling process will be stored in containers provided by the drilling contractor. Ish Inc. team members will sample and analyze the investigation-derived waste soils, and RG&E will then properly dispose of these soils in accordance with NYSDEC guidance.

3.3.1.3.2 Monitoring Well Installation

The planned monitoring wells and their rationale for installation are shown in Table 3-3. A minimum of two overburden wells will be installed. Deep (bedrock) groundwater will be addressed in the site wide RI work plan to be separately developed and submitted for DEC review and approval at a later date. A shallow overburden well (MW201) will be installed in the general area shown on Figure 3-1 to examine water quality at that location and to collect NAPL if present. A second well (MW202 – not shown on the figure) will be installed at a location to be determined based on field observations. A 10-foot screened interval will be placed to intersect the zone of highest contamination. If NAPL is observed in a boring, the screened interval will intersect that depth. The two monitoring wells will be screened using 2-inch flush-joint PVC with 0.020-inch slot screens and O-rings between riser connections. The slot size may be altered pending the results of the subsurface drilling program. For example, if there are significant fines in the saturated zone, 0.010-inch slot screens may be used. A two-foot PVC sump will be placed at the bottom of the monitoring well provided this construction technique would not prevent DNAPL collection. For example, if NAPL is present only at the very bottom of the boring where refusal is met, a sump will not be used, as this would prevent NAPL from flowing into the well.

Table 3-3
Monitoring Well Locations and Rationale

Well	Rationale
MW201	To determine if mobile NAPL is present in the vicinity of former oil tar separator and to examine groundwater quality in that area.
MW202	To determine if mobile NAPL is present at a boring location where NAPL is observed in site soils and to examine groundwater quality in that area. (optional)

The two newly installed wells will be developed no sooner than 24 hours after installation is complete, using the surge and evacuate method. This method will minimize the effect of fine-grained soils that would increase the turbidity of the groundwater samples and thus interfere with groundwater quality analyses. This method also increases the hydraulic connection between the sand pack and the natural formation material.

Soil cuttings generated during the boring process will be stored in appropriate containers. Ish Inc. team members will sample and analyze the investigation-derived waste soils and RG&E will then properly dispose of these soils in accordance with NYSDEC guidance.

Decontamination/purge water generated during the installation development and purging of the wells will be stored in a 500-gallon storage tank or other suitable container until the generation of fluids is finished. RG&E will properly dispose of these materials in a manner consistent with NYSDEC guidance.

3.3.1.4 Groundwater Sampling

Initially, one round of groundwater sampling is proposed for the two new monitoring wells (MW201, and MW202) installed unless NAPL accumulates in a given well. Prior to sampling of the monitoring wells, the presence and depth of any NAPL that has accumulated in each well will be noted. The groundwater samples from the new wells will be analyzed for TCL VOCs, TCL SVOCs, TAL metals, and total cyanide. If required, a second round of groundwater sampling may be performed with the concurrence of NYSDEC to supplement the initial groundwater sampling data.

Monitoring wells will be sampled using the QED Micropurge pump at a purge rate of 150 mL/min. Groundwater samples will be collected at a minimum of two weeks after the wells have been developed. It should be noted that turbid groundwater samples may not be indicative of groundwater conditions. If groundwater during the purging process has turbidity greater than 50 NTUs, two alternatives may be implemented to provide more accurate groundwater quality results. The first alternative which is part of this plan is to collect the samples via low flow sampling methods, while the second alternative is to collect both filtered and unfiltered samples. However, based on the NYSDEC TAGM # 4015, “filtration is never to be the “cure” for improperly built/developed wells which produce turbid sample”. For more details on the sampling procedures to be used, refer to the FSP (Appendix A).

Table 3-4
Approximate Numbers of Samples and Analytical Parameters

Parameter	Subsurface Soil	Groundwater (1st round)	QA/QC Duplicates	Field Blanks/ Trip Blanks	Water/Soil Drum Samples	Total No. Samples
TCL VOCs	4 to 8	2	1 soil/ 1 groundwater	1/2	1/2	12 to 16
TCL SVOCs	4 to 8	2	1 soil/ 1 groundwater	1/0		7 to 11
TAL Metals	4 to 8	2	1 soil/ 1 groundwater	1/0		7 to11
Cyanide (total)	4 to 8	2	1 soil/ 1 groundwater	1/0	0/2	9 to 13
TCLP Benzene					0/1	1
Reactivity					0/1	1
Total Sulfur					0/1	1

3.3.1.5 Investigation-Derived Waste Handling

The investigation-derived waste materials generated during the IRM field activities will consist of soil cuttings from borings, groundwater purged from sampling locations, and wastewater from decontamination of reusable drilling equipment, and soil and groundwater sampling equipment. Wastewater will be contained in a large polyethylene tank designed for wastewater storage or Department of Transportation (DOT)-approved 55-gallon drums. Soil cuttings will be contained in appropriate containers and sampled by Ish Inc. and properly disposed of by RG&E.

3.3.1.6 Survey

The location and elevation of test pits, soil borings, and new monitoring wells will be surveyed following completion of the field effort. In addition, the locations of the oil/tar separator and associated piping will be surveyed where possible.

3.3.1.7 Health and Safety

A detailed, project-specific Health and Safety Plan (HASP) has been prepared and can be found in Appendix C. This plan contains site-specific information including emergency contacts, the route to the nearest hospital, and site-specific hazards. Based on previous experience at former MGP sites and existing site data it is anticipated that the field sampling activities will be performed with modified level D personal protection equipment.

In addition to a project-specific HASP, a Community Air Monitoring Plan (CAMP), consistent with NYSDOH guidelines, is included with this work plan in Appendix D. The CAMP describes the procedures and equipment that will be used to protect the nearby community from fugitive chemical and particulate emissions during the field activities. Also, an Odor Mitigation Plan (OMP) is included in Appendix E to protect the nearby community from fugitive odors during field work.

3.3.2 Sample Analysis

The primary potential constituents of concern (COCs) at the oil-tar separator area of the West Station Site are those related to the former MGP processes. These COCs include monocyclic aromatic hydrocarbons (MAHs), polycyclic aromatic hydrocarbons (PAHs), petroleum fuels, cyanide, and some metals. Therefore, some soil samples will be analyzed for the following analytical parameters: VOCs, SVOCs, TAL metals, and total cyanide.

RG&E's analytical laboratory contractor, Severn Trent Laboratories, is certified by the ELAP and is a participating member of the NYSDEC ASP-CLP. STL has supported Ish Inc. on other MGP and Energy East specific projects.

3.3.2.1 Data Quality Objectives

Ish Inc. recognizes that the analytical results from the IRM will undergo detailed review by NYSDEC. To support these results, laboratory analyses of environmental samples will be conducted in accordance with NYSDOH ASP protocols, and Category B deliverables. As part of the ASP analyses, STL will generate analytical packages that can undergo data validation, as described in Section 3.2.2.3.

3.3.2.2 Quality Assurance and Quality Control (QA/QC) Samples

An integral part of the overall analytical program is the collection of appropriate QA/QC samples, as summarized in Table 3-4.

Field blanks will be analyzed to verify the appropriateness of field decontamination techniques for sampling equipment. Field blanks will be analyzed at a frequency of one per 20 samples for the same parameters as the associated environmental samples. Trip blanks will only accompany groundwater samples to be analyzed for VOCs.

Field duplicate samples will be analyzed at a frequency of one per 20 per environmental media, the same parameters as parent media samples. Matrix spike/matrix spike duplicate (MS/MSD) samples will be collected at a frequency of one per 20 field samples or one per week. The reproducibility and homogeneity of the samples will be assessed by determining the Relative Percent Difference (RPD) for both spike and non-spike compounds. Coded field duplicates will be collected to determine the reproducibility and homogeneity of samples. The samples are "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are a duplicate sample. The frequency of collection of these samples is one per 20 field samples.

3.3.2.3 Data Validation Screening

Ish Inc. will perform a QA/QC data validation review of the analytical data generated by STL. This validation will include a review of pertinent QA/QC data such as sample extraction and analysis, holding times, calibration, a review of laboratory blanks and QA/QC sample results, and a review of the analytical case narrative. A Data Usability Summary Report (DUSR) will be prepared which will include a compliance chart, a list of samples included in each sample delivery group and recalculations of sample results. Nonconforming QA/QC results will be evaluated with respect to their implications for data reliability and usability. The DUSR will be the responsibility of the Project QAO.

3.3.3 Data Management

One aspect common to environmental site investigations is the large volume of data collected. Once collected, this data requires compilation, validation, manipulation and presentation. Therefore, data management is an important tool to identify data gaps, present an accurate site characterization, and prioritize technical issues for overall site strategy.

Ish Inc. team has developed a data management system using Microsoft Access and AutoCAD Land Desktop. These programs are powerful computerized tools to cost-effectively manage site data. The system can produce tables, graphs, figures, borehole and well logs, cross-sections, statistics, etc. The data management system is designed to lower costs of generating reports while increasing quality by eliminating data reduction errors. The database will consist of historical groundwater and soil analytical data provided by RG&E in electronic format and new data generated during the proposed activities.

New soil and groundwater analytical data will be reviewed by an experienced analytical chemist prior to reporting.

3.3.4 Development of the Oil-tar Separator Characterization Summary Report

Following completion of the field activities Ish Inc. will prepare a summary report/data package for the characterization of oil-tar separator area. The report will include the following major elements:

- Illustration of MGP impacts to subsurface soil, if any, including chemical concentrations and presence of NAPL;
- Evaluation and mapping of groundwater flow, to the extent possible based on the data collected during this work;
- Presentation of groundwater quality impacts;

- Comparison of soil, sediment, and groundwater quality results to New York State standards, criteria, and guidelines (SCGs);
- Documentation of field activities, boring logs, laboratory results, calculations, and models; and

Based on the conclusions of the characterization work for the oil-tar separator area and further discussions with RG&E and NYSDEC, Ish Inc. will develop and submit a “source removal” IRM work plan for the oil-tar separator, as necessary.

4
PROJECT MANAGEMENT APPROACH

This section presents the project management plan contemplated at this time for the West Station characterization and development of an IRM design for the oil-tar separator area. The Ish Inc. project team is presented in Figure 4-1, and each of the individuals is introduced below.

The Principal-in-Charge, Dr. Ishwar Murarka, has full authority and responsibility for the delivery of the oil-tar separator area project results including overall management, direction and execution of the this work Plan. Dr. Murarka will be Ish Inc.'s primary point of contact with RG&E's Project Manager Mr. Dan Kennedy.

Dr. Murarka will implement QC standards through participation in, and review of internal work products. Dr. Murarka will monitor project progress and technical quality and provide assistance in assessing Ish Inc.'s resources, as required, to ensure successful project completion. He will also maintain contact with RG&E, as he has supported other MGP projects, to ensure client satisfaction. Dr. Murarka presently performs this function on existing RG&E projects.

Mr. Peter De Clercq will aid Dr. Murarka in managing the project, particularly the field team. Mr. De Clercq will also spearhead the report preparation. Mr. David Mauro, Principal and QAO, will provide data quality oversight. Ms. Lara Gray will serve as Field Team Leader and will be responsible for implementation of field activities associated with this subsurface characterization work. Ms Lara Gray will also serve as the project geologist. Mr. Keir Craigie will perform the data usability assessment. Table 4-1 describes the Project Team with associated responsibilities.

All project related decisions will be subject to NYSDEC input and concurrence.

Figure 4-1
Organizational Chart – Key Individuals

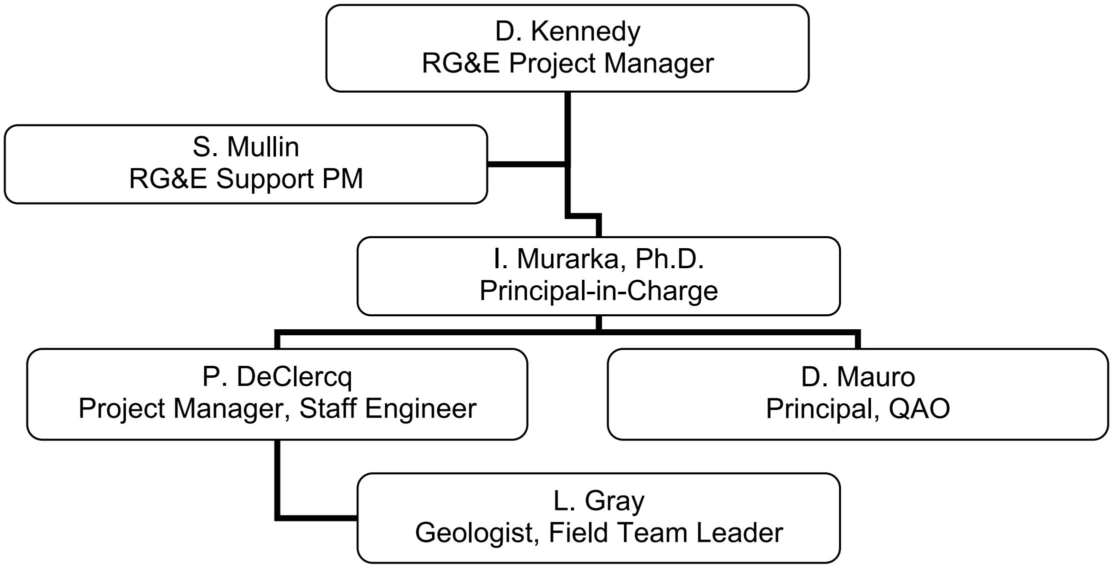


Table 4-1
Ish Inc. Personnel and Responsibilities

Personnel	**Project Title**	**Responsibility**	**Location**
Dr. Ishwar Murarka	Principal	Technical review, regulatory coordination, remediation options evaluation, principal-in-charge	Raleigh, NC
Peter DeClercq	Staff Engineer	Report preparation, remediation options evaluation, project management	Watertown, MA
Lara Gray	Geologist	Field team leader, geologist, sampling	Watertown, MA
Keir Craigie	Scientist	Data usability summary report	Watertown, MA
David Mauro	Principal	Technical review, data quality assessment	Watertown, MA

Three subcontractors are contemplated to be utilized for this work (depending on availability), Nothnagle Drilling, Sevenson Environmental Services (SES), and Severn Trent Laboratories. Nothnagle Drilling will provide drilling services, while Sevenson Environmental Services may provide test pitting services and Severn Trent Laboratories will perform analytical testing for this RI. An RG&E surveyor will perform the survey for mapping of test pits, soil borings and monitoring wells completed during the characterization effort.

Table 4-2
Potential Subcontractors

Company	**Contact**	**Service Area**
Nothnagle Drilling Scottsville, NY	Tim Nothnagle	Soil boring and drilling, monitoring well installation
Severn Trent Laboratories Amherst NY	Paul Morrow	Chemical analyses
Sevenson Environmental Services, Niagara Falls, NY	Gary Rose	Test pitting services

5

SCHEDULE

The following is a tentative duration schedule for the investigation activities in this revised work plan. Upon NYSDEC approval of the work plan, a schedule with target dates for implementation will be provided to the NYSDEC.

Table 5-1
Target Project Duration Schedule

Task Name	Estimated Task Duration Time/Comments
Final Work Plan submission to NYSDEC	3/05/06 Deadline
NYSDEC Work Plan Approval	**Assumed** 1 month for NYSDEC approval
Mobilization, test pit excavations, soil borings, soil sampling, monitoring well installation and development	4 to 8 weeks
Soil analyses w/DUSR	2 - 4 weeks
Groundwater sampling	1 - 2 days
Groundwater analyses w/DUSR	2 - 4 weeks
Data review, and interpretation, report preparation	6 - 10 weeks
DRAFT report to RG&E for comments and review	3 weeks
Final report to DEC	2 weeks

6
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A

FIELD SAMPLING PLAN

FINAL FIELD SAMPLING PLAN FOR THE WORK PLAN FOR CHARACTERIZATION AND DESIGN OF INTERIM REMEDIAL MEASURE FOR THE OIL/TAR SEPARATOR AREA AT THE RG&E WEST STATION FORMER MGP SITE ROCHESTER, NEW YORK

SITE #: V00593-8

INDEX #: B8-0535-98-07

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Revised February 2006

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1
INTRODUCTION

This field sampling plan describes sampling activities to be performed at the West Station former MGP site located at 254 Mill Street, City of Rochester, New York. The field sampling plan covers equipment used, decontamination procedures, soil identification and sample collection practices, well and piezometer installation, groundwater sampling and collection practices, air monitoring, and documentation procedures.

2
GENERAL FIELD PROTOCOLS

2.1 UNDERGROUND UTILITIES

Underground utilities, including electric, telephone, cable TV, sewers, water, etc., will be identified and marked prior to any drilling or sampling activities. Public and privately owned utilities will be contacted by phone at least 72 hours prior to field activities to conduct stake-out of their underground utilities. In New York State, Dig Safely New York (formerly UFPO) is the agency responsible for coordination of underground clearance. Other potential on-site hazards such as sharp objects, overhead power lines, and building hazards will be identified during the initial site visit and noted in the Health and Safety Plan.

2.2 SAMPLE IDENTIFICATION

Each sample will be assigned a unique field sample ID according to the following scheme:

WS-SB01 (   ) or TP01 or MW201

Where:

WS	West Station former MGP site
SB01	Sequential number representing soil boring (sampling depth interval, feet)
TP01	Sequential number representing test pit location
MW201	Sequential number representing new monitoring well

2.3 SAMPLING EQUIPMENT

The following is a general list of equipment necessary for sample collection:

1. Stainless steel spoons and bowls for compositing soil samples.
2. Appropriate sample containers provided by the laboratory.
3. Sample bottles (kept closed and in the laboratory-shipped coolers until the samples are collected)

4. Reagent-grade preservatives and pH paper or meter (or pre-preserved sample containers for aqueous samples.
5. Chain of custody forms, sample labels, and fine-point waterproof pens for writing on sample labels.
6. Log book and field sampling records.
7. Laboratory grade decontamination soaps (such as Alconox), reagent grade solvents, and deionized water to be used for decontamination.
8. Buckets, wash basins, and scrub brushes to be used for decontamination.
9. Camera, film, and batteries to document sampling procedures and locations.
10. Shipping labels and forms.
11. Packing/Shipping material for sample bottles.
12. Clear plastic tape.
13. Duct tape.
14. Aluminum foil.
15. Resealable plastic bags.
16. Portable field instruments, including a photo-ionization detector (PID), CGI/O_2 meter, pH meter, conductivity meter, water level indicator, and temperature meter.
17. Poly-sheeting

2.4 FIELD RECORDS

The project manager will control field log books. Field log books will be issued to the field team leader and will be maintained by both the field team leader and other field team members on site. Field log books should provide a daily record of significant events, observations, and measurements and should include at a minimum:

1. Name and title of author, date and time of entry, and physical/environmental conditions during field activity.
2. Purpose of sampling activity.
3. Location of sampling activity.
4. Names and titles of field crew members.
5. Names and titles of any site visitors.

6. Sample matrix (soil, sediment, groundwater, etc.).
7. Sample collection method.
8. Number and volume of sample taken.
9. Description of sampling point.
10. Volume of groundwater removed before sampling.
11. Preservatives used.
12. Date and time of collection.
13. Sample identification number.
14. Field observations.
15. Field measurements (pH, temperature, conductivity, water level, etc.)
16. References for maps and photographs of the sampling site.

Data recorded in field log books, sample labels, and chain of custody forms will be written with waterproof ink. If an error is made in the field log book or chain of custody form the error will be corrected by simply crossing a single line through the errors and entering the correct information. The erroneous information will not be erased. Corrections will be initialed and dated.

3
EQUIPMENT DECONTAMINATION

3.1 SAMPLING EQUIPMENT DECONTAMINATION

An area for the decontamination of field equipment will be set up on-site in close proximity to the investigation activities. This area will be designated by a section of high density polyethylene sheeting placed on the ground. Decontamination of field equipment will occur in this area.

Non-disposable field equipment used for the collection of soil, such as split-spoons, continuous cores, spatulas, spoons, trowels, and bowls, will be decontaminated after each use by the following procedure:

- knock, scrape, or wipe off excess soil,
- pre-rinse with tap water,
- wash with non-phosphate detergent and tap water,
- rinse with tap water,
- rinse with methanol,
- rinse with distilled water,
- rinse with nitric acid,
- rinse with distilled water, and
- air dry on a designated clean surface.

Washed equipment will be wrapped in polyethylene sheeting or aluminum foil for storage or transportation from the designated decontamination area to the sampling location. At no time will washed equipment be placed directly on the ground. Decon waste water will be collected and properly disposed of.

3.2 DRILL RIG AND BACKHOE DECONTAMINATION

Equipment used in intrusive work, including backhoe, drilling rig, augers and bits will be cleaned with high pressure hot water and scrubbed with a wire brush to remove dirt, grease, and oil before beginning field work and before leaving the project site upon completion of the last sampling activity.

A decontamination pad will be constructed of high density polyethylene sheeting on a prepared surface sloped to a sump. The sides of the pad will be bermed to contain decon water. Upon completion of field activities, the decontamination pad will be properly decommissioned by removing liquid from the sheeting, including the sump area, and allowing area to dry. The sheeting will then be folded and placed in the waste container. The earthen material or wood timbers used to construct the containment berm will be inspected to ascertain if the material has come in contact with decon liquids during use. If they have, the materials will be disposed in the waste container for subsequent disposal at an appropriate facility. If the materials have not been in contact with decon liquids, they may be reused.

4
TEST PITS

4.1 TEST PIT EXCAVATIONS

Test pits will be excavated using a backhoe. The purpose and general locations of the test pits are discussed in the IRM Work Plan and will be finalized in the field after the locations of existing underground utilities have been marked. During excavation activities, personnel will stand upwind of the excavation area to the extent possible. Air monitoring will be conducted in accordance with the site-specific Health and Safety Plan (HASP), which is Appendix C of the IRM Work Plan, and the Community Air Monitoring Program (CAMP) which is located in Appendix D of the IRM Work Plan. Test pit material will be visually described, as well as photographed for future reference. In addition, soil samples will be collected from soil piles or using a remote sampling device, such as a stainless steel spoon clamped to extension rods. The observations made for each test pit will be recorded in accordance with META SOP MET6002 (see Appendix A). Material removed from the test pit will be placed on polyethylene sheeting. Upon completion, the materials from the test pit will be placed back in the excavation. Under no circumstances, will test pits greater than 4 feet deep be entered by site personnel.

Visually clean soils, such as surface soils, will be segregated from soils that may be impacted. The visually clean soils will be used to cover the impacted soils/source materials when placed back in the excavation. Special care will be given to try to separate clean soils from impacted soils so as to replace contaminated soils back in the trench first. Test pits will be back-filled as soon as possible after completion. For gravel roadways and parking areas, the backfill will be tamped down in lifts as they are replaced. For test pits located in asphalt-covered area, the surface will be replaced with cold or hot asphalt mix, compacted by rolling, and trimmed flush with the adjoining surface. Following backfilling of the excavation, the test pit boundaries and locations of subsurface structures will be appropriately marked for surveying.

If during test pitting activities, a pipe or other buried utility is encountered, the excavation will cease, the orientation and dimensions will be recorded, the test pit backfilled, and a new test pit attempted in the general vicinity of the initial location. If a pipe or utility is accidentally severed, the owner of the utility will be immediately notified. Liquid flows or electricity will be shut off immediately and appropriate repairs initiated as soon as possible. The NYSDEC will be notified if the release of fluid material occurs and the appropriate response action implemented.

5
SOIL BORINGS

5.1 DRILLING METHODS

5.1.1 Drill Rig with Hollow Stem Augers

Drilling by means of hollow stem augering involves construction of the borehole by simultaneously rotating and axially advancing the auger column into unconsolidated or poorly consolidated formations. Drill cuttings generated at the drill bit are conveyed upward to the surface on the auger flights. The borehole is normally advanced without the use of a drilling fluid. When the borehole has been advanced to a desired sampling depth, sampling tools are inserted through the axis of the auger column and a formation sample is obtained by driving the sampler into the formation materials.

5.1.2 Direct Push

A direct push method consists of advancing a 2.125-inch Geoprobe® Macro-Core® sampling core to desired depth. A new acrylic sleeve is inserted within the coring apparatus to help eliminate cross contamination between sampling intervals and between different locations. At each location the Macro-Core® is continuously advanced to the target depth. Once a core is collected, the acrylic sleeve is laid horizontally, sliced open and examined thoroughly both for geology and chemical/odor screening. Bore holes are then back filled with liquefied grout to grade.

5.2 GEOLOGIC LOGGING, SOIL CLASSIFICATION AND DOCUMENTATION

The field geologist will log borehole and core hole geology in the field log book and on field forms. Samples collected from the borehole will be classified in accordance with ASTM standards D2487 Standard Method for Classification of Soils for Engineering Purposes and D2488 Standard Practice for Description and Identification of Soils. The field geologist will be on-site during the drilling operations to classify each sample in the field log book and/or forms including:

- Site;
- Boring number;
- Interval sampled;
- Date;
- Initials of sampling personnel;
- Soil type;
- Soil Color;
- Feet of recovery;
- Soil moisture content;
- Soil texture;
- Soil grain size and shape;
- Relative density;
- Soil Consistency;
- Visible evidence of residues; and
- Miscellaneous observations (including organic vapor readings).

5.3 BORING COMPLETION

Soil borings will be completed by adding cement/bentonite grout via tremie pipe from the bottom of the borehole to ground surface as the augers are withdrawn or, in the case of the Geoprobe® borings, after the Macro-Core® has been withdrawn.

5.4 SOLID WASTE HANDLING

Solid waste generated during the field program will include plastic sheeting, polyethylene tubing and soil cuttings. Wastes will be containerized and sampled for disposal characteristics. Composite samples of soil will be collected and analyzed for Toxicity Characteristic Leachate Procedure (TCLP) benzene, reactivity, and total sulfur. Waste materials will be disposed of properly.

6
SUBSURFACE SOIL SAMPLING

Samples selected for laboratory analysis will be obtained from split spoons or Geoprobe® cores and placed in the appropriate containers provided by the laboratory as described in META SOP MET6006 (see Appendix A). Sample containers for volatile organic analysis will be filled first by sub-sampling the core. Samples for volatile analysis will be taken from the portion of the split spoon sample where the highest PID reading is recorded. A sufficient amount of the remaining soil will be homogenized by mixing the sample in a decontaminated steel bowl with a decontaminated trowel or spatula.

Samples collected for laboratory analysis will be placed immediately into sampling containers provided by the laboratory and properly stored before transport to the laboratory, as described in META SOP MET6009 (see Appendix A). In addition, a geologist will be on-site during the drilling operations to fully describe each sample including:

- Soil type;
- Color;
- Feet of recovery;
- Moisture content;
- Texture;
- Grain size and shape;
- Relative density;
- Consistency;
- Visible evidence of residues; and
- Miscellaneous observations.

Duplicate samples will be collected at the frequency detailed in the QAPP.

7
MONITORING WELLS AND PIEZOMETERS

7.1 MONITORING WELL INSTALLATION

Monitoring wells will be installed through the advancement of hollow stem augers. Monitoring wells will be constructed of 2-inch PVC riser and screened using 0.020-slotted screen. Figure 7-1 depicts a typical monitoring well installation. PVC riser will have an o-ring between riser connections. The slot size may be altered depending on the results of the subsurface drilling program. In addition, if DNAPL is encountered during the drilling process, a sump may be incorporated below the screened interval. This well construction configuration screened across the water table with an attached sump, allows for monitoring of NAPL potentially “floating” on the water table or water bearing surface, in addition to collecting heavier DNAPL

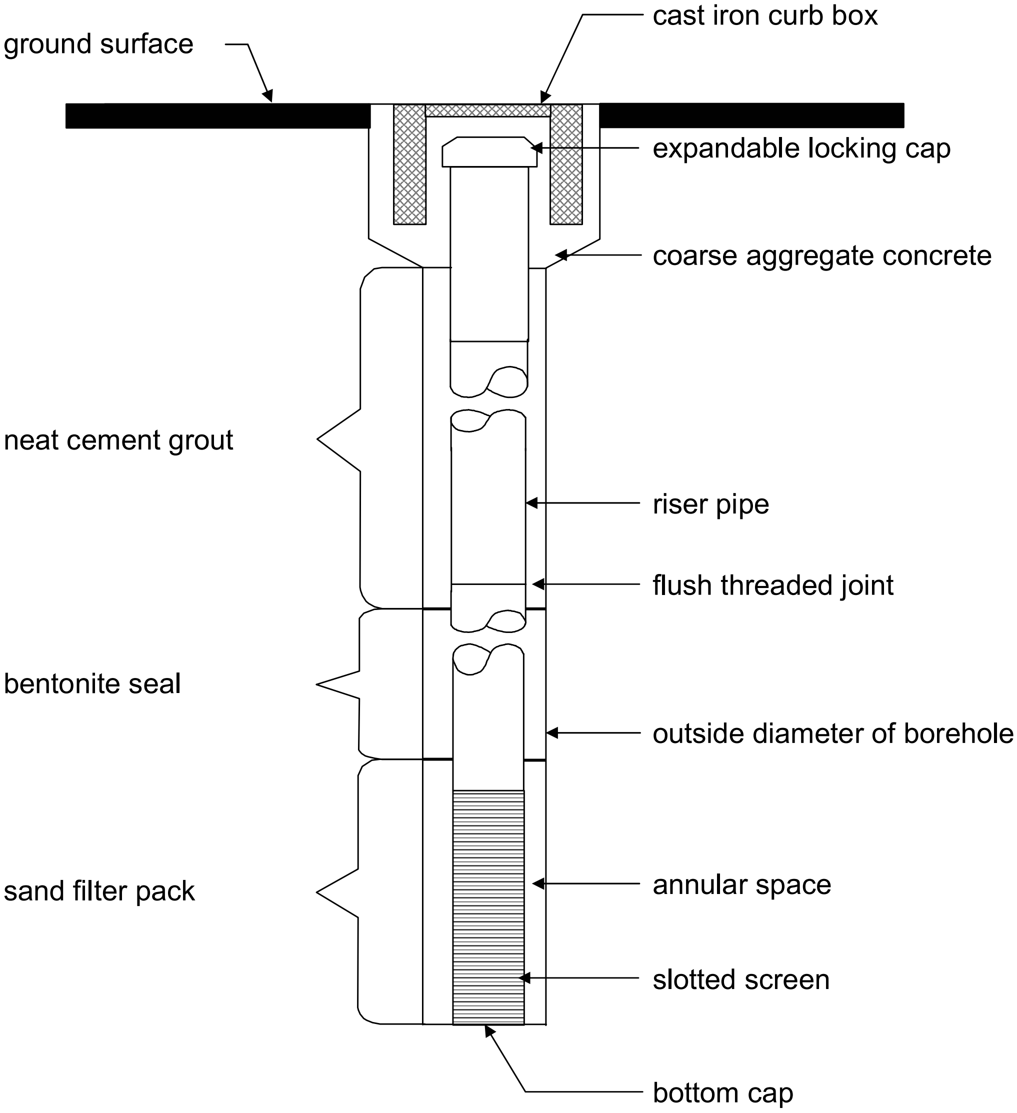
The rationale for each well location is described in the Work Plan. A 10 foot screened interval will be placed to intersect zone of highest contamination. If NAPL is observed in a boring, the screened interval will intersect that depth.

Monitoring wells will be installed in accordance with the general procedure outlined in SOP MET6020 (see Appendix A).

7.2 DIRECT PUSH PIEZOMETERS

A drive point sampling system, consisting of Geoprobe® drive equipment is typically employed to install each 1-inch piezometer. The drive point system is designed to: 1) collect discrete groundwater samples from the saturated zone; and 2) minimize the disturbance of the area from sampling activities.

Figure 7-1
Typical Monitoring Well or Piezometer Installation



The drive point system consists of two major components, an outer steel casing with an expendable drive point, and an inner PVC casing with a five-foot screened interval at the base. The outer casing is a 2.0 inch standard AQ drill rod. This outer casing is decontaminated between each use, and re-used with the exception of the expendable drive-point. The inner casing consists of 1-inch Schedule 40 PVC with a 5-foot, 0.010-inch slotted screened interval at its base.

At each location, the outer steel casing is advanced using equipment capable of installing the casing (such as a Geoprobe® machine or conventional drill rig equipped with a hydraulic hammer) to a predetermined depth estimated to be 10 feet below the water table interface. The PVC inner casing is assembled, and lowered down through the outer casing. The outer casing is then removed, disconnecting the expendable drive point in the process.. Alternatively, the piezometers may be constructed in open holes from direct push soil sampling, as appropriate. Each 1-inch piezometer can be installed with a sand pack around the screen, to the extent possible, which will vary based on the caving of subsurface soils. Then, the piezometers are completed in the same way as the monitoring wells (Figure 7-1) to allow for future sampling and water level gauging.

8
GROUNDWATER SAMPLING

8.1 MONITORING WELLS/PIEZOMETERS

8.1.1 Monitoring Well/Piezometer Gauging

Prior to sampling, existing monitoring wells/piezometers will be gauged to measure the depth to groundwater and the depth to the bottom of the casing. Depth to groundwater information will be used to generate groundwater contour diagrams, as needed. In addition, the measured depths to the well/piezometer bottoms will be compared to construction logs. If there is evidence of siltation in any wells or piezometers (soft bottom and/or difference between construction log and field measurement), those locations will be redeveloped prior to sampling.

8.1.2 Monitoring Well/Piezometer Development

Development will be performed according to industry standards and consist of a combination of surging and pumping to remove suspended sediments from the water column until the purge water is clear and relatively free of sediment. Subsequent sampling will occur after allowing the well or piezometer to equilibrate for at least 24 hours.

8.1.3 Piezometer Sampling

The 2-inch piezometers will be installed by the conventional drilling method described in the previous section. The casing will be surrounded by sand and bentonite, capped, and allowed to equilibrate.

Samples will be collected using a QED SamplePro Micropurge submersible pump with the QED Micropurge MP10 Controller and QED 12V compressor, or equivalent pump system. The pump will be set up with polyethylene tubing and bladder; bladders may be decontaminated and used more than once while tubing will be disposed of after each use. Samples will be collected at a low flow rate (150 mL/min). Piezometers will be purged and sampled for TCL VOCs, TCL

SVOCs, TAL metals and cyanide in accordance with the general procedure outlined in SOP MET6021 (see Appendix A). Between each sampling location, the submersible pump will be decontaminated as described in Section 4.4 of the West Station QAPP.

Appropriate sample preservation and shipping methods will be utilized during collection and transportation of samples. For details on the sample handling methods, see the West Station QAPP (Appendix B).

During monitoring well and piezometer purging, water quality measurements, such as pH, conductivity, temperature, dissolved oxygen, and Eh (reduction-oxidation potential), will be collected to provide information on subsurface conditions.

8.1.4 Monitoring Well Sampling

Samples will be collected using a QED SamplePro Micropurge submersible pump with the QED Micropurge MP10 Controller and QED 12V compressor, or equivalent pump system. The pump will be set up with polyethylene tubing and bladder; bladders may be decontaminated and used more than once while tubing will be disposed of after each use. Samples will be collected at a low flow rate (150 mL/min). Monitoring wells will be purged and sampled for TCL VOCs, TCL SVOCs, TAL metals and cyanide in accordance with the general procedure outlined in SOP MET6027 (see Appendix A). Between each sampling location, the submersible pump will be decontaminated as described in MET6001 (see Appendix A).

Appropriate sample preservation and shipping methods will be utilized during collection and transportation of samples. For details on the sample handling methods, see the West Station QAPP (Appendix B).

During monitoring well and piezometer purging, water quality measurements, such as pH, conductivity, temperature, dissolved oxygen, and Eh (reduction-oxidation potential), will be collected to provide information on subsurface conditions.

8.1.5 Waste Handling

The materials that will be generated during the groundwater monitoring program (groundwater purged during the development and sampling of existing monitoring wells and piezometers and waste water from decontamination of the submersible pumps) will be containerized in DOT-approved 55-gallon drums or other secure container(s), sampled for disposal characteristics, and disposed of appropriately.

9
FIELD INSTRUMENTS

9.1 FIELD INSTRUMENTS

Field instruments will be calibrated at the beginning of each day of use and more frequently if required. The calibration procedures will conform to the manufacturer’s standard instructions. Calibration is preformed to ensure that equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. Records of instrument calibration, as well as copies of instrument manuals will be maintained by the Field Team Leader.

9.1.1 Thermo Photoionization Detector (PID) 580B (or equivalent)

The Thermo photo-ionization detector will be equipped with a minimum 10.6 eV lamp and should be capable of ionizing and detecting compounds with an ionization potential of less than 10.6 eV. This accounts for up to 73% of the volatile organic compounds on the NYSDEC ASP Target Compound List. Calibration and a battery check will be performed at the beginning of each working day and recorded in the field log book.

9.1.2 MIE Miniram Model PDM-3 (or equivalent)

The MIE Miniram PDM-3 is a portable, nephelometric, airborne particle monitor. This instrument measures the concentration of both solid and liquid airborne particles ranging from 0.01 to 10 mg/m^3 and 0.1 to 100 mg/m^3. Calibration and a battery check will be performed at the beginning of each working day and recorded in the field log book.

9.1.3 Combustible Gas Indicator (CGI)/O_2 MSA Model 361 (or equivalent)

The combustible gas indicator oxygen meter (CGI/O2) MSA model 361 measures combustible gas and vapors in the air to determine if a flammability hazard exists, as well as percent oxygen to determine if sufficient oxygen is present in the air. The combustible gases or vapors are measured as percent lower explosive limit (LEL) with a range of 0-100% and oxygen is measured as a percent present with a range of 0-25%. Calibration and a battery check will be performed at the beginning of each working day and recorded in the field log book

9.1.4 Horiba U-22 with Flow-through Cell (or equivalent)

The Horiba U-22 water quality monitoring system simultaneously measures pH, dissolved oxygen, conductivity, salinity, total dissolved solids, temperature, turbidity, depth, and oxidation reduction potential. Calibration and a battery check will be performed at the beginning of each working day and recorded in the field log book.

A

FIELD STANDARD OPERATING PROCEDURES (SOPs)

MET6001

Decontamination of Equipment in the Field for Organics and Inorganics

1.0 **Purpose**

1.1 This Standard Operating Procedure (SOP) describes the methods to be used for decontamination of sampling equipment in the field. The use of properly cleaned sampling equipment will minimize the possibility of cross-contamination of samples, equipment wear and tear, and the exposure of site personnel to potentially hazardous substances.

2.0 **Introduction**

2.1 The best way to avoid cross-contamination from improperly cleaned sampling equipment is to use new, pre-cleaned, or disposable equipment whenever possible. For example, disposable scoops could be used when collecting soil samples.

2.2 When sampling equipment must be reused, decontamination is mainly achieved by washing with detergent solutions, rinsing with tap and distilled water, and rinsing with organic solvents, principally methanol. The actual procedure will vary depending upon regulatory guidelines, the type of equipment used, the site matrix, and the parameters of interest.

2.3 A decontamination zone must be placed in a convenient area of the site which is separate from and unaffected by site activities. A large sheet of clean plastic sheeting is placed on the ground and secured. The decontamination zone is then segregated into a dirty area and a clean area, and appropriate tasks are performed in each.

3.0 **Equipment**

3.1 The following cleaning supplies are needed: scrub brushes in a variety of sizes, non-phosphate, low sudsing detergent such as Alconox or Micro, several large galvanized steel tubs or plastic buckets, squeeze bottles appropriate for the organic solvent being used, and clean plastic sheeting.

3.2 Sources of clean tap and distilled water are needed.

3.3 Sufficient amounts of clean methanol are needed for solvent rinsing.

4.0 Procedure

4.1 Knock, scrape, or wipe off excess soil from the equipment into a solid waste drum.

4.2 Rinse each piece of equipment with tap water, and collect the rinsates in an aqueous waste drum.

4.3 Scrub each piece of equipment with a brush in a galvanized steel tub or plastic bucket containing a solution of non-phosphate, low-sudsing detergent. Replace the wash solution frequently to prevent the accumulation of excessive levels of site contaminants. Dispose of the wash solution in an aqueous waste drum.

4.4 Rinse each piece of equipment thoroughly with tap water. Shake the excess tap water off each piece.

4.5 Rinse each piece of equipment with clean methanol which is placed in an appropriately labeled hand sprayer. Collect the methanol rinsate in an aqueous waste drum.

4.6 Rinse each piece of equipment with clean distilled water.

4.7 If metals and or cyanide are to be sampled in the field program **ADD THIS STEP.** Rinse each piece of equipment with a dilute solution of 10% nitric acid (HNO_3 in distilled water) placed in an appropriately labeled hand sprayer. Collect the nitric acid waste in combined aqueous waste drum.

4.8 Rinse thoroughly with clean distilled water

4.9 Shake the excess water off and allow each piece of equipment to dry on a designated clean surface or re-use immediately.

4.10 If the equipment is portable and or not ready for use, the equipment should be wrapped in aluminum foil so as to ensure no cross contamination of the equipment prior to its use. Once ready for use, the equipment can be unwrapped an the foil can be discarded as solid waste.

4.11 Dispose of all waste solids and fluids according to the site-specific work plan.

5.0 Safety

5.1 At a minimum, eye protection, safety shoes, gloves, and protective clothing are to be worn while working in the decontamination area.

5.2 There are several types of gloves that may be worn, depending upon the equipment being cleaned, extent of contamination, and type of contamination. All gloves must be visibly clean and uncontaminated. Between samples, dirty gloves may be rinsed with methanol and distilled water, or replaced with new, clean gloves.

5.3 Polyvinyl gloves may be worn when the equipment to be decontaminated is not heavily coated with residues such as tar or oil. In cases where heavy accumulations of tar or oil are present on the equipment, neoprene or similar gloves are recommended.

6.0 Responsibilities

6.1 It is the primary responsibility of the Field Team Leader to assure that the proper decontamination procedures are followed. It is the responsibility of the project Health and Safety Officer or designee to draft and enforce safety measures which provide the best protection for all persons involved directly with sampling or decontamination. It is the responsibility of the Quality Assurance Officer (QAO) to draft and enforce quality assurance measures, and to monitor the effectiveness of those measures with quality control operations.

7.0 Quality Assurance and Quality Control

7.1 Quality assurance (QA) is implemented through the use of written quality assurance project plans (QAPPs) and SOPs. The QAO, with the assistance of the project manager, will write project-specific plans, and distribute them to all project personnel.

7.2 The effectiveness of decontamination operations is monitored by analyzing quality control samples.

7.3 A field, equipment, or rinsate blank consists of pouring or pumping distilled water over the sampling equipment or through the device after it has been cleaned. The rinsate blank is collected in the field, and generally, one rinsate blank is collected each day of sampling, for each matrix being sampled. The rinsate blanks are handled like other samples, shipped to the laboratory, and analyzed for the same parameters. The frequency of field blanks will be determined in the site specific Field Sampling Plan (FSP) and the (QAPP).

"I hereby certify that I have read and understood the contents of this Standard Operating Procedure, and I am capable of and qualified to perform the tasks described herein"

Print Name	Signature	Title	Date

MET6002

Procedures for Logging
Subsurface Conditions in Test Pit Excavations

1.0 Purpose

1.1 This Standard Operating Procedure (SOP) describes the methods to be used for conducting and documenting test pit excavations during site disposal, hydrogeological, and geotechnical investigations. A standard procedure for photographing samples and excavations is also included.

1.2 This SOP is intended to offer a standard method for the documentation of subsurface conditions that will be encountered in test pit excavations. Although this SOP provides a framework for the logging of subsurface conditions in test- pit excavations, project requirements may require that some modifications be made. These modifications will be detailed in the site sampling plan and should be noted in the field sampling logbook.

2.0 Equipment

2.1 A field notebook and boring logs are required for field documentation.

2.2 In addition to the heavy excavation equipment (rubber-tired backhoe, Gradall, etc.) the following equipment may be required: wooden stakes, nails, flags, spray paint (for use as reference markers); metal or fiberglass tape or surveyor's stadiarod, clipboard, camera, and ruler (for scale). *A rubber-tired backhoe is preferred for safety reasons*

3.0 Definition of Terms

3.1 *Mottled Zone* - A layer that is marked with either spots or blotches of different color or shades.

3.2 *"A" Horizon* - Top soil; the uppermost zone in the soil profile in which organic matter and mineral fractions have accumulated.

4.0 **Procedure**

4.1 Safety Considerations

4.1.1 Local or on-site buried utilities must be cleared through the proper engineering departments of each utility serving the area as well as the local "DIG SAFE" service. A minimum of 48 hours notification is required prior to digging.

4.1.2 If surface water exists in the vicinity of the test pit, sufficient controls will be taken to divert the water away from the proposed samples location prior to excavation.

4.1.3 The backhoe operator will take directions directly from the field supervisor. Hand signals will be used to communicate instructions due to loud background noise.

4.1.4 Personnel will be prohibited from entering test pits greater than 4 feet in depth.

4.1.5 All spoils removed from the excavation will be placed a minimum of 2 feet from the sides of the pit to prevent the excavation soil from slumping into the pit and to prevent the weight of the excavated soil from caving in the side wall of the test pit.

4.1.6 Test pits will generally be terminated either at refusal or at the water table or the backhoe's limit.

4.1.7 Open excavations are not to be left unattended under any circumstance. The test pit will be backfilled immediately after the soil borings have been logged with either clean fill material or the previously excavated material.

4.1.8 During all excavation work, the field supervisor should make all attempts to stand in front of the operator and away from the bucket arm. In addition, for safety reasons, viewing of the test pits should be performed from the short side of test pit away from the backhoe.

4.2 Logging of Soils

4.2.1 Vertical measurements in the excavation will be made from the top of the test pit at a spot representative of the original grade.

4.2.2 If groundwater levels are to be measured over time, a reference point will be established at original grade.

4.2.3 If the test pit is to be surveyed after backfilling, a flagged stake will be established at the pit on ground representative of the original grade.

4.2.4 A fresh exposure of soil will be made at the side of the pit (preferably facing the sun) in an area most representative of the soil profile. The exposure will be made by having the backhoe take a smooth clean scraping off the entire side wall.

4.2.5 The soil profile log will be recorded in the field notebook. Each test pit log will be preceded by the following information:

- Date
- Client and project number
- Location of project site
- Weather conditions
- Time excavation started
- Test pit ID number and specific location
- Personnel logging pit

4.2.6 The soil profile will be logged from the top down beginning with the 'A' horizon (top soil). A metal or fiberglass tape or surveyor's stadiarod should be used to measure all of the soil horizons.

4.2.7 The description of each horizon will include the following information:

- Textural description of grains (i.e., fine to medium), pertaining to sand and gravel.

- Predominant grain size (clay, silt, sand, or gravel).

- Secondary grain size which will be referred to in the following manner: trace, 0-10%; little, 10-20%; some, 20-35%; and, 35-50%; mostly, 50-100%.

- Relative density and consistency of soils, using descriptions for cohesionless soils (sands and gravels) of very loose, loose, medium, dense, and very dense. For cohesive soils (silts and clays) the consistency descriptions of very soft, soft, medium, stiff, very stiff, and hard will be used.

- Moisture content of soil using the relative descriptions dry, damp, wet, and saturated. A saturated soil will yield free water when squeezed.

- Structure of soil, (i.e., blocky, granular, prismatic, none).

- Note the presence or absence of any mottled zone and the depth at which it stops and ends.

- Any staining or visible contaminants should be described vertically and laterally.

- Depth of each soil layer.

- Location and description of non-indigenous encounters.

- Depth of seepage into pit.

- Record the total depth of pit and note if this was a refusal point where further excavation was limited by rock, concrete or other tough surfaces.

- Describe any bedrock encountered in the excavation.

4.3 Photographing Test Pit Excavations and Samples

4.3.1 Photographs should be taken with a 35mm camera on color slide film. The field personnel taking photographs shall log all photos in the field notebook.

4.3.2 Photographs of test pits should be taken in good light, preferably on the side of the pit most exposed to sunlight.

4.3.3 Identification must be placed in the photo. This can be done by writing the test pit ID in bold letters on a clipboard and placing it within the field of view of the camera. This must be documented in the test pit log. In all photos, an object, preferably a ruler, must be placed in the photo for scale.

"I hereby certify that I have read and understood the contents of this Standard Operating Procedure, and I am capable of and qualified to perform the tasks described herein"

Print Name	Signature	Title	Date

MET6006

Procedures for Subsurface Soil Sampling: Drilling

1.0 Purpose

1.1 This Standard Operating Procedure (SOP) describes the methods to be used when collecting buried waste material and subsurface soil samples by auger drill rig for chemical and physical parameters. The intention of this SOP is to provide procedures for collecting samples which are representative of the study area and are free of cross-contamination.

1.2 The methods and materials listed below are general. Site-specific conditions, such as soil type, parameters of interest, area to be sampled, and program objectives will determine the specific procedures which should be followed.

2.0 Introduction

2.1 During a site investigation, subsurface soil samples may be collected from exploratory or monitoring well borings advanced by a drill rig.

2.2 Split spoon samplers are typically 2 feet in length, 2 to 3 inches in diameter, and are capable of collecting discrete samples at known depths. Other sampling equipment (e.g., Waterloo Sampler) can be utilized with a drill rig to collect longer continuous cores.

2.3 The location, volume, type, and frequency of sample collection will be delineated in the project-specific Sampling and Analysis Plan (SAP).

3.0 Equipment

3.1 Samples may be collected from the split-spoon with stainless steel spatulas or spoons, or any other appropriate scooping device. The specific size and type of equipment used may be specified in the project-specific SAP.

3.2 To the greatest extent possible, all sampling equipment should be made of stainless steel or Teflon, or will be single-use and disposable.

3.3 Composite samples may be mixed in stainless steel bowls, according to SOP No.

MET6007.

3.4 Other equipment needed may include: organic vapor monitor (OVA or PID meter), logbook, log forms, QC-acceptable sample jars, labels, permanent ink marker, trip blank, PPE, sampling table, plastic sheeting, plastic waste bags, coolers, packing material, ice, tape measure, location markers, Chain-of-Custody (COC) forms, and decontamination supplies.

4.0 <u>Procedure</u>

4.1 This method typically involves a drill rig operation with split-spoon samplers.

4.2 Locate the sampling point or area as specified in the SAP. Mark the location for later reference, and record the exact location in the sampling logbook using two (preferably three) prominent and lasting points of reference.

4.3 Once the split-spoon sampler is retrieved to the surface, it will be "cracked" open, logged, and sampled.

4.3.1 Prior to sampling, the sampler will don rubber/latex gloves and appropriate PPE as a safety precaution and to prevent cross-contamination.

4.3.2 The sampler will select a sampling location which does not lie within the top several inches of the spoon since this probably consists of soil washings or cave-in material from an unknown area. Also, the sampler will avoid soil which is in direct contact with the interior wall of the sampling spoon.

4.3.3 The sampling location to be collected will be screened for volatile organic compounds (VOCs) with an organic vapor monitor according to SOP No. MET6024.

4.3.4 Collect a sufficient volume of soil for the analytical work planned.

4.3.4.a Samples to be analyzed for VOCs should be collected as discrete grabs and placed directly into pre-chilled sample jars, with no headspace. This process should be done quickly and preferably not in direct sunlight or cross-wind.

4.3.4.b Ideally, soils collected from the split spoon should be collected from the center of the diameter of the core first, so as to collect soils not touching the side walls of the split spoon. This reduces the potential collection of soils impacted by the movement of liquids within the split spoon during retrevial.

4.3.4.c Where required by state regulatory agencies, VOC soil samples may be required to be preserved with methanol.

4.3.4.d Samples to be analyzed for other parameters may be placed directly into sample jars, or into stainless steel bowls for mixing.

4.3.5 Wipe the jar threads, cap, and label the sample jar immediately after sampling. Sample labels should include, at a minimum, the sample ID, date, time, and initials of the sampler, and analyses to be performed.

4.3.6 Record the conditions of sample collection in a field notebook as quickly after sample collection as possible, so that the information is fresh and accurate.

4.3.7 Field notebooks should be weatherproof and entries should be made in permanent, waterproof ink.

4.3.8 Notebook entries should include for each sample, at a minimum: sample ID (including depth); number of blow counts; location collected; date and time of collection; initials of the sampler; other relevant information such as the sample appearance, odors, sheens, temperature, weather, etc.

4.4 Pack and ship the samples according to SOP No. MET6009. Include a COC form which has been filled out in accordance with SOP No. MET6022.

4.4.1 If required, the sample will be kept in a cooler full of ice until shipment to the laboratory.

4.5 The stainless steel split-spoon will then be properly decontaminated following SOP No. MET6001, and prepared for another sample.

5.0 Safety

5.1 At a minimum, a hard hat, eye protection, ear protection, safety shoes, gloves, and protective clothing are to be worn when collecting samples (Level D or equivalent).

5.2 Additional safety measures will be implemented if warranted by site considerations. These procedures will be specified in the project Health and Safety Plan (HASP).

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Print Name	Signature	Title	Date

MET6009

Procedures for Packing and Shipping Environmental Samples

1.0 Purpose

1.1 This Standard Operating Procedure (SOP) describes methods to be used when packing and shipping water, soil and/or other environmental samples from the field to an analytical laboratory.

1.2 It is the intention of this SOP that the integrity of the samples be maintained.

1.3 It is the intention of this SOP that the samples are shipped to the analytical laboratory within a reasonable time from the date of sampling such that they can be extracted prior to the holding time.

2.0 Introduction

2.1 Samples are to be preserved at a temperature of 4ºC throughout storage and transport.

3.0 Equipment

The equipment for packing and shipping will vary according to the amount and type of samples to be shipped.

3.1 The following packing and shipping supplies are needed: Chain-of-Custody (COC) forms, air shipping documents (ASDs), mailing labels, ice, gallon ziploc bags, packing material (i.e. peanuts, bubble wrap, bubble bags, custom foam inserts), duct tape, clear packing tape, tape dispenser, 48 and/or 54 quart coolers.

3.2 For the shipment of a small number of samples, smaller coolers will be needed.

4.0 Procedure

4.1 Prior to mobilization to the field site, the field team leader will select a shipper based on the proximity to the site and availability of overnight shipping. Once on site, the shipping office will be located for sample drop off. The cut-off time for overnight air shipping must also be determined, as all samples will be shipped overnight.

4.2 The following steps will be followed for packing a sample cooler for shipment:

4.2.1 For 2 oz., 4 oz., 16 oz., 1 liter, and/or 40 ml VOA vials, place samples in the custom made inserts (if available) and place 2 inserts in each cooler. Place an additional solid foam insert under the lower insert to shield the base of the samples from breakage. If inserts not available individually wrap each jar or bottle with sufficient bubble-wrap.

4.2.2 Place 3 double bagged gallon ziploc bags full of ice between the inserts in each cooler. Place any additional ice bags below the bottom layer and on top of the top insert.

4.2.3 For samples in containers other than those previously mentioned, the following steps are recommended: seal samples in separate bubble bags; or wrap securely with bubble wrap; situate in cooler; place enough packing material in the cooler to secure the samples from motion in transport; finally, place a minimum of 3 double bagged gallon ziploc bags of ice in each cooler.

4.2.4 Place a completed Chain-of-Custody (according to SOP No. MET6022) into each respective cooler.

4.2.5 Seal the ends of each cooler 2 to 3 times around with duct tape.

4.2.6 Place a completed mailing label and ASD on each cooler and secure with clear shipping tape.

4.3 The field team leader or designated field team member will drop the samples off at the local office of the shipper, making sure to get copies of the shipping documents.

4.3.1 Samples will not be sent on Friday unless the Field Team Leader has confirmed that the analytical laboratory will be open and ready to receive samples on Saturday.

4.4 Once the samples have been shipped, the Field Team Leader will make contact with the analytical laboratory to notify them of the forthcoming sample shipment and to give the necessary details.

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Print Name	Signature	Title	Date

MET6020

Procedures for the Installation of Overburden Groundwater Monitoring Wells

1.0 Purpose

1.1 This Standard Operating Procedure (SOP) is intended to offer a standard method for the installation of groundwater monitoring wells. This should result in reliable and accurate information regarding groundwater chemistry, water table elevations, groundwater flow direction, and other aquifer characteristics.

1.2 Although this SOP provides a framework for the installation of groundwater monitoring wells, variations in hydrogeological and chemical environments may make modifications necessary in some cases. Any modifications to the methods described in this SOP should be fully documented in the field sampling logbook, should not contribute to further contamination or distribution of contaminants, and should adhere to regulatory guidelines, such as ASTM D5092-90 "Standard Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers".

2.0 Well Construction Materials

2.1 Well casing. Closed riser pipe that isolates the inside of the well from the surrounding materials.

2.1.1 The well casing should be constructed of inert materials, with an inside diameter of at least two inches.

2.1.2 Polyvinyl chloride (PVC) is a commonly used well construction material.

2.1.2.a Use PVC which is certified by the National Sanitation Foundation (NSF) as suitable for use in potable water wells (NSF-PW) or well casing applications (NSF-WC).

2.1.2.b Joints should not be solvent welded, and glues and resins should not be used in the construction of the well. Threaded joints with o-rings are the industry standard.

2.1.2.c Schedule 40 PVC is suitable for shallow wells less than 100 feet.

2.1.2.d Schedule 80 PVC should be used for wells deeper than 100 feet, to prevent cracking at the joints. Deeper wells may require a larger diameter, to facilitate the use of larger sampling devices.

2.1.3 Stainless steel is also used as a well construction material but not commonly.

2.1.4 Flush threaded joints should be used to minimize leakage and cross-contamination.

2.2 Well screen. The opening that allows the groundwater to flow through the well.

2.2.1 The screen material should be constructed of inert materials. In most cases, the screen material is the same as the well casing material.

2.2.2 Industry standard length of a well screen is 10 feet, however ultimately the application will dictate the length of the screen.

2.2.2 The slot openings should be large enough so that they do not plug easily. The slot size varies depending on the geologic material in which the screen is placed.

2.2.2.a For most conditions, a slot size of 0.006 inches (6 slot) or 0.010 inches (10 slot) is recommended.

2.2.2.b For sand and gravel, a larger slot size such as 0.020 inches (20 slot) may be used.

2.2.2.c The slot openings should cover approximately 10% of screen surface area to ensure proper communication with the aquifer and proper development of the well.

2.2.2.d The slot size should accommodate the filter pack material.

2.2.3 The slot configuration and open area should facilitate effective development of the well.

2.2.4 Never substitute hand cut screen for factory machined screen because it has much less open area and may not effectively filter out sediments.

2.3 Filter pack. The material that is placed around the screen.

2.3.1 The filter pack serves three purposes: it filters out sediments, it increases the effective diameter of the well, and it allows the use of a larger slot size in the well screen.

2.3.2 The filter pack should not interfere with the integrity of the monitoring well.

2.3.2.a Clean silica sand (such as commercial filter packs or Ottawa sand) should be used.

2.3.2.b Commercial filter packs are washed, sized, and bagged, which minimizes the possibility of contamination prior to installation.

2.3.2.c Crushed limestone should never be used. Limestone reacts with groundwater and causes chemical interferences.

2.3.3 The filter pack must be the only material surrounding the screen.

2.3.3.a To ensure that no other material comes in contact with the screen, extend the filter pack from one foot below the base of the screen to three to five feet above the top of the screen.

2.3.3.b Some of the pack above the screen will settle as the well is developed.

2.3.3.c If the pack is not extended far enough above the screen, bentonite or grout from the well seal or backfill may filter downward. This could clog the screen and/or interfere with the water quality.

2.3.3.d If the pack is extended too far above the screen, the effective length of the screen may be undesirable for measuring *in situ* hydraulic conductivity.

2.3.4 The grain size of the filter pack depends on the grain size of the geologic material in which the screen is to be placed.

2.3.4.a Generally, a well-sorted medium to coarse sand (10-20) pack should be used.

2.3.4.b In silt, silty-clay, and clay soils, an extremely fine sand pack, such as 20-40 size, should be used.

2.4 Well seal. An important component of monitoring well construction because it prevents possible contamination of the filter pack and screen interval from above.

2.4.1 The well seal is typically composed of bentonite pellets at least two feet thick, and placed immediately above the top of the filter pack.

2.5 Well backfill. Placed on top of the seal using a "tremie" pipe.

2.5.1 Backfill is typically composed of bentonite and cement grout.

2.5.2 Allow the backfill to settle for at least 24 hours before installing the steel casing.

2.6 Outer steel casing. Used to protect the well from damage or vandalism.

2.6.1 An outer steel casing with a diameter at least two to four inches wider than the well casing, and five feet in length, should be placed around the well casing for protection.

2.6.2 The steel casing extends below the frostline to prevent damage from frost heaving.

2.6.3 A concrete pad, extending at least one foot in all directions, and sloping down and away from the steel casing, is added to prevent standing water from accumulating at the well head.

2.6.4 The top of the steel casing should extend three to four inches above the inner casing, and be fitted with a locking cap.

3.0 **Well Installation Procedures**

3.1 Monitoring well locations and screen intervals should be chosen by the project manager, based on all available hydrogeological and chemical data, as well as site-specific needs.

3.1.1 In some cases, screen intervals may be chosen in the field by field screening and olfactory observations of split-spoons.

3.1.2 For wells in which the water table is to be intersected, two feet of screen should be placed above the water table to allow for groundwater fluctuation. However, if site specific seasonal groundwater elevation data exists, one should review the data to determine the net annual elevation fluctuation and place well screens accordingly with respect to elevation.

3.2 Drilling techniques should be chosen so that the least amount of foreign material is introduced into the borehole, there is the least possible disturbance of the formation, and proper sealing and backfilling are permitted.

3.2.1 The use of hollow stem augers (HSA) is an effective way to drill a borehole while fulfilling these criteria.

3.2.1.a HSA can be used to sample the soil from the borehole prior to installing the well, or the auger can be fitted with a plug and advanced to a pre-determined well depth.

3.2.1.b The use of large diameter HSA (6.25 inches or greater) is preferable, because they provide abundant annular space around the well casing to facilitate proper well completion. However, this size will cost more for soil disposal and the amount of backfill material required.

3.2.1.c The commonly used 4.25 inch diameter HSA can be used, but care must be taken that the filter pack and well seal are evenly distributed around the casing.

3.2.2 It is mandatory to decontaminate all augers and drilling equipment between well installations.

3.2.3 When lifted, long lengths of casing can place stress on the joints and crack them. Therefore, it is important to place the length of screen inside the HSA, and then attach and lower single lengths of casing into the borehole until the total depth is reached.

3.3 Center the well casing in the borehole to allow even distribution of the filter pack and well seal. Even spacing is essential for proper performance.

3.3.1 Clean latex gloves should be worn whenever the casing is handled.

3.4 Install one foot of filter pack in the bottom of the borehole before centering the well casing, then fill the annular space around the casing to three to five feet above the top of the screen.

3.4.1 Raise the augers two or three times while installing the filter pack in order to allow the pack to settle in the borehole.

3.4.2 Measure the height of the filter pack continuously in order to ensure that the proper amount of pack has been installed above the top of the well screen.

3.5 A two foot seal of bentonite is placed on top of the filter pack.

3.5.1 Care should be taken to prevent "bridging" of the bentonite pellets between the well casing and the HSA.

3.6 A tremie pipe is usually required when backfilling a well.

3.6.1 Place the tremie pipe two to three feet above the top of the well seal in order to avoid forcing grout through the well seal and into the filter pack.

3.6.2 Slowly fill the remaining annular space with the backfill. Keep the tremie pipe submerged so that a continuous seal is maintained.

3.6.3 Withdraw the HSA as the well is backfilled.

3.6.4 Allow the backfill to settle for 24 hours, then add more if necessary to reach desired backfill length.

3.7 At least 24 hours after the last of the backfill has been added, install the steel casing.

3.7.1 Paint the well head a bright color ("safety" yellow or orange), and lock the cap.

3.8 All construction information, a sketch diagram, and any other pertinent information should be recorded on a Monitoring Well Information form.

3.9 A diagram of typical monitoring well construction is appended to this SOP.

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Print Name	Signature	Title	Date

MET6022

Procedure for the Preparation of Chain-of-Custody (COC) Forms

1.0 **Purpose**

1.1 This Standard Operating Procedure is intended to describe the proper method for completing COC forms to ensure proper legal documentation and traceability of environmental samples from the time they are collected until the final data package has been delivered to the project manager.

2.0 **Procedure**

2.1 A COC form should accompany all shipped samples, regardless of collection point.

2.1.1 Samples shipped from the point of collection should be accompanied by a COC form.

2.1.2 Samples shipped from one laboratory to another should also be accompanied by a COC form, and, if applicable, a copy of the sampling COC form.

2.2 The top section of the COC form includes the following information: sample collector's company name, project, address, and phone number, and the names and signatures of all samplers.

2.3 The middle section of the COC form presents general sample information in tabular form. It lists the sample number, date, time, and location of sampling. In addition, the COC lists whether the sample is a composite or grab sample, and information regarding the number, size, and types of containers used, any preservatives used, and the sample matrix.

2.3.1 "Sample Number" is a consecutive number that indicates the number of samples collected.

2.3.2 "Sample Location" is a descriptive sample ID.

2.3.3 Alternatively, if more space is needed to describe the sample location, or if the sample ID is not indicative of the sample location, the "Sample Number" column may be used for the sample ID, with the "Sample Location" providing a written description of the location.

2.3.4 All times should be noted in military format.

2.3.5 "Size" is the size of sample jar submitted (e.g., 2 oz, 40 mL, 1 L, or V, meaning various).

2.3.6 "G/P" indicates whether the sample jars are glass (G) or plastic (P).

2.3.7 "Grab" or "Comp" indicates whether the sample is a composite or a grab sample. Only one of these boxes should be checked for each sample.

2.3.8 "No. of Containers" indicates the total number of sample jars submitted for each sample.

2.3.9 "Preservative" indicates the type of preservative used for the samples (e.g., HCl, 4°C, none, etc.).

2.3.10 "Analyses" is the section where the sampler writes the types of analyses requested for each sample. Use a separate line for every analysis. If necessary, use two COC forms to list all the analyses. Try to be specific (i.e., for semivolatile organics write "Method 8270 SVOCs" not just "SVOCs").

2.3.11 "Comments" is the section where the sampler may make any notes to the laboratory regarding each sample. For example, "Use as MS/MSD" or "Heavily Contaminated".

2.4 The bottom section of the COC form is the custody chain, with dates and times of transfer indicated along with the appropriate signatures.

2.4.1 The person preparing the COC is always the "relinquished by" signature, and the analytical laboratory is always the "received by" signature.

2.4.2 Theoretically, all individuals handling the samples between collection and receipt the laboratory should sign the form.

2.4.2.a If a common carrier (e.g., United Parcel Service, Federal Express) is used for shipping, the carrier is not required to sign.

2.4.2.b If a common carrier is used, then the carrier and waybill number should be recorded under the "Method of Shipment" section.

2.4.3 The bottom section of the COC form also includes a "Remarks" section. Any comments about the samples, analysis, reporting needs, method of shipment, or any other relevant topic may be recorded in this space.

2.5 The COC form serves as a legal document to guarantee that samples were not mishandled uring shipment, and that they arrived at the laboratory within the time frame to start analysis.

2.5.1 COC forms are often used during litigation, so it is very important that they are completed accurately and signed.

2.6 Occasionally, a contract laboratory will provide their own COC form. As long as there are spaces to record all the necessary information, this is an acceptable form of documentation.

2.7 A copy of the COC form should remain with the sampling personnel while they are in the field. When the field team returns to the office, they should relinquish the COC copy to the project manager. Upon completion of the analysis, the laboratory should provide a complete set of COC forms with the final data package.

2.8 Refer to the attached sample COC as a guide.

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Print Name	Signature	Title	Date

MET6027

Procedure for the Collection of Groundwater Samples by QED SamplePro Micropurge Pump

1.0 Purpose

1.1 This Standard Operating Procedure (SOP) is intended to offer a standard method for the collection of groundwater samples using a QED SamplePro Micropurge Pump, without compromising sample integrity.

1.2 This method is limited to use for monitoring wells where the depth to water is less than 100 feet. The total depth of the well does not matter.

2.0 Procedure

2.1 The groundwater sampling locations are chosen by the project manager and/or field team leader before the onset of the sampling event.

2.2 Measure the depth of the monitoring well, and the depth to the water table.

2.2.1 Measurements should be recorded on the Well Sampling Data (WSD) sheet to the nearest 0.01 feet.

2.2.2 The measuring device should be cleaned and decontaminated before each use to prevent the possibility of well cross-contamination.

2.2.3 The depths of the well and the water table are typically measured from a reference point established on the top of the well casing.

2.2.4 Also record the length of casing that is above the ground surface.

2.2.4.a If both an inner and an outer casing are present, the one used as the reference point shall be identified. Normally, the inner casing is used.

2.2.4.b The distance between the inner and outer well casings also should be measured and recorded.

2.3 In order to ensure that the groundwater samples collected are representative of the aquifer from which they were taken, it is necessary to purge the stagnant water in the well prior to sampling.

2.3.1 Calculate the maximum volume of well water that needs to be purged before sampling, using the following formula,

$$V_p = 3 \text{ x } (W_b - W_{wt})\pi r^2 \text{ x } 7.481 \qquad \text{Units: Gallons}$$

where:

V_p is the volume of water to be purged from the well
3 is a multiplication factor indicating that a maximum of three well volumes should be purged;
W_b is the measured distance to the bottom of the well (in feet);
W_w is the measured distance to the water table (in feet);
π is the constant, pi, equal to 3.142 (no units);
r^2 is the radius of the well riser pipe (in feet), squared; and
7.481 is a conversion factor (in gallons/cubic foot).

2.3.2 This formula should be provided on the WSD sheet. Be sure to note the calculated volume on the WSD sheet.

2.3.3 An alternative method of determining the amount of water to be purged is to monitor water quality parameters, such as pH and conductivity.

2.3.3.a When three consecutive readings are within ±10%, the water column is considered stable.

2.3.3.b The readings should be taken initially, after each half well volume, and just prior to sampling.

2.3.3.c A minimum of five readings should be taken, which means the well can be sampled after 2 well volumes if the readings are stable.

2.3.3.d All pH and conductivity measurements should be noted on the WSD sheet.

2.4 The tubing and bladder used for the well sampling should be made of an inert material, and should not interfere with the analyses to be performed.

2.4.1 Polyethylene tubing and bladders are suitable for sampling in most cases. <u>Example</u>: Polyethylene tubing with 0.170 inch ID and 1/4 inch OD, available from Pine Environmental (TB10145). Polyethylene bladders are also available from Pine Environmental either in a kit containing O-rings and a stainless steel tubing plate, or individually.

2.4.2 New, clean tubing should be used for each well sampled, unless dedicated tubing is installed in the well. Bladders should be decontaminated according to MET6001 and then inspected before re-using. If any staining or odors remain, a new bladder will be used at the next location.

2.5 Lower the pumphead with clean tubing inserted into both the air and water lines into the monitoring well.

2.5.1 The pumphead should be lowered to the middle of the screened interval.

2.5.2 If the screen interval information is not available, lower the pumphead to approximately two feet above the base of the well.

2.6 Attach the water-line tubing to a water quality meter with a flow through cell.

2.6.1 Flexible tubing can be used to attach the downhole water-line tubing to the barb on the flow through cell. This tubing should be made of thick-walled, flexible, organic resistant material.
<u>Example</u>: Masterflex tygon fuel and lube tubing, listed by Cole Parmer as F-4040-A, size 15.

2.7 Attach the air-line tubing from the pump to the QED Micropurge MP10 Controller.

2.7.1 The downhole air line is attached to the air-out hose of the control box. The air-in hose of the control box is attached to the QED compressor.

2.8 Begin evacuating the well.

2.8.1 Evacuation should be performed at a rate of no more than 150 mL/minute.

2.8.2 Site conditions, client needs, or state regulations may make it necessary to alter the rate of evacuation.

2.8.3 The rate of evacuation should be measured for each well, and clearly noted on the WSD sheet.

2.8.4 Continue until the volume of groundwater calculated in Section 2.3 has been evacuated from the well.

2.8.5 If purging the well causes it to go dry, then allow the well to recharge and go to Section 2.10 of this SOP.

2.8.5.a The well should be sampled as soon as sufficient volume of water reenters the well and within 24 hours of purging.

2.8.5.b Minimize the amount of time that a recharged well sits prior to sampling.

2.8.5.c If recovery of the well takes more than three hours, then samples should be collected in order of their volatility, with the most volatile samples being collected first.

2.9 The water removed from the well during purging may have the potential for further environmental contamination.

2.9.1 If no previous analyses have been performed on the monitoring well being sampled, then the purged water must be containerized until analysis is complete.

2.9.2 If previous analyses have shown that the water from a particular monitoring well may pose a threat to the environment, the purged water must be containerized.

2.9.3 If previous analyses have shown that the water from a particular monitoring well is clean, then the water may be disposed of in a sewer system, or dumped away from any wells, depending on applicable regulations.

2.9.4 Any decisions regarding the disposal of purged well water should be made by the project manager, based on analytical results, prior to the commencement of sampling.

2.9.5 The fate of the purged well water should be noted on the WSD sheet.

2.10 The following procedure will be followed for collecting groundwater samples from monitoring wells.

2.10.1 Prior to collecting each sample, place a waterproof label on each jar that contains the following information: project, sample ID, date, time, preservative used, sampler's initials, and analyses to be performed.

2.10.2 Using a sampling rate of no more than 150 mL/minute, first fill any 40-mL VOA vials.

2.10.2.a Do not allow the groundwater tubing to touch the inside of the sample container.

2.10.2.b Make sure no headspace is left in each vial.

2.10.2.c Minimize the disturbance of the water sample during collection.

2.10.3 After the VOA vial samples have been collected, fill all other the remaining sample jars.

2.10.4 Clean latex or nitrile gloves should be worn during the entire sampling procedure.

2.10.5 The following pieces of information should also be noted on the WSD sheet: sample ID, location of well,, date, time, sampler's initials, visual and olfactory description of the sample (i.e., color, odor, turbidity, etc.), and weather conditions.

2.10.6 Secure the well after sampling has been completed. Record any unsatisfactory well conditions on the WSD sheet. Make sure that all well labels and markings are intact.

2.11 Pack the samples, trip blanks, and chain-of-custody (COC) form into a cooler with blue ice or ziploc bags of ice chips.

2.11.1 The trip blanks should be obtained from the laboratory prior to commencing field work, and stored with the samples throughout all field and shipping activities.

2.11.2 Fill out the COC forms in accordance with SOP No. MET6022.

2.11.3 Pack and ship the samples overnight in accordance with SOP No. MET 6009, to ensure that the sample jars will not be broken in transit.

"I hereby certify that I have read and understood the contents of this Standard Operating Procedure, and I am capable of and qualified to perform the tasks described herein"

Print Name	Signature	Title	Date

B

QUALITY ASSURANCE PROJECT PLAN

FINAL QUALITY ASSURANCE PROJECT PLAN FOR THE WORK PLAN FOR CHARACTERIZATION AND DESIGN OF INTERIM REMEDIAL MEASURE FOR THE OIL/TAR SEPARATOR AREA AT THE RG&E WEST STATION FORMER MGP SITE ROCHESTER, NEW YORK

SITE #: V00593-8

INDEX #: B8-0535-98-07

Prepared for:

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February 2006

STATEMENT OF PURPOSE

Data generated for environmental purposes must be technically sound and supported by defined and verified limits of confidence. This document specifies quality assurance and quality control procedures, to be applied to a Remedial Investigation (RI) at the former West Station manufactured gas plant site located at 254 Mill Street, City of Rochester, New York, to ensure the generation of valid data. It is the responsibility of project-related personnel to perform and document the required procedures designated herein.

Prior to conducting field activities, personnel involved in work activities subject to this QAPP must provide verification that they have read and understand the relevant requirements of this document by signing below.

Name (Print)	Signature	Date
____________________	____________________	__________
____________________	____________________	__________
____________________	____________________	__________
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1
PROJECT DESCRIPTION

This Quality Assurance Project Plan (QAPP) was prepared by Ish Inc. and META Environmental, Inc. for Rochester Gas & Electric Corporation (RG&E). It covers the Quality Assurance (QA) and Quality Control (QC) operations to be implemented during environmental media sampling, shipping, storage, laboratory analysis, and data reduction of samples collected by Ish Inc./META by implementing the work plan for the Remedial Investigation (RI) of the West Station former manufactured gas plant (MGP) site (site). This work is being performed by Ish Inc./META for RG&E in accordance with New York State Department of Environmental Conservation (NYSDEC) Voluntary Cleanup Agreement Number B8-0535-98-07. This QAAP provides guidance and specifications to assure that the resulting data are of known quality and meet the needs of the project goals. The types, numbers and locations of environmental sampling to be performed are also described in the site specific Work Plan. Field procedures for all environmental sampling activities are detailed in the FSP.

1.1 BACKGROUND AND OBJECTIVES

The specific objective of the Phase I characterization and design of IRM is:

- to identify and delineate occurrence of NAPL, if any, in the subsurface in the area of the NAPL observed and documented in the 2004 River Bank Observation Report of the former West Station MGP site and to determine if Phases II – IV are warranted. Refer to the Work Plan for more detail on the possible phases of work.

1.2 SCOPE

In order to accomplish these objectives, a work plan for subsurface investigation with the collection and analysis of samples has been prepared.

Soil samples will be collected from subsurface locations. Soil parameters such as color, texture, and grain size will be recorded in the field. Selected samples will be transported to the laboratory and analyzed for selected chemical parameters.

Groundwater samples will be collected from new monitoring wells, transported to the laboratory, and analyzed. In addition, selected water quality parameters will be measured in the field, including pH, conductivity, temperature, dissolved oxygen, and oxidation-reduction potential.

The sample preservation, handling, and storage conditions are described in Sections 4, 5, and 6, while the analytical methods are described in Section 7.

Upon completion of the chemical analysis, the resulting data will undergo review to ensure that the identification and quantitation of each element or compound was properly done. After the review is completed, the results will be entered into a database and checked for proper data entry. The data will be used to generate tables and graphs for reporting purposes.

2
PROJECT ORGANIZATION AND RESPONSIBILITIES

Technical aspects of the performance of the study will be the responsibility of Ish Inc. Ish Inc. will identify the personnel who will manage field and laboratory work, and coordinate other tasks and other subcontractors as necessary. It will be the responsibility of the Quality Assurance Officer (QAO) to assure that operations and results meet the requirements of this QAPP. The QAO will assist the Project Manager for this work. The daily activities of the project will be managed by the Project Manager. The responsibilities of the individuals associated with this quality assurance/quality control (QA/QC) program are described below.

2.1 PRINCIPAL INVESTIGATOR

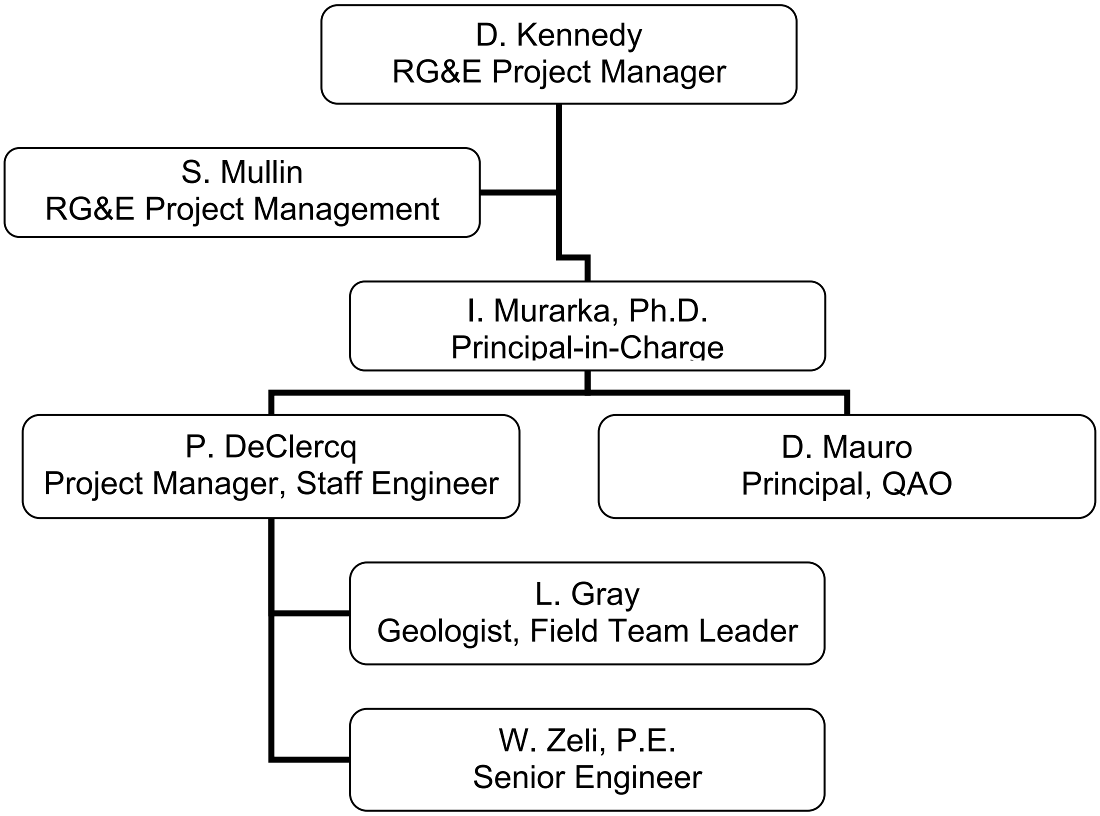
The Principal Investigator (PI) must have superior technical expertise in the field of study and must have proven capabilities managing environmental investigations. Ish Inc. will designate a staff person who will be responsible for developing the objectives of the work, for directing the work of others on the project team, for evaluating and interpreting the results, and for communicating the basis, objectives, and results of the work to interested parties.

2.2 PROJECT MANAGER

The Project Manager (PM) has the overall responsibility for management of the field and laboratory work. The responsibilities of the PM are to:

1. work with the client, Principal Investigator, Field Team Leader, and Quality Assurance Officer to develop a work plan that specifies the requirements of the project, the data quality objectives, the methods, the schedule, and the budget;
2. directly formulate the work plan and implement work plan revisions;
3. manage all aspects of project implementation; and
4. generate progress reports and project reports.

Figure 2-1
Project Organization Chart



2.3 QUALITY ASSURANCE OFFICER

The QAO is responsible for reviewing and advising on all aspects of methodology and QA/QC. The responsibilities of the QAO are to:

1. advise the PI, PM, and Laboratory Director(s) on methodology and QA/QC practices;
2. discuss methods and QA/QC objectives with the PI and PM for each project;
3. perform biannual internal laboratory audits, including a written summary of the results of the audit;

4. oversee data validation efforts, and review project reports prior to issue;
5. prepare QA review reports for all data packages and advise corrective actions for non-conformances;
6. monitor and review laboratory procedures and activities to assure conformance with the Laboratory Quality Assurance Plan (LQAP), as well as this QAPP;
7. oversee the development, writing, review, and maintenance of SOPs;
8. suggest pathways, experiments, or procedural changes to resolve laboratory QA issues; and,
9. work with the PM and Laboratory Director to prepare project-specific QAPP.

2.4 FIELD TEAM LEADER

The Field Team Leader is responsible for coordinating and directing the field sampling activities. The Field Team Leader will work closely with the PM and Laboratory Director(s) to assure that the samples are collected and handled properly, and that information flows smoothly among the project team. The responsibilities of the Field Team Leader are to:

1. administer and supervise sampling activities as presented in the Work Plan to ensure meeting project objectives on schedule;
2. work with the PM, Laboratory Director(s), and QAO in planning and conducting project activities;
3. generate and review work plans, QAPP, progress reports, and field data prior to issue to the PM or QAO; and
4. identify problem areas and institute corrective actions.

2.5 LABORATORY MANAGER - OUTSIDE LABORATORIES

The Outside Laboratory Manager is responsible for ensuring that the samples are analyzed for TCL VOCs, TCL SVOCs, TAL metals, and total cyanide, in accordance with the procedures described in the Work Plan, QAPP, and reference methods. The laboratory to be retained for performing the analyses will have New York Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP) - CLP Certification for all analyte categories:

Severn Trent Laboratories	TCL SVOCs TCL VOCs TAL Metals Total Cyanide

2.6 HEALTH AND SAFETY OFFICER (HSO)

The HSO is responsible for the development and implementation of the Health and Safety Plan (HASP). The HSO may also act as the Field Team Leader or Field Team Member. The responsibilities of the HSO, are to:

1. to develop a HASP which conforms to applicable Federal and State health and safety regulations, and is designed to assure a safe working environment for project personnel;
2. to implement the HASP and report to the Project Manager any problems with conformance to the plan; and
3. to make periodic inspections of field and laboratory activities to assure that personnel are conforming to the requirements of the HASP, and to identify any potentially harmful conditions.

3
DATA QUALITY OBJECTIVES

3.1 INTRODUCTION

The overall quality assurance objective for this project is to provide data of known quality. This will be accomplished in two ways:

1. field samples will be collected, handled, preserved, shipped, and stored using standard procedures which protect the representativeness of the samples, and
2. appropriate laboratory quality control measure will be employed so that precision, accuracy, completeness, and comparability can be assessed and corrective actions taken, if needed.

In general, a system of careful monitoring and documentation, along with the use of quality equipment and established procedures, will be used to assure high quality analytical results. For example, the use of frequent blank analyses, instrument calibration, calibration checks, surrogate and matrix spikes, and replicate analyses will help monitor analytical method performance.

3.2 OBJECTIVES

The QC measures, frequencies, and objectives for analytes determined by STL will be as stated in EPA's Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, as appropriate for the particular analyte and matrix, and the deliverables will conform to Category B of the New York State Analytical Services Protocols.

Sampling protocols and documentation, sample handling, and analytical procedures appropriate for meeting the project objectives are presented in this QAPP.

The QA objectives for this project are to:

- generate accurate chemical data for VOCs, SVOCs, metals, and total cyanide, in soil and water samples from the site;
- collect sufficient field QC samples to allow an assessment of the contribution to the variability in the data from field operations;
- analyze sufficient laboratory QC samples to allow an assessment of the contribution to variability in the data from laboratory procedures; and
- produce documented, consistent, and technically defensible results.

3.3 LEVEL OF QA EFFORTS

Every attempt will be made to have the data generated be valid. A data usability summary report (DUSR) will be prepared by a qualified chemist for the Category B deliverable packages from the laboratory. The procedures for reviewing compliance with the data quality objectives are specified in Exhibits E and I of the NYSDEC ASP guidelines in order to provide NYS ASP Category B deliverables.

3.4 ACCURACY AND PRECISION

3.4.1 Accuracy

Accuracy is a measure of the degree of agreement between an analyzed value and the true or accepted reference value where it is known. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material and is expressed as the percent of the known quantity, which is recovered, or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes which are close to the detection limit are less accurate because they are affected by such factors as instrument “noise”. Higher concentrations will not be as affected by instrument or other variable and thus will be more accurate.

Accuracy will be monitored through the analysis of appropriate QC samples. Analytical accuracy will be monitored using recovery of analytes from surrogate spikes, matrix spikes, and independent check standards, and/or samples.

3.4.2 Precision

Precision is a measure of the mutual agreement among individual measurements of the same parameter under similar conditions. Precision is a qualitative measurement of the variability of a group of measurements compared to their average value. Precision can be expressed in terms of standard deviation, coefficient of standard deviation, range, or relative range.

Precision will be monitored through the analysis of appropriate QC samples. The precision of laboratory analysis will be evaluated using sample duplicates and matrix spike duplicates.

3.5 COMPLETENESS

Completeness is a measure of the amount of valid data obtained from the analytical measurement system, expressed as a percentage of the number of valid measurements that should have been or were planned to be collected. Sufficient sample material will be collected to assure that samples can be reanalyzed as necessary. In addition, precautions will be taken during the packing and shipping of samples to minimize the possibility of breakage. However, realistically, some samples may be lost or results deemed questionable due to sample matrix effects or internal QC problems. The QC objective for completeness is generation of valid data for 100 percent of the analyses requested.

3.6 REPRESENTATIVENESS

Representativeness is a measure of how closely the measured results reflect the actual concentration or distribution of the chemicals in the sample. Sampling will be performed in strict accordance with the sampling procedures defined in Section 4.0 of this QAPP and the companion SAP and the work plan documents. These sampling procedures were developed to preserve the representativeness of the collected samples. In addition, samples will be properly preserved, and stored prior to, during, and after shipment to the laboratories. Finally, samples will be prepared and analyzed within holding times so as to preserve the integrity of the samples.

3.7 COMPARABILITY

Comparability is a measure of how closely sample data generated by the primary laboratory and method compare to data generated by another laboratory or method. Data comparability will be ensured by strict adherence to the analytical and QA/QC protocols defined in this QAPP.

3.8 DEFINITION OF QC BLANK SAMPLE TYPES

3.8.1 Field Equipment Blank

A field equipment blank is a blank prepared from the distilled water sources used on-site. One field water blank is required from each water source. If distilled water is purchased for use, then a single blank is required for each brand of water purchased. The field equipment blank is used as an indicator of problems with the distilled water used in equipment decontamination procedures.

A field equipment blank is a composite rinsate of the sampling equipment that comes into contact with the sample during the sampling procedure. It is an indicator of problems with the equipment decontamination procedures. Field equipment blanks will be collected and analyzed at the rate of a minimum of one per every 20 samples collected.

3.8.2 Trip Blank

A Trip Blank will be prepared by the laboratory and will consist of 40 ml VOA vial containing deionized water which accompanies the other sample bottles into the field and back to the laboratory. A trip blank is included with samples to be analyzed for VOCs or BTEX. The trip blank will be analyzed for TCL volatile organic compounds or BTEX to assess any contamination introduced as a result of sampling and transport, and internal laboratory problems.

3.8.3 Laboratory Equipment Blank

A laboratory equipment blank is a composite rinsate of the laboratory sample preparation equipment that comes into direct contact with the sample. This equipment includes: weighing pans, culture tubes, scintillation vials, KD receivers, and extract vials. If any contamination is found, then individual rinsates must be performed. The laboratory equipment blank is an indicator of in-house contamination problems.

3.8.4 Laboratory Method Blank

A method blank or preparation is an aliquot of clean water or soil that has been prepared under the same conditions as the samples. It is an indicator of problems with contaminants introduced during the sample preparation procedure.

3.9 DEFINITION OF QC DUPLICATE TYPES

3.9.1 Field Duplicate

A field duplicate is a sample that is collected in duplicate in the field at the time of sampling. Two sample containers are filled, and they are logged in separately upon arrival at the laboratory. A field duplicate is considered a blind duplicate if the sample ID does not give any indication to the laboratory doing the analyses that the sample is a duplicate. The frequency of collection of samples is one per every 20 field samples collected.

3.9.2 Matrix Spike/Matrix Spike Duplicate (MS/MSD/MD)

MS/MSD/MD samples (MSD for organics; MD for inorganics) will be collected at a frequency of one per every 20 field samples. The reproducibility and homogeneity of the samples can be assessed by determining the RPD for both spike and non-spike compounds as described in Section 9.0. The MS, MSD, MD samples should be site specific, unless otherwise authorized by the Project Manager.

3.9.3 Laboratory Duplicate

A laboratory duplicate is a duplicate that is prepared at the time of extraction. A single sample jar has been received, but the laboratory prepares two separate aliquots of the sample for extraction and analysis.

4
SAMPLING PROCEDURES

4.1 INTRODUCTION

Quality assurance (QA) practices associated with sampling activities are designed to ensure that samples are collected from documented locations, and that the samples collected are representative of the natural conditions at that location. Also, if samples of a known type, such as from a particular geologic matrix, are desired, the QA program should ensure that those samples are collected.

4.2 SAMPLING SCHEME

The rationale for the selection of sampling locations is described in the Work Plan.

4.3 SAMPLE COLLECTION

Samples will be collected according to the methods described in the FSP. Each sample will be assigned a unique field sample ID according to the following scheme:

WS-SB01 ( ) or TP01 or MW201

Where:

WS	West Station former MGP site
SB01( )	Sequential number representing soil boring (sampling depth interval, feet)
TP01	Sequential number representing test pit location
MW201	Sequential number representing new monitoring well

To maintain the integrity and representativeness of the field samples, standard operating procedures (SOPs) will be used for the field sampling. The following SOPs can be found in Appendix A of the Field Sampling Plan:

Table 4-1
Standard Operating Procedures

SOP No.	Title
MET6001	Decontamination of Field Equipment
MET6002	Procedures for Logging Subsurface Conditions in Test Pit Excavations
MET6006	Procedures for Subsurface Soil Sampling: Drilling
MET6009	Procedures for Packing and Shipping Environmental Samples
MET6020	Procedures for the Installation of Overburden Groundwater Monitoring Wells
MET6022	Procedure for the Preparation of Chain-of-Custody (COC) Forms
MET6027	Procedure for the Collection of Samples by QED SamplePro Micropurge Pump

Sampling activities will be logged on field sampling sheets designed for purging and sampling of monitoring wells and piezometers.

4.4 EQUIPMENT DECONTAMINATION PROCEDURE

An area for the decontamination of field equipment will be set up on-site in close proximity to the investigation activities. This area will be designated by a section of high density polyethylene sheeting placed on the ground. Decontamination of field equipment will occur in this area.

Non-disposable field equipment used for the collection of soil, such as split-spoons, continuous cores, spatulas, spoons, trowels, and bowls, will be decontaminated after each use by the following procedure:

- knock, scrape, or wipe off excess soil,
- pre-rinse with tap water,
- wash with non-phosphate detergent and tap water,
- rinse with tap water,

- rinse with methanol,
- rinse with distilled water,
- rinse with nitric acid,
- rinse with distilled water, and
- air dry on a designated clean surface.

Washed equipment will be wrapped in polyethylene sheeting or aluminum foil for storage or transportation from the designated decontamination area to the sampling location. At no time will washed equipment be placed directly on the ground. Decon waste water will be collected and properly disposed of.

The QED SamplePro Micropurge pump, or equivalent, will be decontaminated prior to each use, following Standard Operating Procedure (SOP) No. MET6001, with the addition of a nitric acid rinse for removal of trace inorganic compounds prior to the methanol rinse. The pump will be disassembled completely and all parts cleaned. The polyethylene bladder may be cleaned and re-used, however if odors or visible contamination persist a new poly bladder will be used at the next sampling location. A new piece of 1/4-inch polyethylene will be used for each well that is sampled.

The effectiveness of decontamination activities will be monitored by the analysis of equipment rinsate blanks. Equipment rinsate blanks will be collected daily by flushing distilled water over the submersible pump and collecting the liquid in appropriate QC-acceptable containers. Equipment rinsate blanks will be delivered to the selected laboratory and analyzed for the full list of analyses including VOCs, SVOCs, metals, and cyanide.

Waste water generate during decontamination activities will be containerized in DOT-approved storage drums or other secure container(s), pending characterization and subsequent disposal.

4.5 SAMPLE CONTAINERS

Sample containers will be QC-acceptable, pre-cleaned glass containers with Teflon-lined lids. Table 4-2 lists the various chemical analyses to be utilized during the field program with associated containers, preservatives and holding times.

Table 4-2
Sample Containers, Preservation, and Holding Times

Matrix	Parameter	Container	Preservative	Holding Time*
Soil	TCL VOCs	4 oz Septa Jar	Cool 4 ^oC	14 days
Soil	TCL SVOCs	8 oz Jar	Cool 4 ^oC	7 days
Soil	TAL Metals	4 oz Jar	Cool 4 ^oC	6 Months
Soil	Total Cyanide	8 oz Jar	Cool 4 ^oC	14 Days
Groundwater	TCL VOCs	Glass 40 ml VOA	pH 2 HCl, 4 ^oC	14 days
Groundwater	TCL SVOCs	Glass, 1L	Cool 4 ^oC	7 days
Groundwater	TAL Metals	HDPE 0.5 L	pH<2 HNO_3	6 Months
Groundwater	Total Cyanide	HDPE, 1L	Cool 4 ^oC, NaOH to pH>12	14 Days

* - from day of collection

4.6 SAMPLE PRESERVATION

Samples will be preserved by immediately cooling them on ice to approximately 4 ^oC, and maintaining that temperature throughout the chain of custody process.

4.7 SAMPLE SHIPMENT

Samples shipped to the laboratories will be stored in a cooler at approximately 4 ^oC or less while awaiting transportation and during transportation. Samples will be shipped via overnight carrier or delivered on the day of sampling to the selected laboratory. Samples will be packed carefully to ensure the integrity of the sampling containers during shipment. A complete and accurate Chain of Custody (COC) will accompany the samples. The Field Team Leader will be responsible for proper sample shipment and documentation.

5
SAMPLE CUSTODY

The purpose of the COC procedure is to document the transfer of custody for each sample from the time of collection throughout the analytical process to the time when the analytical results are completed and reported. The Field Team Leader and Laboratory Manager(s) will jointly monitor the sample shipping, receipt, storage, and analysis process to ensure that proper COC has been followed and documented.

The samples will be packed on ice in coolers, according to MET6009, and will be accompanied by a complete COC, prepared according to MET6022. Samples that are shipped to the laboratory will be logged and tracked according to their information management system described in the Laboratory's Quality Assurance Manual (see Appendix A).

Copies of the Sample Receipt Records will be placed in the project file. Samples will be stored in secure areas of the laboratories at approximately 4^{o}C.

6
DOCUMENTATION

Documentation of activities in the laboratory is a critically important aspect of the sample analysis process. Each laboratory has a written and computerized system for documenting each step in the preparation and analysis of environmental samples.

Appendix A includes the Quality Assurance Manual for the selected laboratory, which provides the procedures that they use to document the laboratory activities.

7
ANALYTICAL PROCEDURES

7.1 CONVENTIONAL ANALYSES

The primary potential constituents of concern (COCs) at the West Station Site are those related to the former MGP processes. These COCs include monocyclic aromatic hydrocarbons (MAHs), polycyclic aromatic hydrocarbons (PAHs), petroleum fuels, cyanide, and some metals. Therefore, some soil samples will be analyzed for all of the following analytical parameters: VOCs, SVOCs, TAL metals, and total cyanide.

Ish Inc.'s analytical laboratory subcontractor (as currently planned), Severn Trent Laboratory, is certified by the ELAP, and is a participating member of the NYSDEC ASP-CLP. STL has supported Ish Inc. on other MGP and Energy East specific projects. Analyses to be performed by STL are summarized in Table 7-1 below:

Table 7-1
Analytical Methodologies

Parameter	Method	Description
TCL VOCs	EPA 8260	VOCs by GC/MS Capillary Column Technique
TCL SVOCs	EPA 8270	SVOCs by GC/MS Capillary Column Technique
TAL Metals	EPA 6010B/7000	ICP-AES or GFAA Methods
Total Cyanide	335.2/9010B	Colorimetric
TCLP Benzene	EPA 1311/8260	Aqueous leaching of benzene with GC/MS Analysis
Reactivity	7.3.3.2/7.3.4.2	
Total sulfur	Hach 8131	

In addition, the Laboratory's Quality Assurance Manual is attached to this document (see Appendix A).

Appendix B lists the Minimum Detection Limits (MDLs) for each analyte in soil and groundwater to be measured in the field program.

7.2 ENVIRONMENTAL FORENSIC PARAMETERS

In addition to the conventional analyses listed above, it is possible that as many as 10 NAPL-impacted soil and sediment samples may be analyzed for environmental forensic parameters to identify those potential on-shore source areas that may have or continue to be releasing MGP NAPL to the sediments. The analyses will be conducted by the environmental forensics laboratory at META Environmental, Inc. The parameters will include:

1. hydrocarbon fingerprint by GC/FID (EPA Method 8100mod). META has modified the GC conditions so that both volatile and semivolatile organic compounds from hexane (C6) to tetracontane (C40) can be detected in one run, effectively combining two analyses. This range includes gasoline to heavy oil, as well as the GC-analyzable fraction of coal tar.
2. Extended PAH Profiles (EPPs) by GC/MS/SIM (EPA Method 8270mod). This is the standard approach for identifying the source(s) of oil spills used by the U.S. Coast Guard and has been used effectively by META at numerous MGP sites for similar purposes. It provides the concentrations of certain diagnostic PAH groups not determined by GC/FID or standard EPA Method 8270.

Table 7-2 lists the environmental forensic parameters to be determined.

Table 7-2
Forensic Parameters

Wide-range GC/FID fingerprint	
Extended PAH profiles	
Benzene	
C1-Benzenes	Phenanthrene
C2-Benzenes	Anthracene
C3-Benzenes	C_1-Phenanthrene/anthracenes
C4-Benzenes	C_2-Phenanthrene/anthracenes
C5-Benzenes	C_3-Phenanthrene/anthracenes
Naphthalene	C_4-Phenanthrene/anthracenes
C_1-Naphthalenes	Fluoranthene
C_2-Naphthalenes	Pyrene
C_3-Naphthalenes	C_1-Fluoranthene/pyrenes
C_4-Naphthalenes	C_2-Fluoranthene/pyrenes
1-Methylnaphthalene	C_3-Fluoranthene/pyrenes
2-Methylnaphthalene	Benz(a)anthracene
Acenaphthylene	Chrysene
Acenaphthene	C_1-Chrysenes
Dibenzofuran	C_2-Chrysenes
Fluorene	C_3-Chrysenes
C_1-Fluorenes	C_4-Chrysenes
C_2-Fluorenes	Benzo(b)fluoranthene
C_3-Fluorenes	Benzo(k)fluoranthene
Dibenzothiophene	Benzo(a)pyrene
C_1-Dibenzothiophenes	Indeno(1,2,3-cd)pyrene
C_2-Dibenzothiophenes	Dibenz(a,h)anthracene
C_3-Dibenzothiophenes	Benzo(g,h,i)perylene

8

DATA REDUCTION, VALIDATION AND REPORTING

8.1 DATA REDUCTION

Analysis results will be reduced to the concentration units specified in the analytical procedures using the equations provided in the analytical references cited in Section 7. Blank correction will not be performed, but blank analysis results will be documented. Calculations will be independently checked according to the procedures of the laboratory.

8.2 DATA VALIDATION

Data generated by the laboratory will be reviewed by the QAO or their representative prior to reporting, following the "Guidance for the Development of Data Usability Summary Reports", as documented by the NYSDEC Division of Environmental Remediation. The review will include a check of the accuracy of log-in information, a transcription check, checks of initial, continuing, and QC check standard results, method and field blank results, spiked sample results, replicates, and other QC parameters, as well as checks of compound identifications and calculations. The QAO will attempt to reconcile any QC problems with the laboratory prior to reporting. If certain problems cannot be corrected, the data will be clearly flagged in any reports.

8.3 DATA REPORTING

Laboratory data generated by STL and META will be reported to Ish Inc./META in NYS ASP Category B deliverables format.

9
REFERENCES

New York State Department of Environmental Conservation, “Analytical Services Protocol”, 12/91.

New York State Department of Environmental Conservation, Technical Administrative Guidance Memorandum #4046, “Determination of Soil Cleanup Objectives and Cleanup Levels”, 01/94

New York State Department of Environmental Conservation Draft DER-10, “Technical Guidance For Site Investigation and Remediation”, 12/02

Standard Methods for the Examination of Water and Wastewater, 18th Edition, 1992.

U.S. EPA, 1986. Test Methods for Evaluating Solid Waste Physical/Chemical Methods. SW-846 Third Edition. Office of Solid Waste, US EPA, Washington DC.

10
SIGNATURES OF APPROVING OFFICIALS

Name	**Title**	**Signature**	**Date**
David Mauro	QAO	______________________	__________
Peter DeClercq	Project Manager	______________________	__________
Ishwar Murarka	Principal Investigator	______________________	__________

A
LABORATORY QUALITY ASSURANCE MANUAL

STL Buffalo

**10 Hazelwood Drive
Amherst, New York 14228
(716) 691-2600**

Laboratory Quality Manual

Revision: 2

June 15, 2002

Approved: Robt K Wyeth Date: 6/24/02
STL Buffalo General Manager
Robert K. Wyeth

Approved: Susan L Mazur Date: 6/25/02
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Approved: Kenneth E Kasperek Date: 6/25/2002
STL Buffalo Technical Director
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Approved: Verl D. Preston Date: 6/25/02
STL Buffalo Quality Manager
Verl D. Preston

2.0 Table of Contents

3.0 Description

3.1 Introduction

STL-Buffalo is a part of Severn Trent Laboratories, Inc. (STL), a major group of environmental laboratories. Both companies are owned by Severn Trent, plc, an international provider of water and wastewater services headquartered in Birmingham, UK.

3.2 Terms and Definitions

Accuracy: the degree of agreement between an observed value and an accepted reference value.

Audit: a systematic evaluation to determine the conformance to specifications of an operational function or activity.

Batch: environmental samples, which are prepared and/or analyzed together with the same process, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same matrix, meeting the above mentioned criteria. An analytical batch is composed of prepared environmental samples, extracts, digestates or concentrates that are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.

Chain of Custody (COC): an unbroken trail of accountability that ensures the physical security of samples, data and records.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/Superfund): legislation (42 U.S.C. 9601-9675 et seq., as amended by the Superfund Amendments and reauthorization Act of 1986 (SARA), 42 U.S.C. 9601et seq.)

Compromised Sample: a sample received in a condition that jeopardizes the integrity of the results.

Confidential Business Information (CBI): information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products.

Confirmation: verification of the presence of a component using an additional analytical technique. These may include second column confirmation, alternate wavelength, derivatization, mass spectral interpretation, alternative detectors, or additional cleanup procedures.

Corrective Action: action taken to eliminate the causes of an existing non-conformance, defect or other undesirable situation in order to prevent recurrence.

Data Audit: a qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data are of acceptable quality.

Equipment Blank: a portion of the final rinse water used after decontamination of field equipment; also referred to as Rinsate Blank and Equipment Rinsate.

Document Control: the act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled to ensure use of the correct version at the location where the prescribed activity is performed.

Federal Water Pollution Control Act (Clean Water Act, CWA): legislation under 33 U.S.C. 1251 et seq., Public Law 92-50086 Stat. 816.

Field Blank: a blank matrix brought to the field and exposed to field environmental conditions.

Good Laboratory Practices (GLP): formal regulations for performing basic laboratory operations outlined in 40 CFR Part 160 and 40 CFR Part 729 and required for activities performed under FIFRA and TSCA.

Good Automated Laboratory Practices (GALP): EPA 2185, 1995. Referenced as part of the basis of the STL Buffalo Quality system.

Holding Time: the maximum time that a sample may be held before preparation and/or analysis and still be considered valid as promulgated in the method.

Initial Demonstration of Capability (IDOC): procedure to establish the ability to generate acceptable accuracy and precision. Also referred to as Initial Demonstration of Proficiency.

Instrument Blank: a blank matrix that is the same as the processed sample matrix (i.e. extract, digestate, and condensate) and introduced onto the instrument for analysis.

Laboratory Control Sample (LCS): a blank matrix spiked with a known amount of analyte(s), processed simultaneously with, and under the same conditions as, samples through all steps of the analytical procedure. Also known as a Matrix Spike Blank (MSB).

Laboratory Quality Manual (LQM): a document stating the quality policy, quality system and quality practices of the laboratory. The LQM may include by reference other documentation relating to the laboratory's quality system.

Matrix: The substrate of a test sample. For purposes of batch and QC requirement determination, the matrix descriptions in Table 1 are used.

Table 1: Matrix Descriptions

Matrix	Description
Aqueous	Aqueous sample excluded from the definition of Drinking Water or Saline/Estuarine source. Includes surface water, groundwater and effluents.
Drinking Water	Aqueous sample that has been designated a potable water source.
Saline	Aqueous sample from an ocean or estuary, or other salt-water source such as the Great Salt Lake.
Air	Air samples are ambient air particulate filters, PUF's, cartridges or canisters.
Leachate / Synthetic Leachate	Product of a solid matrix that is exposed to/reacted with an aqueous matrix.
Liquid	Non solid material with < 0.5% non-dissolved solids
Solid	Soil, sediment, sludge or non-liquid matrices
Waste	A product or by-product of an industrial process that results in a matrix not previously defined.

Matrix Duplicate (MD): duplicate aliquot of a sample processed and analyzed independently; under the same laboratory conditions; also referred to as Sample Duplicate.

Matrix Spike (MS): field sample to which a known amount of target analyte(s) is added.

Matrix Spike Duplicate (MSD): a replicate matrix spike.

Method Blank: a blank matrix processed simultaneously with, and under the same conditions as, samples through all steps of the analytical procedure.

Method Detection Limit (MDL): the minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific method. An MDL value, by definition, has an uncertainty of ± 100%. The MDL thus represents the range where qualitative detection occurs using a specific method. Quanitative results are not produced in this range. Also referred to as a Limit of Detection (LOD).

Non-conformance: an indication, judgement, or state of not having met the requirements of the relevant specifications, contract, or regulation.

Precision: the degree to which a set of observations or measurements of the same property, usually obtained under similar conditions, conform to themselves; a data quality indicator.

Preservation: refrigeration and or reagents added, at the time of sample collection or after filtration, to maintain the chemical and or biological integrity of the sample.

Proficiency Testing: determination of the laboratory calibration or testing performance by means of inter-laboratory comparisons.

Proficiency Test (PT) Sample: a sample, the composition of which is unknown to the analyst, that is provided to test whether the analyst/laboratory can produce analytical results within specified performance limits.

Proprietary: belonging to a private person or company.

Storage Blank: a blank matrix stored with field samples of a similar matrix. Sometimes referred to as a holding blank.

Trip Blank: a blank matrix placed in a sealed container at the laboratory that is shipped and held unopened in the field and returned to the laboratory in the shipping container with the field samples.

Quality Assurance (QA): an integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.

Quality Assurance (Project) Plan (QAPP): a formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved.

Quality Control (QC): the overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.

Quality Control Sample: an uncontaminated sample matrix spiked with a known amount(s) of an analyte(s) from a source independent from the calibration standards. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

Quality Management Plan (QMP): a formal document describing the management policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an agency, organization or laboratory to ensure the quality of its product and the utility of the product to its users.

Quality System: a structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA/QC.

Raw Data: any original information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof and that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments.

Record Retention: the systematic collection, indexing and storing of documented information under secure conditions.

Reference Standard: a standard, generally of the highest quality available at a given location, from which measurements made at that location are derived.

Resource Conservation and Recovery Act (RCRA): legislation under 42 USC 321 et seq. (1976).

Safe Drinking Water Act (SDWA): legislation under 42 USC 300f et seq. (1974), (Public Law 93-523).

Selectivity: The capability of a method or instrument to respond to a target substance or constituent in the presence of non-target substances.

Sensitivity: the capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest.

Spike: a known amount of an analyte added to a blank, sample or sub-sample.

Standard Operating Procedure (SOP): a written document which details the method of an operation, analysis or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks.

Systems Audit: a thorough, systematic, on-site, qualitative review of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system.

Test Method: defined technical procedure for performing a test.

Toxic Substances Control Act (TSCA): legislation under 15 USC 2601 et seq., (1976).

Traceability: the property of a result of a measurement that can be related to appropriate international or national standards through an unbroken chain of comparisons.

Verification: confirmation by examination and provision of evidence that specified requirements have been met.

4.0 Organization and Personnel

4.1 QA Policy and Objectives

4.1.1 STL Quality Assurance Policy

It is STL's policy to:

- provide high quality, consistent, and objective environmental testing services that meet all federal, state, and municipal regulatory requirements.
- generate data that are scientifically sound, legally defensible, meet project objectives, and are appropriate for their intended use.
- provide STL clients with the highest level of professionalism and the best service practices in the industry.
- build continuous improvement mechanisms into all laboratory, administrative, and managerial activities.
- maintain a working environment that fosters open communication with both clients and staff.

4.1.2 Management Commitment to Quality Assurance

STL management is committed to providing the highest quality data and the best overall service in the environmental testing industry. To ensure that the data produced and reported by STL meet the requirements of its clients, complies with the ISO 17025 Quality Policy and agrees with the letter and spirit of municipal, state and federal regulations. STL maintains a Quality System that is clear, effective, well communicated, and supported at all levels within the company.

4.1.3 STL Mission Statement

We enable our customers to create safe and environmentally favorable policies and practices, by leading the market in scientific and consultancy services. We provide this support within a customer service framework that sets the standard to which others aspire. This is achieved by people whose professionalism and development is valued as the key to success and through continued investments in science and technology.

4.1.4 Purpose and Scope of LQM

The purpose of this Laboratory Quality Manual (LQM) is to describe the implementation of the Severn Trent Laboratories (STL) Quality system at the STL Buffalo laboratory. The LQM is written within the guidelines of the STL Quality Management Plan (QMP), which applies to all STL laboratories. This LQM outlines specific policies, organization, responsibilities and activities required to assure high quality laboratory services. The LQM also fulfills the requirements of our clients and government agencies for the laboratory quality manual. Particular emphasis is given to the requirements of the National Environmental laboratory Accreditation Conference (NELAC) standards.

The requirements set forth in this document are applicable to all employees at the STL Buffalo laboratory. The policies and practices described here are presented as minimum guidelines only. Based on good scientific judgment, more rigorous requirements may be applied by laboratory employees. Specific requirements delineated in project plans may supersede general quality requirements described in this manual.

4.2 QA Management

4.2.1 Organization and Responsibilities

The STL Buffalo laboratory operational and support staff works under the direction of the Laboratory Director. A functional organizational chart of STL Buffalo is depicted in Appendix A. The responsibilities of the individuals associated with Quality Assurance Management are described below. A list of STL Buffalo personnel (management and supervisory level) including education and experience is found in Appendix B. A designee will be appointed by the General Manager/Laboratory Director, for an interim period not to exceed three months, if a prolonged absence in a supervisory position occurs.

The General Manager is directly responsible for the overall operations of one or more operating facilities within STL. The GM's responsibilities include:

- Allocation of personnel and resources, long term planning, setting goals, and achieving the financial, business, and quality objectives of STL.
- Ensures Timely compliance with corporate management directives, policies, and management systems reviews.

The Laboratory Director reports directly to the General Manager and oversees the daily operations of the facility. The duties and responsibilities of the Laboratory Director are:

- Supervision of staff, setting goals and objectives for both the business and the employees
- Achieving the financial, business, and quality objectives of the facility
- Ensures timely compliance with audits and corrective actions
- Responsible for maintaining a working environment that encourages open, constructive problem solving and continuous improvement.
- Annually assess the effectiveness of the QMP and LQM within the operation.

The Technical Director reports directly to the Lab Director and is responsible for technical operations and business management. The duties and responsibilities of the Technical Director are:

- Facility design, construction and management
- Maintaining environmental conditions
- Technical and financial evaluation of capital equipment
- Capital budgeting and asset valuation
- Investigates technical issues related to projects as directed by QA or Senior Management Team.

The Program Management Supervisor reports directly to the Lab Director and has overall responsibility for management of the client requirements for sample analysis. The duties and responsibilities of the Program Management Supervisor are to:

- Supervise all requirements of the analytical tasks to ensure meeting the client objectives on schedule.
- Act as liaison between the laboratory and the client to discuss and resolve any problems that may occur.
- Work with laboratory supervisors in planning and conducting progress meetings.
- Take part in corrective actions.
- Assesses and assures customer satisfaction.

The Health & Safety Officer reports directly to the Technical Director and has overall responsibility for the facility's safety training and compliance with all required safety regulations. The Health & Safety Officer is responsible for:

- Development of the safety training manual.
- Oversight on the facility safety committee. Acting as liaison between the committee and management.
- Conduct and document training on waste handling and disposal.
- Documenting and tracking all incidents and accidents.

The QA Manager reports directly to the Lab Director and, for all QA matters, to the Corporate QA Director to maintain independence of QA oversight, and is responsible for reviewing and advising on all program aspects of QA/QC. The duties and responsibilities of the QA Manager are to:

- Coordinate the maintenance, update and pursuit of certifications with various state and federal agencies.
- Implement quality control procedures and techniques to assure that the laboratory achieves established standards of quality.
- Evaluate data quality and maintain records on other pertinent information.
- Monitor laboratory activities to determine conformance with the authorized quality assurance policy and to implement appropriate steps to ensure adherence to quality assurance programs.
- Coordinate internal facility audits

- Hosts external audits conducted by outside agencies.
- Review performance evaluation results.
- Administer intralaboratory and interlaboratory QA efforts.
- Approves quality control reference data changes in the LIMS
- Review all new or revised controlled documents.
- Responsible for maintaining, approving and implementing the Laboratory Quality Manual
- Responsible for implementing and communicating the QMP
- Providing Quality Systems and Ethics training to all new personnel
- Prepare monthly QA reports to management
- Authorized representative/contact for state/agency certification procedures.
- Has final authority to accept or reject data, and to stop work in progress in the event that procedures or practices compromise the validity and integrity of the analytical data.

The Laboratory Manager reports directly to the Lab Director and oversees the daily operations of the analytical laboratory. The duties and responsibilities of the Laboratory Manager are:

- Supervision of laboratory staff, setting goals and objectives for the laboratory.
- Ensures compliance with project/client requirements (report/data due date, holding time, client/agency specific QAPP).
- Oversees the implementation of the quality systems.
- Ensures timely compliance with audits and corrective actions
- Supervises maintenance of instruments and scheduling of repairs
- Responsible for maintaining a working environment that encourages open, constructive problem solving and continuous improvement.

The Information Services Manager reports directly to the Lab Director and is responsible for maintaining the in-house and commercially purchased software systems. The areas of responsibility are to:

- Supervise the design, development, testing/validation, implementation and output of software modifications.
- Control/Monitor access of personnel and clients to data information.

The Laboratory Supervisors report directly to the Laboratory Manager and are responsible for meeting all the technical and analytical terms and conditions for sample analysis. Their areas of responsibilities are:

- Organize the personnel, equipment and materials in a manner required to fulfill the analytical requirements of sample analysis.
- Oversee daily activities of laboratory analyses within the group and provide technical support when necessary.
- Review analytical data for validity and clarity.

- Maintain contact with the Project Manager in areas of technical concern, and advise the Project Manager of analytical progress, needs of potential problems that occur.
- Advise the Laboratory Director of progress, needs and potential problems that occur.
- Inform Laboratory Manager if the daily review indicates a decline in data quality, deviations or deficiencies in QC and implement corrective actions.
- Perform, evaluate and implement annual MDL & QC limit studies.
- Responsible for generation of SOPs for their department.
- Train employees on the proper methods and procedures performed in their department.

The Sample Analysts report directly to the Laboratory Supervisor and are responsible for the analysis of samples. The analysts will:

- Schedule, prepare and analyze samples according to the method specific requirements indicated by the chain-of custody or ASRF.
- Advise the section supervisor of progress, needs and potential problems that occur.
- Verify that the laboratory QC and analytical procedures are being followed as specified.
- Review sample QC data, at least daily, including inspection of raw chromatograms and calibration curves.
- Inform Laboratory Supervisors and QA Manager if the daily review indicates a decline in data quality and implement actions.
- Responsible for meeting quality requirements defined in this LQM and other supporting QA procedures.

The Sample Custodian reports directly to the Technical Director and is responsible for the receipt and login of client samples:

- Confirming the samples received against the Chain of Custody (COC).
- Transporting the samples to the proper storage unit within the facility.
- Tracking the disposal of client samples after the required holding time.

The Document Control Officer reports directly to the QA Manager and is responsible for the filing, archiving and unarchiving of all related job data and reports:

- Responsible for the security of all on-site issued reports/raw data.
- Tracking all requests for the unarchiving of raw data and job folders.
- Arranging for the off-site archival of data/job reports as space is needed.

4.3 Quality System

4.3.1 Objectives of STL Quality System

The Quality System is a set of management principles, objectives, policies, responsibilities and implementation plans of the organizational and project-specific levels. The goal of the STL Quality System is to ensure that business operations are conducted with the highest standards of professionalism in the industry.

To achieve this goal, it is necessary to provide STL clients with not only scientifically sound, well documented, and regulatory compliant data, but also to ensure that STL provides the highest quality service available in the industry. A well-structured and well-communicated Quality System is essential in meeting this goal. STL's Quality System is designed to minimize systematic error, encourage constructive communication, documented problem solving, and provide a framework for continuous improvement within the organization.

The Corporate Quality Management Plan (QMP) is the basis and outline for STL's Quality System and contains general guidelines under which all STL facilities conduct their operations. This Laboratory Quality Manual (LQM) describes the implementation at the STL Buffalo laboratory.

4.4 Project Document Control Procedures

The goal of the project document control program is to assure that all documents for a group of samples will be accounted for. Before releasing any analytical result, the laboratory assembles and crosschecks the information of custody records, lab bench sheets, analyst and instrument logs and other relevant data to ensure that data pertaining to each particular sample is consistent throughout the record.

4.4.1 Sample File Organization, Preparation and Review Procedures

Project file folders are created prior to sample analysis and stored in the assigned project manager's office. A specific job number will be assigned to samples that are received for analysis for each project. The assignment of job number is sequential, automatically assigned by the laboratory LIMS system and based on the date and time of receipt. All documents, sample tags (if applicable), custody forms, and all other laboratory data pertaining to a particular case will be placed in the job folder. Job folders pertaining to issued data will be filed in numerical order and stored in a secure area with access limited to authorized personnel. Authorized personnel are limited to QA personnel, Lab Director, Technical Director and and Document Control Officer or designee. All other personnel may formally request archived documents using the Document Retrieval Form.

4.5 Request, Tender, and Contract Review

4.5.1 Contract Review

For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is STL Buffalo's intent to provide both standard and customized environmental laboratory services to our clients. To ensure project success, the technical staff performs a thorough review of technical and QC requirements contained in contracts prior to the receipt of samples. Contracts are reviewed for adequately defined requirements and STL Buffalo's capability to meet those requirements.

All contracts entered into by STL Buffalo are reviewed and approved by the Laboratory Director or General Manager/Chief Operating Officer as required based upon value. Agreements for continuing work are the responsibility of the laboratory Project Managers or Project Manager Supervisor. Depending on the size and scope of the proposed project, other STL management staff can also be involved. Any contract requirement or amendment to a contract communicated to STL Buffalo verbally is documented and confirmed with the client in writing. Any discrepancy between the client's requirements and STL Buffalo's capability to meet those requirements is resolved in writing before acceptance of the contract. Contract amendments, initiated by the client and/or STL Buffalo, are documented in writing for the benefit of both the client and STL Buffalo.

All contracts, Quality Assurance Project Plans (QAPPs), Sampling and Analysis Plans (SAPs) contract amendments, and documented communications are part of the permanent project record, as detailed in section 4.7.4 of the LQM.

4.5.2 Project Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, STL Buffalo assigns a Project Manager (PM) to each client. The PM is the first point of contact for the client. It is the PM's responsibility to ensure that project specific technical and QC requirements are effectively communicated to the laboratory personnel before and during the project. The LIMS system (AIMS®) requires the PM to enter project, task and test information before any samples can be logged in.

STL Buffalo has established procedures in order to ensure that communication is inclusive and effective. These include project memos, designation and meetings of project teams, and meetings between the laboratory staff and the client. STL has found it very effective to invite the client into this process. STL strongly encourages our clients to visit the laboratories and hold formal or informal sessions with employees in order to effectively communicate client needs on an ongoing basis, as well as project specific details for customized testing programs.

4.5.3 Subcontracting

STL Buffalo shall advise the client in writing of its intention to subcontract any portion of the testing to another laboratory. This includes both STL laboratories and non-STL laboratories. The laboratory shall not proceed unless a timely response which jeopardizes sample integrity cannot be obtained. All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Proof of required certifications from the subcontract facility is maintained in STL Buffalo's subcontract laboratory file. Where applicable, specific QC guidelines and QAPJPs, are transmitted to the subcontract laboratory. Samples are subcontracted under formal Chain of Custody (COC). A separate QAPP for the subcontract work may be prepared by the subcontract laboratory and submitted under a separate cover. The Quality Department will keep a file on each subcontract laboratory providing analytical results. The file may contain a subcontract lab's QAMP, certifications and or method specific SOPs.

Subcontract laboratories may receive an on-site audit by a representative of STL's QA staff if it is deemed appropriate by the Corporate or facility QA Manager. An audit may be scheduled after a review of SOPs, PE scores or at the request of the client. The audit involves a measure of compliance with the required test method, QC requirements, as well as any special client requirements. Audit reports from applicable state and federal agencies may be substituted for the on-site audit.

Project reports from external subcontract laboratories are not altered and are included in original form in the final project report provided by STL. The final report from STL Buffalo clearly identifies what testing was performed by other laboratories.

Subcontracting may also occur between STL facilities. Subcontracting within STL is subject to the same requirements as detailed above. STL's Corporate Quality Manager oversees each facilities compliance with the corporate quality requirements.

4.5.4 Purchasing Services and Supplies

Evaluation and selection of suppliers and vendors is done, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. STL Corporate Policy #PG-001, "Procurement and Contracts," details the process used. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, a member of the supervisory or management staff approves all purchases from specific vendors.

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Purchasing guidelines for equipment and reagents meet or exceed the requirements of the specific method and testing procedures for which they are being purchased. National vendors and suppliers are available from the on-site purchasing agent.

Where possible, a consignment system is utilized where supplies are provided by the vendor, warehoused at the STL Buffalo facility and billed as used.

The Laboratory Director, or designee has the responsibility for approving purchase orders. The laboratory supervisors are responsible for ensuring that the requested quality of materials ordered matches those received, for verifying that material storage is properly maintained and for removing materials from use when shelf life is expired.

4.5.5 Instrument Maintenance Activities and Schedules

A complete listing of instrumentation may be found in Appendix C. Instrument preventative maintenance and careful calibration help to assure accurate measurements from laboratory instruments. Where applicable, all laboratory instrumentation is on a service contract with the instrument manufacturer or licensed service organization. The service contracts include regular preventative maintenance service calls on a scheduled basis.

Preventative maintenance procedures such as lubrication, source cleaning, detector cleaning and the frequency of such maintenance are performed according to the procedures delineated in the manufacturer's instrument manual or when deemed necessary by the analyst. All maintenance is documented in the instrument's injection log or maintenance logbooks.

Instrument logbooks are in the laboratory at all times. They contain records of usage, calibration, maintenance and repairs. Adequate supplies of spare parts such as GC columns, syringes, septa, injection port liners, and electronic parts are maintained in the laboratory so that they are available when needed or on expedited delivery.

4.6 QA Document Control Procedure

4.6.1 Document Type

The following documents, at a minimum, are controlled at each STL Facility:

- Quality Management Plan
- Laboratory Quality Manual
- Standard Operating Procedures (SOP)
- Laboratory Logbooks

4.6.2 Document Control Procedure

Security and control of documents is necessary to ensure that confidential information is not distributed and that all current copies of a given document are from the latest applicable revision. Unambiguous identification of a controlled document is maintained by identification of the following items in the document header: Document Name, Document Number, Revision Number, Effective Date, and Number of Pages. Management and/or the QA Department authorize controlled documents. Controlled documents are marked as such and the QA Department keeps records of their distribution.

Controlled documents are available at all locations where the operational activity described in the document is performed.

4.6.3 Document Revision

Changes to documents occur when a procedural change warrants a revision of the document. When an approved revision of a controlled document is ready for distribution, obsolete copies of the document are replaced with the current version of the document. The previous revision of the controlled document is archived by the QA Department. Obsolete documents are retired by the QA Department. In accordance with NELAC, all quality documents and records are stored for at least five years.

4.7 Records

4.7.1 Record Types

Record types are described in Table 2.

Table 2: STL Record Types

Raw Data	Controlled Documents	QC Records	Project Records	Administrative Records
Calibration	QMP	Audits/ Responses	COC Documentation	Accounting
Computer Tapes/Disks	LQM	Certifications	Contracts and Amendments	EH&S, Manual, Permits, Disposal Records
QC Sample Data	SOPs	Corrective Action	Correspondence	Employee Handbook
Sample data	Logbooks*		QAPP	OSHA 29 CFR Part 1910
Software (Version control)		Method & Software Validation, Verification	SAP	Personnel files, Employee Signature & Initials, Training Records
		Standards Certificates	Telephone Logbooks	Technical and Administrative Policies

*Logbooks: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature.

4.7.2 Record Retention

Table 3 outlines STL's standard record retention time. For raw data and project records, record retention is calculated from the date the project report is issued. For other records, such as Controlled Documents, QC, or Administrative Records, the retention time is calculated from the date the document is formally retired. Records related to the programs listed in Table 4 have lengthier retention requirements and are not subject to STL's standard record retention time. Record retention responsibilities will be included in the event of an ownership change. Clients will be notified of any change in policy.

Table 3: STL Record Retention

Record Type		Archival Requirement
Raw Data	All*	5 Years from project completion
Controlled Documents	All*	5 Years from document retirement date
QC	All*	5 Years from archival
Project	All*	5 Years from project completion
Administrative	Personnel/Training	7 years from date of hire
	Accounting	See Accounting and Control Procedures Manual

* Exceptions listed in Table 4.

4.7.3 Programs with Longer Retention Requirements

Specific client projects and regulatory programs have longer record retention requirements than the STL standard record retention length. In these cases, the longer retention requirement is noted in the archive. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Programs with record retention requirements greater than five years are detailed in Table 4.

Table 4: Special Record Retention Requirements

Program	Retention Requirement
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
NY Potable Water NYCRR Part 55-2	10 years
Pennsylvania – Drinking Water	10 years
AFCEE	10 years

4.7.4 Archives and Record Transfer

Archives are indexed such that records are accessible on either a project or temporal basis. Archives are protected against fire, theft, loss, deterioration, and vermin. Electronic records are protected from deterioration caused by magnetic fields and/or electronic deterioration. The electronic records (EDDs) are archived off-site in a secured facility. Access to archives is controlled and documented.

STL Buffalo ensures that all records are maintained as required by the regulatory guidelines and per the QMP upon facility location change or ownership transfer.

All observations and results recorded by STL Buffalo are entered into the laboratory LIMS or into permanent laboratory logbooks. Data recorded are referenced with the sample laboratory number, date and analyst's signature at the top of the page. Test records will reference the method of analysis, analyst, date of analysis, instrument, client ID, laboratory ID and results.

All logbooks, data records and other document entries are made in ink. Any corrections made to a logbook entry, data record or other documented entry will be made by crossing a single line through the error and entering the correct information. The person will subsequently date and initial the correction.

All chemicals and reagents received by STL Buffalo must be dated upon receipt, and again dated and initialed upon opening. All samples, standards, extracts, reagents and equipment will be labeled with appropriate inks (labels) to ensure that the identification is permanent when subject to adverse environmental conditions. Documentation of purity, if received, will be kept on file in the laboratory department that received the chemical or reagent.

The preparation of all standards and reagents must be in accordance with the written SOP. Preparation must be documented in a bound preparation log. Documentation must include the date, analyst initials, identification of stock source and the final concentration of the solution.

Once in the possession of the Analyst, all logbooks are their responsibility to maintain. No logbooks are permitted outside the facility. Analysts are responsible for proper documentation in the logbooks. Once a Logbook has been completed it is returned to the QA Manager for proper archiving. Logbooks are archived on-site for a year and then off-site for an additional four years.

4.8 Service to the Client

4.8.1 Sample Acceptance Policy

STL Buffalo's *SOP #ASR–Receipt–05* describes the sample receipt and log-in process in detail. Samples are considered "compromised" if the following conditions are observed upon sample receipt:

- Cooler and/or samples are received outside of temperature specification.
- Samples are received broken or leaking.
- Samples are received beyond holding time.
- Samples are received without appropriate preservative.
- Samples are received in inappropriate containers.
- COC does not match samples received.
- COC is not properly completed or not received.
- Breakage of any Custody Seal.
- Headspace in volatiles samples.
- Seepage of extraneous water or materials into samples.
- Inadequate sample volume.
- Illegible, impermanent, or non-unique sample labeling.

If notified by the customer of the following conditions, samples would also be considered compromised:

- Samples have high levels of polychlorinated dibenzo-p-dioxins/dibenzofurans (PCDD/PCDFs)
- Samples have high level gross alpha or beta radiation
- Samples are from a site known to contain chemical warfare agents (CWAs) and the samples have not been screened for them.

When "compromised" samples are received, it is documented on the chain of custody and the client is contacted for instructions. If the client decides to proceed with analysis, the project report will clearly indicate any of the above conditions and the resolution.

4.8.2 Client Confidentiality and Proprietary Rights

Data and sample materials provided by the client or at the client's request, and the results obtained by STL, shall be held in confidence (unless such information is generally available to the public or is in the public domain or client has failed to pay STL for all services rendered or is otherwise in breach of the terms and conditions set forth in the STL and client contract) subject to any disclosure required by law or legal process. STL's reports, and the data and information provided therein, are for the exclusive use and benefit of client, and are not released to a third party without written consent from the client. The audit reports supplied by federal, state and local regulatory agencies are public information and can be released without written consent of these agencies. However, specific client audits are confidential and must be approved by the client before releasing them to a third party.

4.8.3 Samples Tracking/Custody Procedures

- Sample are received at the laboratory by the sample custodian or designee who removes the samples from the shipping containers together with all accompanying documentation such as chain-of-custody (COC) forms, analysis request forms, etc.
- The condition of the custody seal if present, is examined and recorded.
- The temperature of the samples, upon receipt, will be recorded on the COC.
- The cooler or sample container is scanned for radiation.
- The PM group will be notified of sample arrival in order to perform general inspection and triage procedures.
- The pH of the sample (when required) will be taken upon receipt. Any inappropriate pH reading for reportedly preserved samples will be recorded. Necessary pH adjustments will be made, after confirming with the client and only with their consent, as required and documented in the AIMS® sample inventory log.
- The samples are inspected for general condition and the COC received with any samples is examined for discrepancies between package contents and the enclosed documents.
- Discrepancies, omissions, or inappropriate samples discovered would be noted and an ARRF form generated and sent to the Project Manager. The Project Manager will contact the client to resolve the problem.
- If the client cannot be reached, the samples will be assigned to cold storage (4 degrees +- 2 degrees C) until the problem is resolved. Time critical analysis will be started to ensure holding time compliance.
- Samples delivered directly by the sample collector are received and inspected by the Sample Custodian or designee in the presence of the sample collector. Discrepancies, omissions, or inappropriate samples should be noted and discussed with the sample collector to resolve the problem.
- Samples received through COC by the Sample Custodian or designee will be assigned an STL Buffalo laboratory ASRF (Analytical Services Request Form)number.
- The Sample Custodian or designee will complete the STL COC with the STL Buffalo ASRF number and corresponding individual sample number. The STL Buffalo sample number will be written on the client sample bottle or adhered via printed label to the client sample bottle, making sure the label does not obscure the original sample information. Each bottle will be identified with a unique sample tracking number.
- The sample identification and required test procedures will be entered by sample control into the laboratory sample database (AIMS®). Each sample will be given a unique laboratory identification number. All documents, sample tags, shipping labels, will be stored in the job folder.
- The project manager or designee will validate the accuracy of the sample log-in procedure by initialing the job folder after reviewing the documents against the project set up.
- Upon log-in completion of jobs with expedited turnaround (less than 3 days), notification will be sent to all affected laboratory departments and the Project Manager.

- When a sample is to be analyzed/prepared for analyses the analyst/ technician must verify that the sample ID number and parameter match with the analysis/prep they are performing. This is accomplished by confirming the sample ID with the ID on the analytical batch. In addition, the client ID printed on the label must match the client ID found on the original sample label. If any discrepancies are found the department supervisor is to be notified immediately. All discrepancies need to be addressed and resolved by the supervisor/program manager and with client input if needed.
- Once in the possession of the Laboratory, all samples and extracts are refrigerated and/or stored in areas that are accessible only to Laboratory personnel. Internal COCs are used to track the sample or extract in the lab facility. All coolers and refrigerators are monitored for temperature compliance. Samples and standards must be stored in separate refrigerators or freezers. Storage areas for volatile organic test procedures should be monitored weekly by analysis of a holding blank.
- Access to the facility is limited to STL Buffalo employees and monitored by an outside agency. Employees are granted access to the facility based on their job requirements and normal working hours. A swipe card system is used to open the electronically locked entrances. All visitor access to the building is controlled and monitored. All visitors are required to sign in at the reception desk and escorted through the facility. A log of all visitors is available from the QA Department. The facility is equipped with fire and burglar alarms throughout the facility.
- All Samples are stored at the Laboratory for a minimum of 14 days after the final report has been issued. Specific client or project requirements may lengthen the time a sample is held before disposal. Client and laboratory labels may be removed prior to sample container disposal/recycling.
- If samples are returned to the client rather than disposed of by the laboratory, the original COC or a new COC is used to document custody transfer back to the client.

4.9 Complaints/Inquiries

Client complaints/inquiries are documented, communicated to management, and addressed promptly and thoroughly. The employee receiving the call/letter/fax, normally the Project Manager or a client service representative documents the client complaints/inquiries. The documentation can take the form of a corrective action report (as described in Section 4.11) or in a format specifically designed for that purpose (DQR form). Service to client complaints are forwarded to the Project Manager for response. The Laboratory Director, Project Manager, and QA Manager are informed of all client complaints, and assist in resolving the complaint.

The nature of the complaint is identified, documented, and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA department may conduct a special audit to assist in resolving the issue. A written confirmation, or letter to the client, outlining the issue and response taken is usually part of the overall action taken.

The number and nature of client complaints is reported to the Corporate QA Manager in the QA Monthly report, submitted by STL Buffalo. The overall number of complaints is tracked and the appropriateness of the response to client complaints is assessed. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Management Systems Review.

4.10 Control of Non-conformances

Non-conformances include any out of control occurrence. Non-conformances may relate to client specific requirements, procedural requirements, or equipment issues. All non-conformances in the laboratory are documented at the time of their occurrence.

All non-conformances that affect a sample and/or sample data become part of the affected project's permanent record. A Job Exception form is filed with the Project Manager and QA Department relaying any non-conformance. When appropriate, reanalysis is performed where QC data falls outside of specifications, or where data appears anomalous. If the reanalysis comes back within established tolerances, the results are approved. If the reanalysis is still outside tolerances, further reanalysis or consultation with the Supervisor, Manager, Project Manager, Laboratory Director, or QA Manager for direction may be required. The client may also be consulted for direction in non-compliant situations. All records of reanalysis are kept with the project files.

Where non-conformances specifically affect a client's sample and/or data, the client is informed and action must be taken. Action can take the form of flagging and reporting the affected data, and including the non-conformance in the project narrative or cover letter.

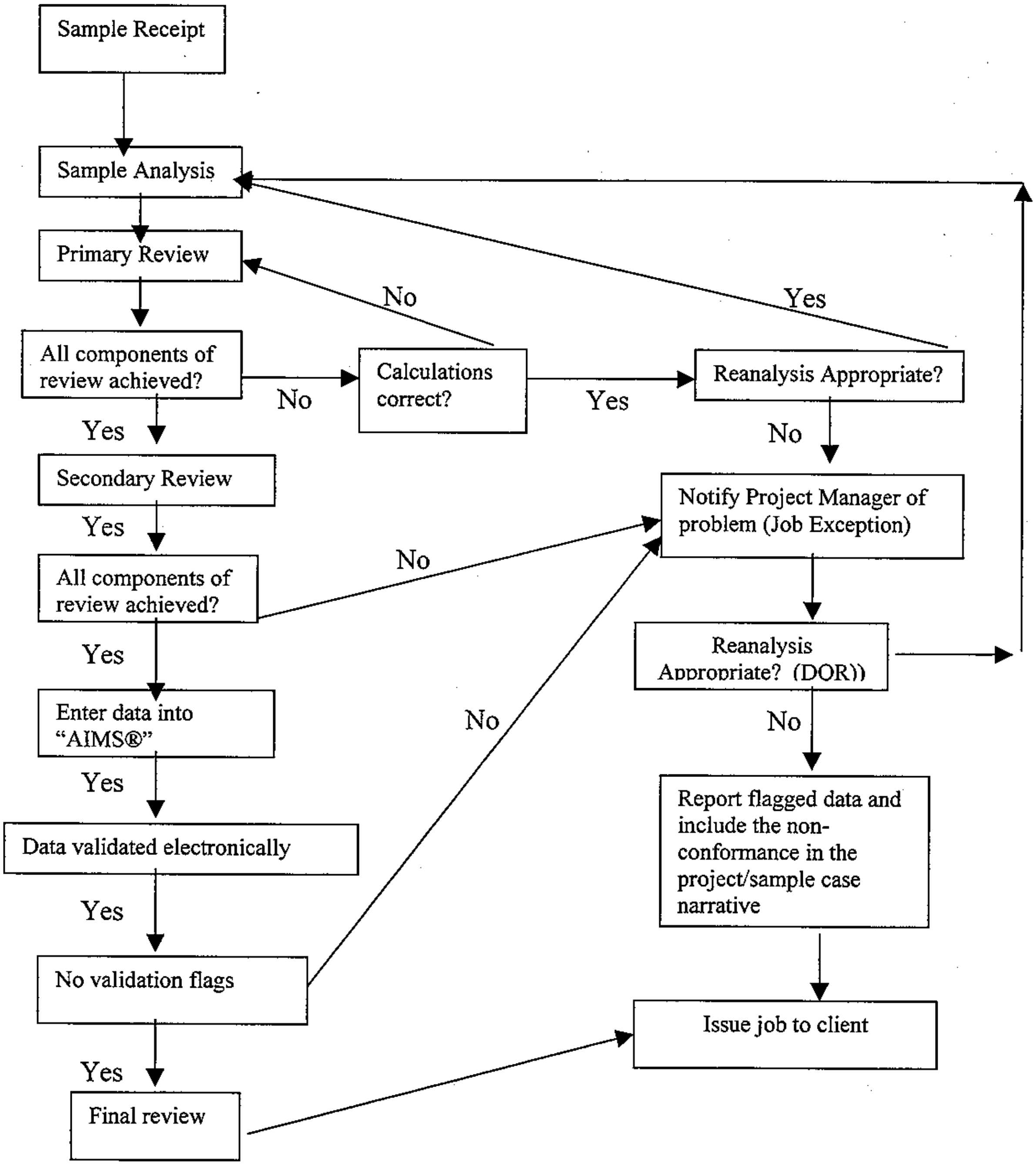
Where a non-conformance has no affect on the analytical data a comment in the job summary will be included with the raw data. The comment will be included in the case narrative.

Whenever a systematic error is discovered that affects the accuracy, validity or defensibility of calibrations or test results reported to STL's clients, our clients will be notified in writing immediately when the nature and extent of the problem are understood. The STL QA Director must also be notified.

4.11 Corrective Action

An important part of any quality assurance program is a well-defined, effective policy for correcting quality problems and to prevent their recurrence. This is depicted in the Figure 1. STL Buffalo maintains a closed-loop corrective action system, which operates under the direction of the QA Manager. While the entire quality assurance program is designed to avoid problems, it also serves to identify and correct those that may exist. Usually these quality problems fall into two categories: immediate corrective action or long-term corrective action.

Figure 1: STL Buffalo Decision Processes, Procedures and Responsibility for Initiation of Corrective Action



Specific quality control procedures are designed to help analysts detect the need for corrective action. Often an analyst's experience will be most valuable in identifying suspicious data or malfunctioning equipment; and an immediate corrective action may then be taken. The actions should be noted in laboratory notebooks but no other formal documentation is required unless further corrective action is necessary.

The need for long-term action may be identified by standard QC procedures, control charts, performance or system audits. Any quality problem, which can not be solved by immediate corrective action, falls into this long-term category. STL Buffalo uses a system to insure that the condition is reported to a person who is part of the closed-loop action and follow up plan (Figure 1)

The essential steps in the closed-loop corrective action system are:

- The problem will be identified
- Responsibility for investigating the problem will be assigned.
- The cause of the problem will be investigated and determined.
- A corrective action to eliminate the problem will be determined
- Responsibility for implementing the corrective action will be assigned
- The effectiveness of the corrective action will be established and corrective action implemented
- The fact that the corrective action has eliminated the problem will be verified
- The complete process of establishing and implementing corrective action will be documented.

This process of corrective action will be used to make all corrections deemed necessary by the STL Buffalo management or QA Department. The corrective action will be assigned for timely completion and tracked by the QA Department.

4.12 Preventive Action

Preventive action is defined as noting and correcting a problem before it happens, because of a weakness in a system, method, or procedure. Preventive action includes analysis of the Quality System to detect, analyze, and eliminate potential causes of non-conformances. When potential problems are identified, preventive action is initiated to effectively address the problem to eliminate or reduce the risk identified. The preventive action process takes the same format as the corrective action process

5.0 Data Generation and Validation

5.1 Data Reduction

Analysis results will be reduced to the concentration units specified in the analytical procedures using the equations provided in the analytical references utilizing AIMS® or technician/analyst. The calculation algorithms used in the AIMS® system for electronically transferred data must be verified to be accurate. The appropriate senior laboratory staff or designee will independently check the manual analytical calculations.

Manual integrations are sometimes necessary to produce good chromatography, but must only be performed when necessary. Further discussion of manual integrations and the required documentation is given in STL Corporate SOP *S–Q–004, "Manual Integration,"* and STL Buffalo SOP, *AGP–Man Int-20, "Manual Integration."*

5.2 Data Validation

Data validation is the process by which analytical data are evaluated and accepted or rejected based on a set of criteria. STL Buffalo uses an electronic data validator built into the AIMS® computer system to monitor compliance with approximately 70 QA issues. In addition, STL Buffalo personnel use the following criteria in the validation of laboratory data:

- Use of published or approved analytical procedures
- Use of properly operating and calibrated instrumentation
- Precision and accuracy achieved comparable to that achieved in similar analytical programs
- Precision, accuracy and blank contamination meeting the analysis specified criteria as and/or the criteria found in the applicable method.
- Completeness of data set.
- Consistency with historical data (where available)
- Cation/Anion calculations (when applicable)

All data will be validated by laboratory supervisors or trained data entry personnel prior to being released for reporting purposes to the STL Buffalo client services group. The persons validating the data will have sufficient knowledge of the technical work to identify questionable values.

5.3 Data Reporting

All analytical data are submitted to the client services group after the secondary review. The client services group generates the case narrative, cover letter and proper analytical forms. The completed report is forwarded to the PM for final review. The reviewed report is copied, scanned into a .PDF file and issued by the client services department. The .PDF file of the report, original raw data and all job summaries are archived.

5.4 Data Review

5.4.1 Primary Review

The primary review is often referred to as a "bench-level" review. In most cases, the analyst who generates the data (i.e. logs in the samples, prepares the samples and/or analyzes the samples) is the primary reviewer. In some cases, an analyst may be reducing data for samples run by an auto-sampler set up by a different analyst. In this case, the identity of both the analyst and the primary reviewer is identified in the raw data.

One of the most important aspects of primary review is to make sure that the test instructions are clear, and that all project specific requirements have been understood and followed. A completed job summary form is used to document the procedure. If directions to the analyst are not clear, the analyst must go to the Supervisor, QA Manager, or Project Manager, who must clarify the instructions.

Once an analysis is complete, the primary reviewer ensures that:

- Sample preparation information is complete, accurate, and documented.
- Analysis information is correct and complete.
- Calculations have been performed correctly.
- Quantitation has been performed accurately.
- Qualitative identifications are accurate.
- Client specific requirements have been followed.
- Method and process SOPs have been followed.
- Method and/or QAPP specific QC criteria have been met.
- QC samples are within established limits.
- Dilution factors are correctly recorded and applied.
- Non-conformances and/or anomalous data have been properly documented and appropriately communicated.
- Internal COC procedures have been followed
- Results are consistent with historical information (where available).

Any anomalous results and/or non-conformances noted during the Primary Review are communicated to the Supervisor and the QA Manager for resolution. Resolution can require sample reanalysis, or it may require that data be reported with a qualification.

The data reduction and primary review are documented on a "job summary" checklist and signed and dated by the analyst completing the process.

5.4.2 Secondary Review

The secondary review is a technical review of a data set and is completed by the department supervisor or designee. The secondary review is conducted after the raw data have been entered into the AIMS® system. Report forms are generated and reviewed against the raw data for compliance. Any exceptions noted by the analyst must be reviewed.. The electronic data validator is run for each test and a comment regarding any non-correctable non-compliance is entered into the AIMS® job comments module. The secondary reviewer closes the sample/test to ensure the results are not changed after the review. Any change in status from closed to open is tracked electronically by the IS department. The following items are reviewed:

- Adherence to procedure and method SOPs
- Correct interpretation of chromatograms, mass spectra, etc.
- Correctness of numerical input when computer programs are used (checked randomly)
- Correct identification and quantitation of constituents with appropriate qualifiers
- Numerical correctness of calculations (checked randomly)
- Acceptability of QC data
- Documentation that instruments were operating according to method specifications (calibrations, performance checks, etc.)
- Documentation of dilution factors, standard concentrations, etc.
- Sample holding time assessment.

If problems are found during the secondary review, the reviewer must work with the appropriate personnel to resolve them and notify the project manager if delays or client input is required.

The specific items covered in the second stage of data verification may vary according to the analytical method, but this review of data must be documented by signing the same checklist utilized for the primary review.

5.4.3 Final Review

Personnel from the Project Management Department perform the final review. The final review serves to verify the completeness of the data report and to ensure that project requirements are met. The final review includes the generation of a project narrative and/or cover letter, which outlines anomalous data and all non-compliances.

If problems are found during the final review, the reviewer must work with the appropriate personnel to resolve them. If changes are made to the data, such as alternate qualitative identifications, identifications of additional target analytes, re-quantitation, or re-integration, the completeness reviewer must contact the laboratory analyst and/or primary reviewer of the data so that the primary analyst and/or reviewer is aware of the appropriate reporting procedures. This is accomplished by submitting a Data Quality Review form to the appropriate personnel.

The final reviewed report is paginated copied, signed by the appropriate personnel, (Program Manager, Laboratory Director, Quality Manager) and mailed to the client. The Quality Department randomly reviews a selection of all issued reports for case narrative, system and method compliance.

5.5 Revised Deliverables

If, after issuance of a report, STL Buffalo observes any mistake that affects the results reported or the QC interpretation of those results, the client will be notified. Any material amendments or changes to a report after issue must clearly be identified as "Revision" and appropriate case narrative comments applied.

6.0 QA Program

6.1 Levels of QC Efforts

The EPA has established six primary analytical Data Quality Objectives (DQOs) for environmental studies. These DQOs are precision, accuracy, representativeness, completeness, comparability and detectability.

The components of analytical variability can be estimated when QA and QC samples of the right types and quantities are incorporated into measurement procedures at the analytical laboratory.

STL Buffalo will make every attempt to have all data generated be valid data and compliant. The precision of laboratory analysis will be evaluated using sample duplicates and matrix spike duplicates. Analytical accuracy will be monitoring using recovery of analytes from system monitoring compounds, matrix spikes, blank spikes, EPA reference check standards and Performance Evaluation (PE) samples. These quality control measures and frequencies are summarized in Section 8.1. Detectability is discussed in section 7.5 of this LQM. These QA efforts will assist in determining the reliability of the analytical data.

6.2 Accuracy and Precision

Accuracy is a measure of the degree of agreement between the analyzed value and the true or accepted reference value where it is known. Systematic errors affect accuracy. Accuracy is usually expressed as a percent recovery.

Precision is a measure of the mutual agreement among individual measurements of the sample parameter under similar conditions. The precision of a measurement system is affected by random errors. Precision is usually expressed as a relative percent difference or as relative standard deviation. Accuracy and precision in the laboratory are assessed by the regular analysis of known standards and duplicate samples.

6.3 Completeness

Completeness is a measure of the amount of valid data obtained from the analytical measurement system, expressed as a percentage of the number of valid measurements that should have been or were planned to be collected. STL Buffalo will make every attempt to generate valid data from all samples received. However, realistically, some samples may be lost in laboratory accidents or some results may be deemed questionable based on internal QC procedures. Due to the variable nature of the completeness value, the objective will be to have data completeness for all samples received for analysis as high as possible to meet completeness objectives as described by the client.

6.4 Representativeness

Representativeness is a measure of how closely the measured results reflect the actual concentration of distribution of the chemical compounds in the sample. Sample handling protocols (e.g., storage, preservation and transportation) have been developed to preserve the representativeness of the collected samples. Subsamples are obtained within the lab using proper homogenization techniques. The techniques are outlined in SOP *AGP–Homo–30*. Compliance with established SOPs ensures representative subsample aliquots within the laboratory. Proper documentation will establish that protocols have been followed and that sample identification and integrity have been assured.

6.5 Comparability

Comparability is a QA objective wherein all sample data are comparable with other representative measurements made by STL Buffalo for past results. STL Buffalo will achieve comparability by operating within the instrument linear range and by strict adherence to analytical protocols. The use of published analytical methods, standards reporting units and thorough documentation will ensure meeting this objective. Comparison of historical data may also be used for this purpose.

7.0 Quality Control

7.1 Internal Quality Control

Quality control is the routine application of procedures for obtaining prescribed standards of performance in the monitoring and measurement process. Quality Control checks are application of the STL Buffalo Quality Control program for laboratory analysis in order to ensure the generation of valid analytical results on project samples. These checks are performed by project participants throughout the program, under the guidance of the Quality Manager.

7.2 Quality Control Samples

STL Buffalo makes use of a number of different types of QC samples to document the validity of the generated data. The following types of QC samples are used routinely:

A. Blank Samples – Blanks are used to assess contamination introduced in transit, storage or in the laboratory.

- Laboratory Method Blanks – The method blank is a AC sample that consists of all reagents specific to the method and is carried through every aspect of the procedure, including preparation, cleanup and analysis. The method blank is used to identify any contamination of the analytical system that may lead to an elevated analyte concentration. In general, the method blank is a volume of de-ionized lab water for water samples or a purified solid matrix for soil/sediment samples that is processed as a sample.
- Laboratory Holding Blank – For organic analyses, these blanks are placed in cold storage with the volatile organic samples during the holding time to assess contamination which may be introduced in storage.
- Instrument Calibration Blanks – For all analyses, these blanks are used in instrument calibration and contain all the reagents used in preparing instrument calibration standards except the parameters of interest.

B. <u>Initial and Continuing Calibration Verification</u> - Verification samples are analyzed during each analysis run to assure calibration accuracy for each analyte. An initial calibration verification is analyzed, minimally, at the beginning of an analytical run. The continuing calibration verification is analyzed on a frequency defined by the analytical method. The concentration level of the verifications is generally the mid-point of the analytical curve.

C. <u>System Monitoring compound</u> – For most organic analyses, samples are fortified with system monitoring (surrogate) compounds prior to sample preparation in order to assess the behavior of actual components in individual samples during the entire preparative and analysis scheme. Surrogate standard compounds are chemically similar to compounds of interest (target compounds).

D. <u>Matrix Spikes</u> – For most analyses at frequencies particular to each method, spiking solutions are added to environmental samples in order to evaluate any matrix effects of the sample on the analytical method. Matrix spikes and analytical spikes are performed using actual elements of interest or target compounds. Due to the potential variability of the matrix of each environmental sample, the results of the matrix spike may have immediate bearing only on the specific sample spiked and not on samples collected at other locations that are included in the batch.

E. <u>Duplicate Samples</u> – For all analyses, a second aliquot of a sample or sample spike is carried through all sample preparation and analysis procedures to verify the precision of the analytical method. At least one sample in each analysis batch of 20 or fewer samples is analyzed in duplicate.

F. <u>Laboratory Control Samples / Matrix Spike Blank</u> – For inorganic / organic analyses, at least one method blank in each preparation batch of 20 or fewer samples is fortified with each analyte of interest or an appropriate subset of analytes and carried through the analysis procedure. The LCS recovery data are used to monitor the analytical method performance in terms of accuracy.

Reagents used in the laboratory are normally of analytical reagent grade or higher purity. Each lot of acid or solvent received is checked for acceptability, i.e., no contaminants, prior to lab use. All reagents are labeled with the date received, date opened and expiration date. The quality of the laboratory de-ionized water is monitored daily. The de-ionized water used at STL Buffalo is run through activated carbon, a cation resin, an anion resin, and a mixed bed resin. The Volatile free water is carbon filtered only and is used only for volatile analyses. The de-ionized water and volatile free water are verified daily by the analysis of the prep blank water for inorganics and by the analysis of the method blank for organics. At the time of field blank / trip blank preparation, a sample is taken of the de-ionized water and volatile free water and is either analyzed immediately or held by the laboratory to be analyzed if contamination of the field blank / trip blank is determined.

7.3 Internal Quality Assurance

To monitor quality, STL Buffalo's QA Department conducts internal quality assurance audits including:

A. QC Blind Samples (Proficiency Testing samples) – STL Buffalo routinely participates in the ERA Performance Evaluation Program studies for both potable and non-potable water. This program allows STL Buffalo to monitor overall performance using a comprehensive set of single-blind check samples that are received as real-time samples. STL Buffalo participates in this program on a quarterly basis (2 of each study per year). In addition, STL Buffalo participates in the New York State Department of Health performance evaluation programs for potable water, non-potable water, solid waste, and CLP deliverables. The program evaluates report format as well as analytical accuracy. Participating laboratories receive detailed reports indicating an overall laboratory quality performance grade. The final reports along with any corrective actions are available upon request.

B. Internal Data Audit – On an ongoing basis, a selection of the issued analytical reports are chosen randomly and reviewed for analytical and client specific requirements. This data review includes each laboratory section.

C. Internal Laboratory Systems Audit – The QA department or designee will perform a systems evaluation covering each operational and support area at least once per year.
   - sample storage
   - chain of custody
   - instrument maintenance
   - documentation
   - precision
   - accuracy

D. Spot Assessments – Spot assessments or special audits are conducted on an as-needed basis, generally as a follow-up to specific issues such as client complaints, data audits, corrective actions or DQR trends. The STL Buffalo "Shadow Program," which focuses on the acceptability of practices surrounding a specific procedure is also a part of spot assessments.

In addition the QA manager will meet frequently with the project managers and laboratory supervisors to review QA data summaries and other pertinent information.

7.4 System and Performance Audits

7.4.1 System Audits

A system audit is an evaluation of the various components of a laboratory's measurements system to assess proper selection and use. This audit will consist of an on-site review of a laboratory's quality assurance system and physical facilities for sampling, calibration and measurements. System audits are performed on a regular basis by the various regulatory agencies and annually by the QA department or designee. The audit may included several or all of the components listed below:

- Personnel, facilities and equipment
- Chain - of - custody procedures
- Instrument calibration and maintenance
- Standards preparation and verification
- Analytical procedures
- Quality control procedures
- Data and sampling handling procedures
- Documentation control procedures

7.4.2 Performance Audits

Performance audits provide a systematic check of laboratory operations and measurement systems by comparing independently obtained data with routinely obtained data. To fulfill the PT requirements for NELAC accreditation, STL Buffalo routinely participates in laboratory performance evaluations received from the NYSDOH ELAP as part of the Potable and Non-Potable Water/Solid & Hazardous Waste/Air & Emissions Chemistry Proficiency Programs. STL Buffalo also analyzes proficiency samples to maintain participation in the NYSDEC CLP program. A corporate double blind proficiency study is analyzed annually and compiled by the corporate Quality Manager. The ERA WP, WS studies and NYSDOH PE studies schedules for STL Buffalo are detailed in Table 5.

Table 5: Laboratory Performance Evaluation Schedule (1 year)

(NELAC)	ERA WP	twice per year
(NELAC)	ERA WS	twice per year
(NELAC)	NYS DOH Potable	twice per year
(NELAC)	NYS DOH Non-Potable	twice per year
(NELAC)	NYS DOH Solid/HW	twice per year
	NYS DOH CLP	twice per year
	APG Non-Potable	once per year
	Corporate Double Blind	once per year

7.5 Detection Limits

7.5.1 Instrument Detection Limit

The Instrument Detection Limit (IDL) is the level at which the instrument can reliably detect an analyte response. Method-specific sample preparation steps are not considered in the IDL calculation. IDLs will be determined on a frequency stated by the method of analysis.

Inorganic IDL Determination
Most frequently, the inorganic IDLs are determined by multiplying the standard deviation obtained for the analysis of a standard solution (each analyte in reagent water) at a concentration of 3x-5x the estimated IDL, with seven consecutive measurements per day by the appropriate Student-t value, for a 99% confidence.

Organic IDL Determination
Most frequently, organic IDLs are determined by multiplying the standard deviation obtained for three to seven replicate analyses of a standard solution (each analyte in reagent water) by the appropriate Student-t value, for a 99% confidence.

The IDL is calculated by multiplying the standard deviation by the Students t-Test (n-1) value.

No. of Replicates	t-statistic
3	6.96
4	4.54
5	3.75
6	3.36
7	3.14
10	2.82

7.5.2 Method Detection Limit (40 CFR 146)

A number of procedures that can be used for estimating the MDL are referenced below:

Critical Level Approach (Currie, 1968)
This approach estimated the LOD based on a critical level. The critical level is determined from the standard deviation and population characteristics of successive blank determinations.

Decision Limit Approach (Hubaux and Vos, 1970)
This procedure uses a decision limit and the confidence limits from at least squares fitted regression line to estimate the LOD.

Decision Limit Approaching using Non-Central t-Distribution (Clayton et al., 1987)
This approach estimates the LOD based on a decision limit. This approach is similar to the Hubaux-Vos method but using a non-centrality parameter of distribution in calculating the LOD.

Method Detection Limit Study (USEPA, Glaser et al., 1981)
This approach establishes a procedure for estimation of the MDL at a single concentration using a minimum of seven successive determinations of samples or spikes containing the analyte to be determined.

Weighted Least Squares Approach (Gibbons et al., 1997)
This approach for estimating the LOD utilizes spiked samples at a series of concentrations and applies a weighted least squares regression analysis to the resulting data.

Most frequently, the Method Detection Limit (MDL) is the minimum concentration of an analyte that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. A MDL utilizes all preparatory steps in the final detection.

To obtain an MDL:

1. Seven method blank samples are spiked at a concentration that is two to five times the IDL, or estimated MDL
2. The MDL is calculated by multiplying the standard deviation obtained for seven replicate analyses of a standard solution (each analyte in reagent water) by the appropriate Student-t value, for a 99% confidence.
3. Calculated MDL's must meet specific requirements stated in 40 CFR part 136 or be repeated.

MDL's are determined per method per sample preparation procedure. MDL's are determined or verified annually, for each method and when analytical conditions or methods change. Verification involves analysis of a single standard prepared at the MDL concentration and carried through the entire procedure, with appropriate documentation of response. The QA Department maintains copies of MDL studies for all tests performed at STL Buffalo.

7.5.3 Reporting Limits

Method reporting limits and client required limits are set by the method or specified by the client. These limits are verified by the MDL and IDL studies. In general, the reporting limit is determined by the concentration of the lowest standard in the calibration curve analyzed for a particular parameter.

The dilution of samples will affect the reporting limit for analytes. Dilutions are required when the matrix of the sample affects the chromatogram/color or if the result is above the analytical range of the analysis.

7.6 Training

STL is committed to furthering the professional and technical development of its employees at all levels. Minimum training requirements for STL- employees are outlined in Table 6.

Table 6: STL – Employee Minimum Training Requirements

Required Training	Time Frame	Employee Type
Environmental Health & Safety	Week 1 from hire	All
Basic Analytical Skills	Week 1 from hire	Technical
Ethics Initiation	Week 1 from hire	All
Quality System & Ethics Training	Quarter 1	All
Initial Demonstration of Capability (IDOC)	Prior to unsupervised method performance	Technical

Technical training is accomplished within each department by the supervisor to ensure method/procedure comprehension. All new personnel are required to demonstrate competency in performing a particular method by successfully completing an Initial Demonstration of Capability (IDOC) before conducting analysis independently on client samples.

IDOCs are most commonly performed by analysis of four replicate QC check samples. Results of successive LCS analyses can be used to fulfill the IDOC requirement. The accuracy and precision, measured as average recovery and standard deviation (using n-1 as the population), of the 4 replicate results are calculated and compared to those in the test method (where available). If the test method does not include accuracy and precision requirements, the results are compared to target criteria set by the laboratory. The laboratory sets the target criteria such that they reflect the data quality objectives of the specific test method or project data quality objectives. An IDOC Certification Statement is recorded and maintained in the employee's training or personnel file.

Prior to an analyst assuming responsibility for an analysis, an Initial Demonstration of Capability (IDOC) must be performed and approved by the Laboratory Manager and QA Manager.

7.7 Ethics Policy

Establishing and maintaining a high ethical standard is an important element of a Quality System. In order to ensure that all personnel understand the importance the company places on maintaining high ethical standards at all times; STL has established an Ethics Agreement. Each employee signs the Ethics Agreement, signifying agreed compliance with its stated purpose. STL Buffalo has established an Ethics Initiation, which is given to new employees within 1 week of employment. A central tenet is that management must consistently convey the message to analysts that financial pressures can never be allowed to compromise the quality of work.

7.8 Management Reviews

7.8.1 QA Reports to Management

A monthly QA report is prepared by QA Manager and forwarded to the Laboratory Director, the General Manager, and the Corporate QA Manager. The reports include metrics that are used to assess the effectiveness of the Quality System. The format of the monthly report is shown in Figure 2.

A Corporate QA Monthly Report containing a compilation of the Facility QA reports statistics, information on progress of the Corporate QA program, and a narrative outlining significant occurrences and/or concerns is prepared by the Corporate QA Manager and forwarded to the STL Chief Operating Officer.

7.8.2 Management Systems Review

The Laboratory Director will conduct annual evaluations of the status of the quality systems in the laboratory to review their suitability and effectiveness, and to introduce necessary changes or improvements. The management systems review is forwarded to the facility QA Manager, the facility General Manager and the Corporate QA Director.

The Corporate QA Manager issues a report on the management systems review within 21 calendar days of the audit. The audit is addressed to the facility Laboratory Director, QA Manager, General Manager, and Chief Operating Officer.

Written responses are required within 21 calendar days of report issue. The response follows the format of the report, and corrective actions and time frames for their implementation are included for each deficiency. The response is directed to all individuals copied on the audit report. Where a corrective action requires longer than 21 days to complete, the target date for the corrective action implementation is stated and evidence of the corrective action is submitted to the Corporate QA Manager in the agreed upon time frame. An internal audit will verify that the corrective actions stated in the response are implemented by the facility.

Figure 3: Monthly QA Report Format

1. Audits
   Internal systems audits performed, significant and/or repeat deficiencies noted.
   External systems audits performed.
   Data audits (in percent).

2. Revised Reports/Client Complaints
   Revised reports in percent.
   Total number of client complaints, reason, and resolution.

3. Certifications/parameters changes.

4. Proficiency Testing
   Score for each PT as a percent.
   Note repeat failures and/or significant problems.

5. Standard Operating Procedures
   - Total number requiring revision.
   - Percent complete.
   - Percent still requiring revision.

6. Miscellaneous QA and Operational Issues
   Narrative outlining improvements, regulatory compliance issues, general concerns, and assistance required from Corporate QA. Include corrective actions and/or audit follow through that are beyond completion date.

8.0 Standard Operating Procedures

STL Buffalo maintains a SOP Index (see Appendix D) for all standard, non-standard, and laboratory developed methods (see Appendix E). The SOPs are available to all employees through the facility Intra-Net. Original signed copies are stored in a secure file cabinet and maintained by the QA department. SOPs are also maintained for describing processes that are not related to a specific method. Method SOPs are maintained to describe a specific test method. Process SOPs are maintained to describe function and processes not related to a specific test method.

8.1Method SOPs contain the following information:

Title Page with Document Name, Revision Number, Effective Date, Page Numbers and Total # of Pages, Authorized Signatures, Dates and Proprietary Information Statement (Figure 3), and Certification of Test Method.

1. Identification of Test Methods
2. Applicable Matrix
3. Quantitation Limit
4. Scope and Application, including test analytes
5. Summary of the Test Method
6. Definitions
7. Interferences
8. Safety
9. Equipment and Supplies
10. Reagents and Standards
11. Sample Collection, Preservation, Shipment and Storage
12. Quality control
13. Calibration and Standardization
14. Procedure
15. Calculations
16. Method Performance
17. Data Assessment and Acceptance Criteria for Quality Control Measures
18. Corrective Actions for Out-of-Control Data
19. Contingencies for Handling Out-of-Control or Unacceptable Data
20. Waste Management
21. References
22. Tables, Diagrams, Flowcharts and Validation Data
23. Changes from Previous SOP

8.2 Process SOPs: contain the following information:

Title Page with Document Name, Document Number, Revision Number, Effective Date, Page Numbers and Total # of Pages, Authorized Signatures, Dates and Proprietary Information Statement (Figure 3).

1. Scope
2. Summary
3. Definitions
4. Responsibilities
5. Safety
6. Procedure
7. References
8. Tables, Diagrams, and Flowcharts
9. Changes from Previous SOP

The QA Department is responsible for maintenance of SOPs, archival of SOP historical revisions, and maintenance of a SOP index. SOPs, at a minimum, undergo review every 2 years. If the procedure, scope or content of the SOP changes, a revision to the SOP is issued. This revision may be implemented during the review or at any time that the content of the SOP is altered. Where a SOP is based on a published method, the laboratory maintains a copy of the reference method. A proprietary statement is included with each SOP (figure 3).

Figure 4: Proprietary Information Statement

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SOP Appendix

In some cases, a standard laboratory procedure is modified slightly for a specific client or project, at the client or regulatory agency's request. In these cases, an Appendix to the SOP may be attached that indicates the modifications to the SOP, which are specific to that project. The SOP may also include specific state/agency requirements within the body of the document.

8.3 Laboratory Developed Methods

Laboratory developed methods are validated and documented according to the procedure described in section 8.5.

8.4 Non-standard Methods

Non-standard methods are validated and documented according to the procedure described in section 8.5.

8.5 Method Validation

Before analyzing samples by a particular method, the method is validated. Validation of the method is required for standard methods, non-standard methods, and laboratory developed methods. While method validation can take various courses, the following activities are generally required as part of method validation. Method validation records are designated QC records and are archived accordingly.

8.5.1 Determination of Method Selectivity

Method selectivity is demonstrated for the analyte(s) in the specific matrix or matrices. In some cases, to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

8.5.2 Determination of Method Sensitivity

Method sensitivity is determined using detection limit studies. Method detection limit studies are routinely performed using the criteria in 40 CFR Part 136 Appendix B. Instrument detection limits are performed, where required, by specific data quality objectives or regulation.

8.5.3 Determination of Interferences

A blank matrix is analyzed to indicate that the method is free from analytical interferences. Sample matrix spikes will be analyzed to determine matrix interferences.

8.5.4 Determination of Range

Where appropriate, a determination of the applicable range of the method is performed. In most cases, range is determined and demonstrated by comparison of the response of an analyte in a calibration curve to established or targeted criteria. The curve is used to establish the range of quantitation and the lower and upper values of the curve represent upper and lower quantitation limits. Calibration curves are not limited to linear relationships.

8.5.5 Initial Demonstration of Capability

IDOCs are performed prior to method performance. A single blind standard is analyzed with an acceptable result prior to sample analysis. Certification is received by the regulating agency, if required, prior to analyzing samples.

8.5.6 Documentation of Method

If the method is a minor modification of a standard laboratory method that is already documented in an existing SOP, a SOP Appendix, describing the specific differences in the new method, is acceptable in place of a separate SOP.

8.5.7 Continued Demonstration of Method Performance

Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as Laboratory Control Samples and Method Blanks.

8.6 Measurement Traceability

8.6.1 General

Traceability of measurements is assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration are not necessarily documented in a test method analysis or by analysis of a reference standard, are subject to ongoing certifications of accuracy.

At a minimum, these include procedures for checking specifications for balances, thermometers, temperature, De-ionized (DI) water systems, automatic pipettes and other volumetric measuring devices. Wherever possible, subsidiary or peripheral equipment are checked against standard equipment or standards that are traceable to national or international standards.

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balance calibration is verified on each day of use. All mercury thermometers are calibrated annually against a traceable reference thermometer. A correction factor is listed on the calibrated thermometer. Certified (non-mercury) thermometers are used within the facility as replacements for mercury thermometers and are traceable to their certificate of analysis. The expiration date of the thermometer is documented in the thermometer logbook and on the thermometer. Temperature readings of ovens, refrigerators, and incubators are checked and documented on each day of use. Deviations are noted along with any corrective actions.

Laboratory DI water systems have documented preventative maintenance schedules and the conductivity of the water is recorded on each day of use.

Laboratory SOPs specify the required level of accuracy in volumetric glassware. In all cases, volumetric glassware meets the requirements specified in the published test method.

8.6.2 Reference Standards

The receipt of all reference standards is documented. References standards are labeled with a unique Standard Identification Number, date received, date opened and the expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All standards should be purchased with an accompanying Certificate of Analysis that documents the standard's purity. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The documentation of standard purity is archived, and references the Standard Identification Number.

All efforts are made to purchase standards that are ≥ 97.0% purity. If this is not possible, the weight of the standard is corrected for the purity when performing calculations.

The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a different lot is acceptable for use as a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs.

8.6.3 Reagents

Reagents are, in general, required to be analytical reagent grade unless otherwise specific in method SOPs. Reagents must be, at a minimum, the purity required in the test method. The date of reagent receipt, expiration date and the date the reagent was opened are documented. Sample bottles are certified by the manufacturer to be free of contaminants. The certificates are stored at STL Buffalo.

9.0 Project Reports

9.1 General

The criteria described in Section 9.1.1 apply to all Project Reports that are generated under NELAC, State, Federal Agency and/or client requirements. The criteria described in 9.1.2 apply to all Project Reports.

9.1.1 Project Report Content

- Title
- Laboratory name, address, telephone number, contact person
- Unique Laboratory Project Number
- Total Number of Pages (report must be paginated)
- Name and address of Client
- Client Project Name (if applicable)
- Laboratory Sample Identification
- Client Sample Identification
- Matrix and/or Description of Sample
- Dates: Sample Receipt, Collection, Preparation and/or Analysis Date

- Definition of Data Qualifiers
- Reporting Units
- Test Method
- Chain of Custody

9.1.2 Additional Content Requirements (method specific):

- Solid Samples: Indicate Dry or Wet Weight
- Whole Effluent Toxicity: Statistical package used
- If holding time ≤ 48 hours, Sample Collection, Preparation and/or Analysis Time
- Indication by flagging where results are reported below the quantitation limit.

9.1.3 Project Narrative

A Project Narrative and/or Cover Letter is included with each project report and at a minimum includes an explanation of any and all of the following occurrences:

- Non-conformances
- "Compromised" sample receipt, Method Deviations
- QC criteria failures

9.2 Project Release

The Laboratory Director or his/her designee authorizes the release of the project report with their signature.

Where amendments to project reports are required after issue, these shall be in the form of a separate document and/or electronic data deliverable. The revised report is clearly identified as revised with the date of revision and the initials of the person making the revision. Specific pages of a project report may be revised using the above procedure with an accompanying cover letter indicating the page numbers of the project revised. The original version of the project report must be kept intact and the revisions and cover letter included in the project files.

9.3 Subcontractor Test Results

Subcontracted data are clearly identified as such, and the name, address, and telephone number for the laboratory performing the test is included in the project report. Test results from more than one STL facility are clearly identified with the name of the STL facility that performed the testing, address, and telephone number for that facility.

9.4 Electronic Data Deliverables

Electronic Data Deliverables (EDD) are routinely offered as part of STL Buffalo's services. STL Buffalo offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), New Agency Standard (NAS), Format A, Excel, DBase, GISKEY, and Text Files.

EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process. Once the facility has committed to providing diskettes in a specific format, the coding of the format is performed. This coding is documented and validated. The validation of the code and associated documents are retained as a QC record.

EDDs are subject to a secondary review to ensure their accuracy and completeness.

9.5 Project Report Format

STL Buffalo offers a wide range of project formats, including EDDs, short report formats, and complete data deliverable packages modeled on the Contract Laboratory Protocol (CLP) guidelines. More information on the range of project reports available can be obtained by contacting STL Buffalo. Regardless of the level of reporting, all projects undergo the same levels of review.

10.0 Analytical Methodology

STL Buffalo analyzes samples by the methods listed below. Modified versions of the methods may be used if all Quality System requirements are achieved (MDL, DOC acceptable PE study). All method specific requirements for calibration, QC limits and data analyses are followed.

References

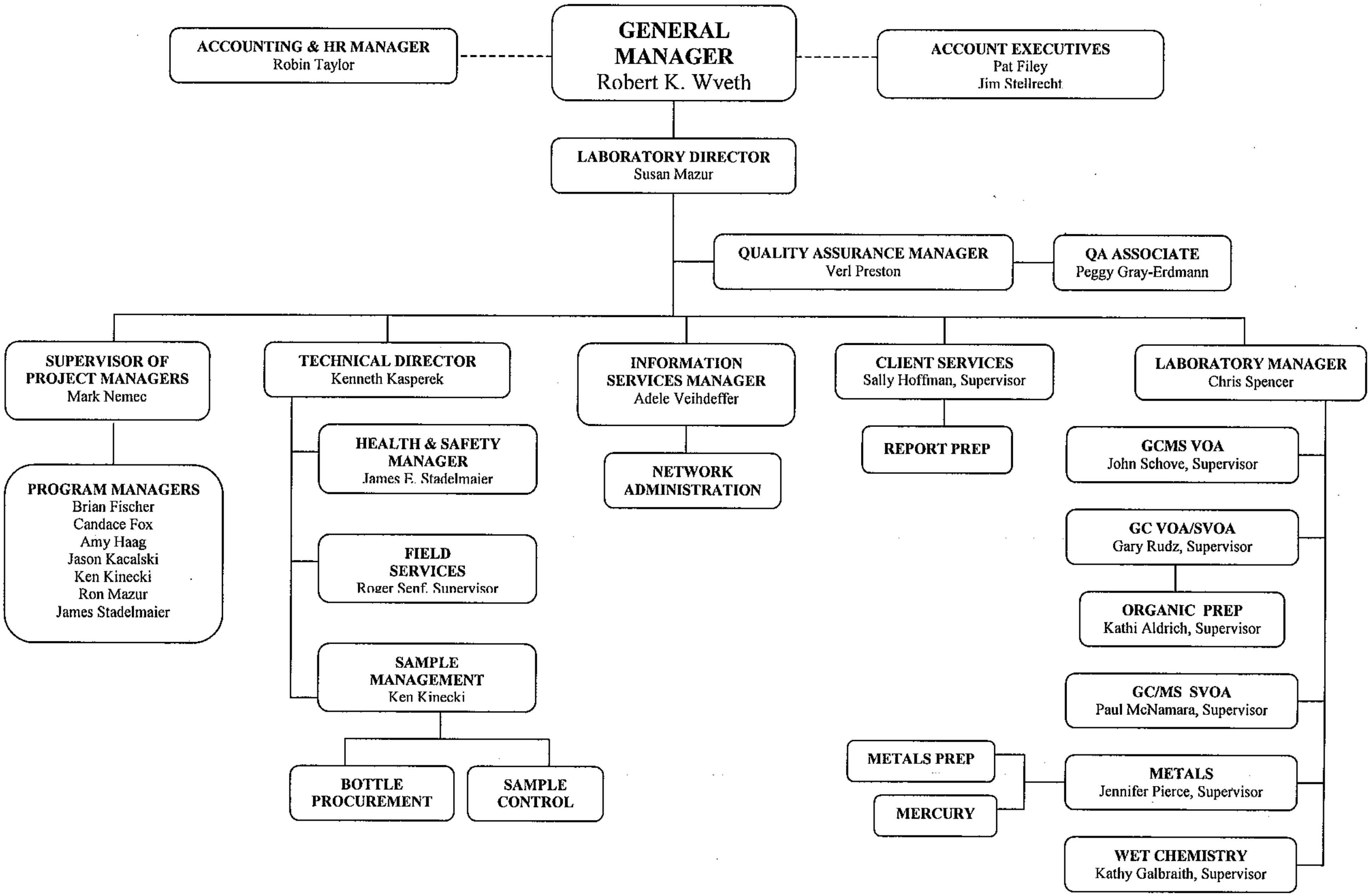
1. Methods for Chemical Analysis of Water and Wastewater", EPA-600/4-79-020, March 1983.
2. "Test Methods for Evaluating Soil Waste", USEPA-SW846, 3RD Edition, September 1986 with all current revisions.
3. "Methods for the Determination of Organic Compounds in Drinking Water," EPS-600/4-88-039, December 1988.
4. The Analysis of Trihalomethanes in Finished Water by the Purge and Trap Method, EMSL, Cincinnati, Ohio 45268, November 6, 1979.
5. Volatile Aromatic and Unsaturated Organic Compounds in Water by Purge and Trap Gas Chromatography, EMSL, Cincinnati, Ohio 45268, Revision 2.0, (1989).
6. Volatile Organic Compounds in Water by Purge and Trap Capillary Column Gas Chromatography with Photoionization and Electrolytic Conductivity Detectors in Series, EMSL, Cincinnati, Ohio 45268, revision 2.0 (1989).

7. Determination of Chlorinated Acids in Water by Gas Chromatography with an Electron Capture Detector, EMSL, Cincinnati, Ohio 45268, Revision 4.0 (1989).
8. "New York State Department of Environmental Conservation Analytical Services Protocol," June 2000.
9. "ASTM, Petroleum Products, Lubricants, and Fossil Fuel, Vol. 5.01 D56-D1947, 1990.
10. "Analytical Handbook for the Laboratory of Organic Analytical Chemistry", Wadsworth Center for Laboratories and Research, New York State Department of Health, August 1991.
11. "Standard Methods for the Examination of Water and Wastewater," 16th Edition, 1986
12. "Standard Methods for the Examination of Water and Wastewater," 17th Edition, 1989
13. "Standard Methods for the Examination of Water and Wastewater," 18th Edition, 1992
14. "Standard Methods for the Examination of Water and Wastewater," 19th Edition, 1995

APPENDIX A

STL BUFFALO ORGANIZATIONAL CHART

SEVERN TRENT LABORATORIES, INC. – BUFFALO
ORGANIZATIONAL CHART



ACCOUNTING & HR MANAGER
Robin Taylor

GENERAL MANAGER
Robert K. Wveth

ACCOUNT EXECUTIVES
Pat Filey
Jim Stellrecht

LABORATORY DIRECTOR
Susan Mazur

QUALITY ASSURANCE MANAGER
Verl Preston

QA ASSOCIATE
Peggy Gray-Erdmann

SUPERVISOR OF PROJECT MANAGERS
Mark Nemec

PROGRAM MANAGERS
Brian Fischer
Candace Fox
Amy Haag
Jason Kacalski
Ken Kinecki
Ron Mazur
James Stadelmaier

TECHNICAL DIRECTOR
Kenneth Kasperek

HEALTH & SAFETY MANAGER
James E. Stadelmaier

FIELD SERVICES
Roger Senf, Supervisor

SAMPLE MANAGEMENT
Ken Kinecki

BOTTLE PROCUREMENT

SAMPLE CONTROL

INFORMATION SERVICES MANAGER
Adele Veihdeffer

NETWORK ADMINISTRATION

CLIENT SERVICES
Sally Hoffman, Supervisor

REPORT PREP

LABORATORY MANAGER
Chris Spencer

GCMS VOA
John Schove, Supervisor

GC VOA/SVOA
Gary Rudz, Supervisor

ORGANIC PREP
Kathi Aldrich, Supervisor

GC/MS SVOA
Paul McNamara, Supervisor

METALS PREP

MERCURY

METALS
Jennifer Pierce, Supervisor

WET CHEMISTRY
Kathy Galbraith, Supervisor

Rev. 5/8/02

APPENDIX B

EDUCATION AND EXPERIENCE OF KEY PERSONNEL

Summary of Key Personnel.

General Manager: **Robert Wyeth**
Education: BS Physical Science, MS Chemistry
Experience: 34 years

Technical Director: **Kenneth Kasperek**
Education: BS Biochemistry, MS Pending
Experience: 16 years
Designated Deputy: Laboratory Director

Laboratory Director: **Susan Mazur**
Education: BS Chemistry
Experience: 12 years
Designated Deputy: Laboratory Manager

Laboratory Manager: **Christopher Spencer**
Education: BS Chemistry
Experience: 12 Years
Designated Deputy: Technical Director

Quality Assurance Officer: **Verl Preston**
Education: BS Medical Technology
Experience: 14 years
Designated Deputy: Peggy Gray-Erdmann

Project Manager Supervisor: **Mark Nemec**
Education: AAS Environmental Science
Experience:19 years
Designated Deputy: Laboratory Director

Information Services Manager: **Adele Veihdeffer**
Education: AAS Computer Programming
Experience: 12 Years
Designated Deputy: Laboratory Director

Organic Department Personnel:

GC/MS Laboratory Supervisor SVOA: **Paul McNamara**
Education: BA Biology
Experience: 12 Years
Designated Deputy: Laboratory Manager

GC/MS Laboratory Supervisor VOA: **John Schove**
Education: BS Chemistry
Experience: 12 Years
Designated Deputy: Laboratory Manager

GC Laboratory Supervisor: **Gary Rudz**
Education: BA Chemistry
Experience: 16 Years
Designated Deputy: Laboratory Manager

Organic Sample Prep Laboratory Supervisor: **Kathleen Aldrich**
Education: BS Biology
Experience: 6 Years
Designated Deputy: Laboratory Manager

Inorganic Department Personnel:

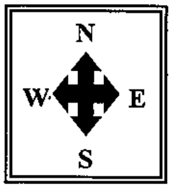
Metals Laboratory Supervisor: **Jennifer Pierce**
Education: BS Chemistry
Experience: 12 Years
Designated Deputy: Laboratory Manager

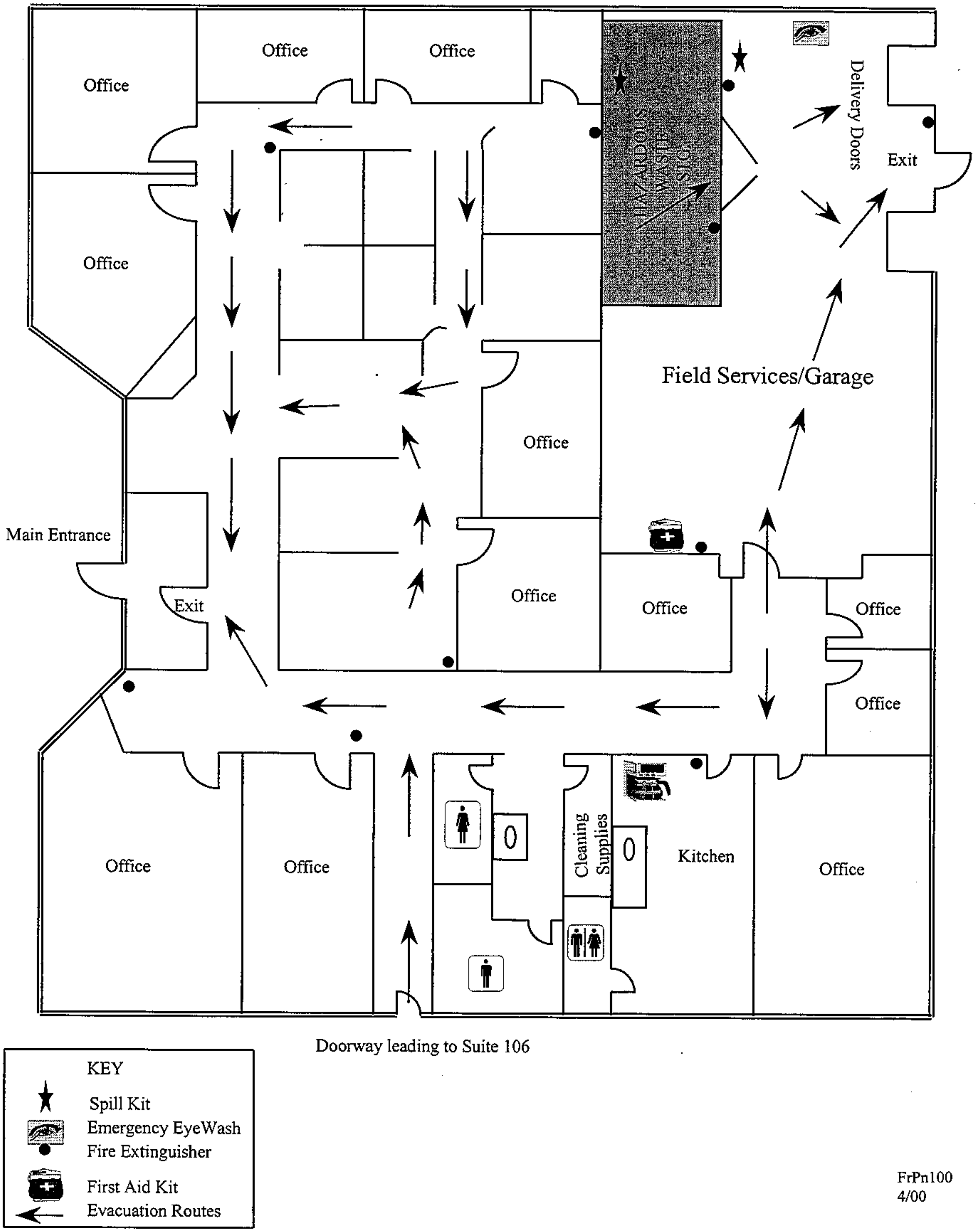
Wet Chemistry Laboratory Supervisor: **Kathy Galbraith**
Education: AAS Laboratory Technology
Experience: 17 Years
Designated Deputy: Laboratory Manager

APPENDIX C

FACILITIES AND EQUIPMENT LIST

SEVERN TRENT LABORATORIES, INC.
HAZELWOOD DR. OFFICES, SUITE 100
FLOOR PLAN





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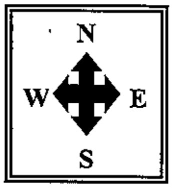
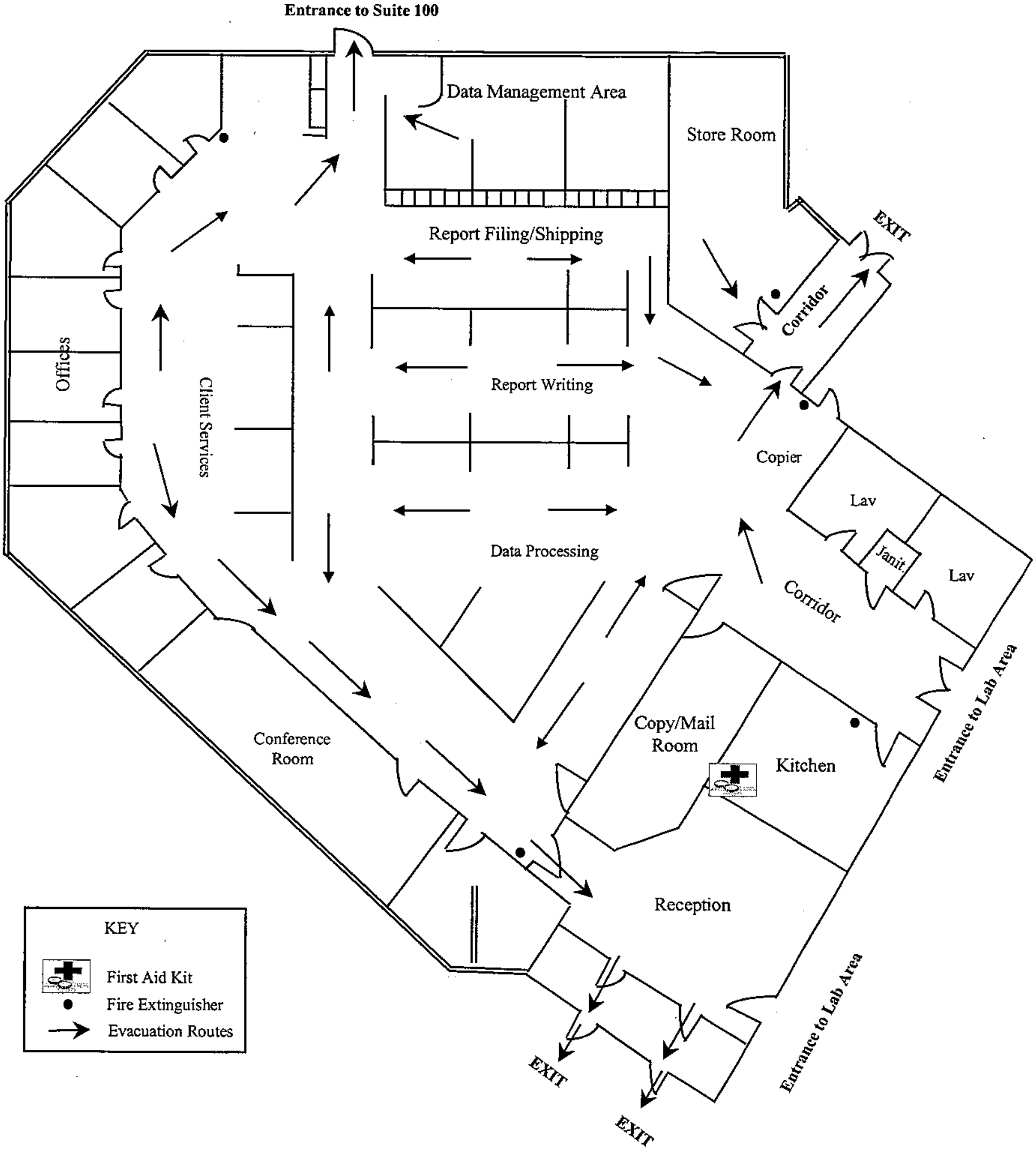
SEVERN TRENT LABORATORIES, INC.
HAZELWOOD DR. OFFICES, SUITE 106
CLIENT SERVICES/REPORT PREP
FLOOR PLAN





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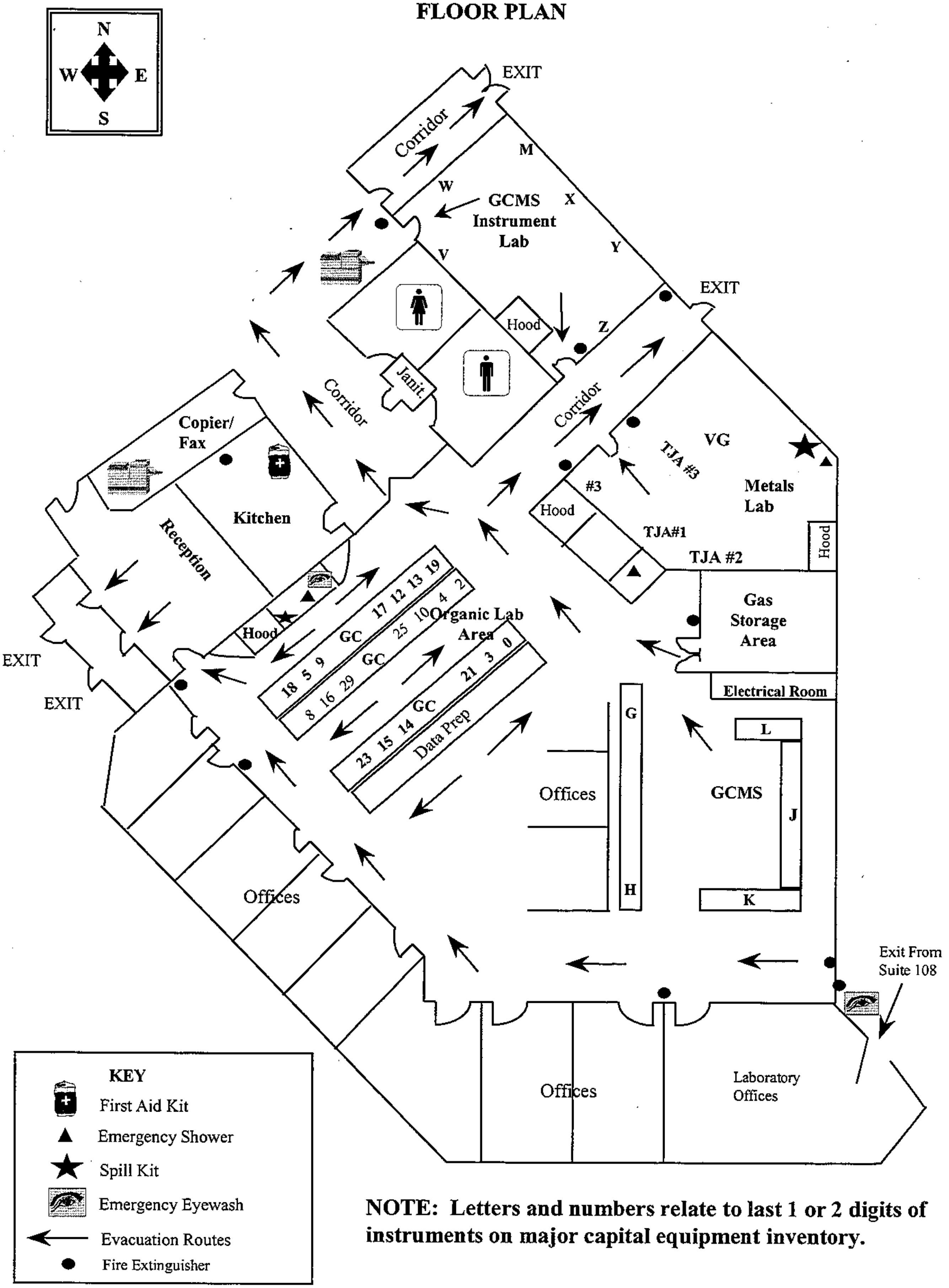
4/00

SEVERN TRENT LABORATORIES, INC.
HAZELWOOD DR. NY OFFICES, SUITE 106
LABORATORY AREA
FLOOR PLAN



NOTE: Letters and numbers relate to last 1 or 2 digits of instruments on major capital equipment inventory.

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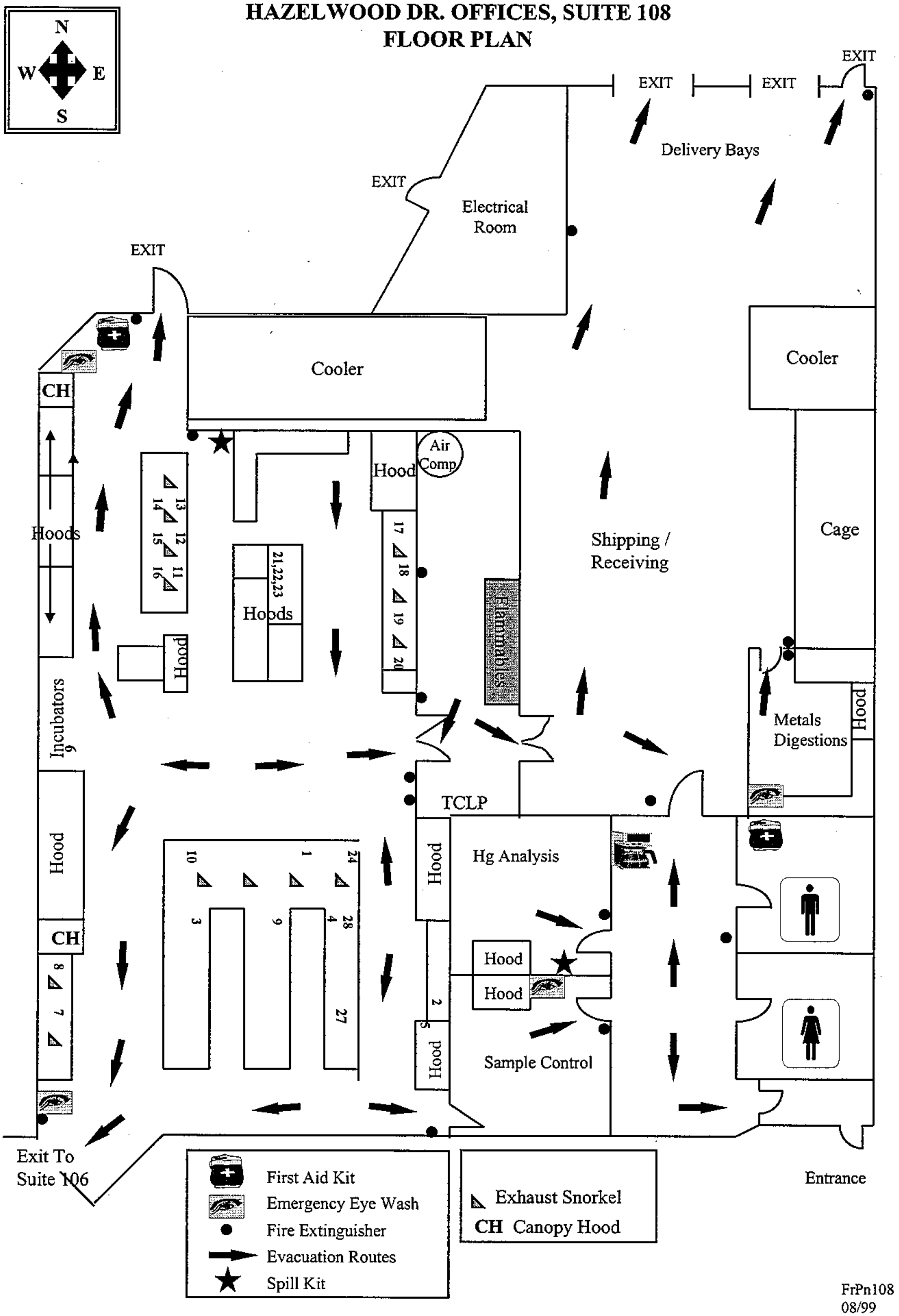
SEVERN TRENT LABORATORIES, INC.
HAZELWOOD DR. OFFICES, SUITE 108
FLOOR PLAN



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08/99

Severn Trent Laboratories, Inc. - Buffalo
Major Laboratory Equipment/Serial Numbers

SEVERN
TRENT
SERVICES

STL Buffalo

Instrumentation	Serial Number	Date In Service	Condition	Hazelwood Floor Plan Location
GC/MS Instrumentation				
Hewlett Packard 5973	US05060076	2001	good	F
Hewlett Packard 5973	US05060084	2001	good	N
Hewlett Packard 5973	US03950346	2001	good	P
Finnigan MAT INCOS 50	IN00568	1991	good	M
Hewlett Packard 5973	US82321636	2001	good	Q
Finnigan MAT INCOS 50	IN002568	1992	good	K
Finnigan MAT INCOS 50	IN002571	1992	good	L
Finnigan MAT INCOS 50	IN000303	1991	good	Y
Finnigan MAT INCOS 50	IN000309	1991	good	Z
Finnigan MAT INCOS 50	IN000470	1991	good	W
Finnigan MAT INCOS 50	IN002570	1991	good	V
Finnigan MAT INCOS 50	IN000296	1991	good	W
Finnigan Magnum Ion Trap	IS3650	1995	good	Ma
GC Instrumentation				
Hewlett Packard 5890 dual FID	2518A04945	1991	good	2
Hewlett Packard 5890 dual FID	3019A28433	1991	good	4
Hewlett Packard 5890 dual ECD	3019A28434	1991	good	5
Hewlett Packard 5890 dual ECD	2413A04914	1992	good	7
Hewlett Packard 5890 dual ECD	3203A42206	1992	good	9
Hewlett Packard 5890 dual ECD	3310A47662	1993	good	10
Hewlett Packard 5890 dual ECD	3310A47661	1993	good	12
Hewlett Packard 5890 dual ECD	336A53325	1993	good	13
Hewlett Packard 5890 dual NPD	3336A63126	1994	good	14
Hewlett Packard 5890 dual ECD	3336A53126	1994	good	15
Hewlett Packard 5890 dual ECD	3336A53464	1994	good	16
Hewlett Packard 5890 dual ECD	3336A53463	1994	good	17
Hewlett Packard 5890 dual ECD	3336A54409	1994	good	18
Hewlett Packard 5890 dual ECD	3336A54408	1994	good	19
Hewlett Packard 5890 Hall/PID	2020A01362	1990	good	3
Hewlett Packard 5890 PID/FID	3133A37157	1993	good	8
Hewlett Packard 5890 PID/FID	3336A51040	1994	good	21
Hewlett Packard 5890 Hall/PID	3235A54089	1994	good	22
Hewlett Packard 5890 PID/FID	3336A53728	1994	good	23
Hewlett Packard 5890 dual FID	3336A53729	1994	good	24
Perkin Elmer 8500 dual PID	42923001070	1991	good	Mobile Lab
Perkin Elmer 8500 dual PID	45645001089	1991	good	Mobile Lab
LC Instrumentation				
Hewlett Packard 1100 HPLC	DE92001578	2000	good	25

Severn Trent Laboratories, Inc. - Buffalo
Major Laboratory Equipment/Serial Numbers

Metals Instrumentation				
Thermo Jarrell Ash ICP61E Trace	334490	1995	good	TJA
Thermo Jarrell Ash ICP61E Trace	382590	1995	good	TJA
VG PlasmaQuad PQ2 ICP-MS	763	1991	good	VG
Perkin Elmer 5100	148244-6788	1992	good	Storage
Perkin Elmer 5100	148244-6846	1992	good	3
Perkin Elmer 3100	139289	1992	good	Storage
Leeman PS200 II	HG9045	2000	good	Hg Lab
Leeman PS200 II	HG0033	2000	good	Hg Lab
Water Quality Instrumentation				**(Suite 108)**
OI Carbon Analyzer Model 1010 #1	H92170411	1999	good	1
OI Carbon Analyzer Model 1010 #2	H014710903	2000	good	24
Shimadzu UV-VIS Spec. #UV-120-02	27A06763	1991	good	2
Spectronic Genesis 4001/4	3SGC199091	2000	good	3
Alpkem 510 Autoanalyzer	9380	1993	good	4
Andrews CN Midi-distillation	MCVA-1290380	1994	good	5
Lab-Line Hi-Lo BOD chamber	391-010	1994	good	6
Dohrmann TOX analyzer #DX2000	99243010	1999	good	7
Dohrmann TOX analyzer #DX2000	99243011	1999	good	8
Lachat Quickchem 8000 Autoanalyzer	A83000-1439	1999	good	9
Lachat Quickchem 8000 Autoanalyzer	A83000-1527	2000	good	27
Dionex Ion Chromatograph #DX-120	99010157	1999	good	28
YSI Oxygen Meter #57	93J09826	1995	good	WQ Lab
VWR Ion Meter #2100	1063	1997	good	WQ Lab
Orion Ion Meter #230A	2229	1999	good	WQ Lab
Fischer Accumet Ion Meter #925	860	1991	good	WQ Lab
HACH Spectrophotometer #DR/2000	940200028465	1995	good	WQ Lab
Sample Preparation Equipment				
ISCO Foxy 200 Fraction Collector-GPC	662130002	2000	good	10
ABC Industries GPC #1002B UV-106	822B-222/2335	1992	poor	Storage
ABC Industries GPC #100 UVD-1	9113-9128/3537	1992	poor	Storage
ABC Industries GPC #1002 UV-106	722B/1470	1992	poor	Storage
Organomation Rot-X-Tractor	16902	1999	good	11
Organomation Rot-X-Tractor	16907	1999	good	12
Organomation Rot-X-Tractor	16913	1999	good	13
Organomation Rot-X-Tractor	14206	1995	good	14
Organomation Rot-X-Tractor	15206	1995	good	15
Organomation Rot-X-Tractor	15224	1995	good	16
TurboVap II	TV9445N5816	1996	good	17
TurboVap II	TV9427N4133	1996	good	18
TurboVap II	TV944N5819	1996	good	19
TurboVap II	TV944N5820	1996	good	20
Heat Systems Sonicator #XL-2020	G1647/C5659	1994	good	21
Heat Systems Sonicator #XL-2020	G2665/C5674	1994	good	22
Heat Systems Sonicator #XL-2020	G2620/C5660	1994	good	23
Microtip Sonicator	G2245/C6328	1995	good	Storage
Microtip Sonicator	G2621/C6733	1995	good	Storage
Microtip Sonicator	G2713/C6732	1995	good	Storage
Microtip Sonicator	G1643/C6837	1995	good	Storage
Microtip Sonicator	G2742/C6842	1995	good	Storage
Microtip Sonicator	G2246/C6327	1995	good	Storage
Heat Systems Sonicator #W385	G9286/C4121	1994	good	Storage

Heat Systems Sonicator #W375	G7122	1994	good	Storage
Heating Banks for Soxhlet	237230	1993	good	Storage
Heating Banks for Soxhlet	240180	1993	good	Storage
Heating Banks for Soxhlet	240181	1993	good	Storage
Heating Banks for Soxhlet	240182	1993	good	Storage
Heating Banks for Soxhlet	240183	1993	good	Storage
Heating Banks for Soxhlet	240184	1993	good	Storage
Heating Banks for Soxhlet	240185	1993	good	Storage

APPENDIX D

PREVENTIVE MAINTENANCE SCHEDULE

Severn Trent Laboratories, Inc. - Buffalo
Preventive Maintenance Schedules

SEVERN
TRENT
SERVICES

STL Buffalo

Instrumentation	Item	Frequency	Comments
GC/MS Systems			
All Systems:	Replace septa	as needed	VOA, SVOA
	Clip Column, replace liner	as needed	VOA, SVOA
	Replace colums	as needed	VOA, SVOA
	Check gas flow	as needed	VOA, SVOA
	Clean injection port	as needed	VOA, SVOA
	Clean syringes	each use	VOA, SVOA
	Replace gas purifier	yearly	VOA
	Check gas supply	as needed	VOA,SVOA
	Check electronics	semi annual	VOA,SVOA
	Check for leaks	as needed	VOA, SVOA
	Change purge vessel	as needed	VOA
	Change trap	as needed	VOA
	Check trap fan	as needed	VOA
	Check valves and clean	as needed	VOA,SVOA
	Clean and replace filters	semi annual	VOA, SVOA
	Check lubricant levels	semi annual	VOA, SVOA
	Replace lubricants	semi annual	VOA, SVOA
	Check power supplies	semi annual	VOA, SVOA
	Check ventilation fans	semi annual	VOA, SVOA
	Check lubricant levels	semi annual	VOA, SVOA
GC Instrumentation			
All Systems:	Replace septa	as needed	VOA, SVOA
	Clip Column, replace liner	as needed	VOA, SVOA
	Replace colums	as needed	VOA, SVOA
	Check gas flow	as needed	VOA, SVOA
	Clean injection port	as needed	VOA, SVOA
	Clean syringes	each use	VOA, SVOA
	Replace gas purifier	yearly	VOA
	Check gas supply	as needed	VOA,SVOA
	Check electronics	semi annual	VOA,SVOA
	Check for leaks	as needed	VOA, SVOA
	Change purge vessel	as needed	VOA
	Change trap	as needed	VOA
	Check trap fan	as needed	VOA
	Clean cell	as needed	SVOA
	Check valves and clean	as needed	VOA, SVOA
LC Instrumentation			
All Systems:	Replace pre-column	as needed	HPLC
	Back flush column	as needed	HPLC
	Clean cell	as needed	HPLC
	Check pump head seals	as needed	HPLC
	Check valves and clean	as needed	HPLC

Severn Trent Laboratories, Inc. - Buffalo
Preventive Maintenance Schedules

Metals Instrumentation			
All Systems:	Clean nebulizer	each use	ICP, ICP/MS
	Clean capillaries	daily	ICP, ICP/MS
	Clean Torch	weekly	ICP
	Clean contact rings	each use	Furnace AA
	Change graphite tubes	as needed	Furnace AA
	Clean furnace windows	each use	Furnace AA
	Change pump oil	annually	ICP, ICP/MS
Water Quality Instrumentation			**(Suite 108)**
All Systems:	Clean bed supports	as needed	IC
	Change filters	as needed	IC
	Replace columns	as needed	IC
	Change bulb	as needed	Alpkem, Lachat
	Check timing	as needed	Alpkem, Lachat
	Rinse flow cell	as needed	Alpkem, Lachat
	Flush valve	as needed	Lachat
	Replace manifold coils	as needed	Alpkem, Lachat
	Check flows, filters	as needed	TOC
	Check bulb	annually	Spectrophotometer
	Check balances	daily	Balances
Sample Preparation Equipment			
All Systems:	Tune system	weekly	Balances
	Check pressure	each use	Turbovap II
	Check for leaks	each use	GPC
	Check filters	as needed	GPC
	Replace column,tubing	as needed	GPC

APPENDIX E

SOP INDEX

STL Buffalo
STANDARD OPERATING PROCEDURES
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6/25/02

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SOP No.	Title	Revision #	Date	Review Date	Reviewed By	Scheduled Review	Word ID#
AGP-PIPET-01	Calibration of Autopipettes, Re-Pipettors & Syringes	0 1 2 3 4	8/11/97 4/21/98 1/27/99 5/17/00 6/22/02			6/04	799
AGP-TEMP-03	Recordkeeping and Corrective Actions for Temperature Control Devices	1 2 3 4	1/27/99 5/13/99 5/18/00 5/21/02			5/04	145
AGP-BAL-05	Maintenance of Analytical Balances	0 1 2 3	4/4/94 1/27/99 5/16/00 5/21/02			5/04	146
AGP-DRYWT-07	Determination of Dry Weight	0 1 2 3	1/31/97 1/27/99 5/18/00 5/20/02			5/04	147
AGP-SUPPLY-08	Procurement of Laboratory Supplies and Services	0 1 2	10/24/96 1/27/99 5/16/00			5/02	148
AGP-CRHT-10	Tracking of Critical Holding Time Parameters	0 1 2 3	12/30/96 1/27/99 5/16/00 6/17/02			6/04	144
AGP-WATER-12	Preparation and QA/QC Procedures for Laboratory Reagent Water	0 1 2 3	11/21/96 1/27/99 5/18/00 5/21/02			5/04	150
AGP-STD-14	Standards Traceability and Preparation Logbooks	0 1 2	2/6/97 1/26/99 5/18/00			5/02	152
AGP-TIME-16	Military Time	0 1 2 3	11/16/93 1/27/99 5/16/00 5/21/02			5/04	154
AGP-MAN.INT-20	Manual Integration	0 1 2 3	4/2/92 1/27/99 5/18/00 6/22/02			6/04	157
AGP-LABCONT-23	Sample Storage & Handling Procedures for Mitigation of Sample & Laboratory Contamination	0 1 2	4/13/93 1/28/99 6/15/00			6/02	174
AGP –SAMP.SECUR-25	Sample Security and Storage	0 1 2	1/25/94 1/28/99 6/14/00			6/02	176
AGP-Homo-30	Sample Homogenization and Subsampling	0 1 2	1/6/98 1/28/99 7/14/00			7/02	177

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SOP No.	Title	Revision #	Date	Review Date	Reviewed By	Scheduled Review	Word ID#
AGP-THERMCAL-33	Thermometer Calibration	0 1 2	6/9/93 1/28/99 7/14/00			7/02	184
AGP-MAINTAUTH-40	Maintenance Authorization	0 1 2	4/13/93 1/28/99 8/2/00			8/02	186
AGP-MSPREV-45	Preventative Maintenance Schedule & Procedures-GCMS Semivolatile & VOA Lab	0 1 2	4/13/93 1/28/99 1/3/01			1/03	188
AGP-COMPUTER-50	Computer User Responsibilities	0 1 2	11/1/95 1/28/99 9/12/00			9/02	192
AGP-OFF-SITE-55	Off-Site Storage Procedures	0 1 2	1/5/2000 9/12/00 6/17/02			6/04	821
AGP-ON-SITE-56	On-Site Storage Procedures	0 1 2	1/5/2000 9/12/00 6/17/02			6/04	820
AGP-TBNK-60	Time Bank Policy	0 1 2	5/30/00 6/16/00 6/7/01			6/03	831
AGP-Out of Service-65	Out of Service Equipment	0	9/19/00			9/02	851
AGP-DILUTIONS-70	Procedure for Diluting Volatile Samples	0	12/11/00			12/02	854
AGP-COMPVOA-75	Compositing of soil matrix samples for volatile analysis	0	4/27/01			4/03	869
ASR-BOT.CONT-01	Sample Bottle Control	0 1 3	4/22/98 1/28/99 3/4/02			3/04	149
ASR-BOTTLE-03	Sample Container Preparation & Shipment, & Preparation of Pre-Preserved Sample Bottles for Use in Collection of Materials for Environmental Analytical Testing	0 1	8/10/92 1/28/99				151
ASR-RECEIPT-05	Receipt of Analytical Samples	0 1 2	2/20/98 1/28/99 2/25/00				163
ASR-PRES-07	The Chemical Preservation or Checking of Chemical Preservation of Analytical Samples	0 1 2 3	3/4/98 1/28/99 3/3/00 4/6/00				164
ASR-INV-08	Analytical Sample Inventory/Preservation Logbook	0 1 2	1/25/94 1/28/99 2/20/02			2/04	165
ASR-ASRF-10	Analytical Services Request Form	0 1	1/25/94 1/28/99				166

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ASR-ARRF-11	Analytical Receipt Resolution Form	0	1/25/94			2/04	167
		1	1/28/99				
		2	4/6/00				
		3	5/18/00				
		4	2/20/02				
ASR-COCLOG-15	Internal Chain-of-Custody Logbook	0	11/19/93				168
		1	1/28/99				
ASR-COCFORM-17	Internal Chain-of-Custody Form	0	1/25/94			2/04	169
		1	1/29/99				
		2	5/24/00				
		3	2/20/02				
ASR-ID-20	AIMS™ Laboratory Sample Identification Systems	0	1/25/94				170
		1	1/29/99				
ASR-TEMPBL-21	Temperature Blanks	0	11/16/93				178
		1	1/29/99				
ASR-STORAGE-27	Sample Transportation/Storage	0	7/27/95				182
		1	1/29/99				
ASR-TEMP-28	Sample-Receipt; Temperature Monitoring	0	7/11/94			3/04	181
		1	1/29/99				
		2	2/25/00				
		3	3/4/02				
ASR-RAD-30	Low-Level Radioactive Waste Minimization Plan	0	9/15/95				183
		1	1/29/99				
ASR-DISP-33	Sample Disposal	0	4/13/93				175
		1	2/20/98				
		2	1/29/99				
		3	2/25/00				
ASP-GLASS-10	Organic Glassware Cleaning	0	4/3/95			2/04	119
		1	3/5/99				
		2	12/27/99				
		3	2/14/02				
ASP-SOLVENT-15	Solvent Purity Check	0	4/2/92			2/04	120
		1	1/29/99				
		2	12/29/99				
		3	2/12/02				
ASP-SONC-20	Sonicator Maintenance	0	2/17/94			2/04	125
		1	1/29/99				
		2	12/29/99				
		3	2/12/02				
ASP-GPCCAL-25	3/90 GPC Calibration	0	6/17/92				126
		1	2/1/99				
		2	11/4/99				
		3	12/27/99				
ASP-507/508-50	Organic Preparation – Methods 507 and 508	0	4/12/94				061
		1	2/1/99				
		2	3/1/00				

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ASP-525.1-55	Sample Preparation – Method 525.2	0	3/29/94			2/04	060
		1	2/1/99				
		2	10/5/99				
		3	12/27/99				
		4	2/4/00				
		5	2/22/02				
ASP-608-65	Organic Prep Laboratory – EPA Method 608 (Recra Method 305): Non-CLP Pesticides and PCB	0	8/4/92			3/04	123
		1	2/1/99				
		2	9/27/99				
		3	12/27/99				
		4	3/4/02				
ASP-625-68	EPA Method 625 (Recra Method 401): Base/Neutral & Acid/Phenols (BN/AP)	0	8/4/92			2/04	127
		1	2/1/99				
		2	10/13/99				
		3	12/23/99				
		4	2/13/02				
ASP-CLPSONC-75	3/90 Pesticide/PCB and BNA Sonication	0	6/17/92			2/04	124
		1	2/1/99				
		2	11/23/99				
		3	2/25/02				
ASP-3510-80	Method 3510B: Aqueous Separatory Funnel Extraction Procedure Method 3510C: Aqueous Separatory Funnel Extraction Procedure	0	5/7/97			3/04	128
		1	4/6/98				
		2	1/26/99				
		3	9/24/99				
		4	12/27/99				
		5	3/2/00				
		6	3/18/02				
ASP-3520B-85	Method 3520B – Continuous Liquid/Liquid Extraction & Accelerated Liquid/Liquid Extraction	0	5/7/98			2/04	224
		1	2/1/99				
		2	9/25/99				
		3	12/27/99				
		4	3/2/00				
		5	2/13/02				
ASP-3550B-93	Method 3550B: Ultrasonic Extraction Of Soils And Wipes	0	2/24/97			2/04	136
		1	1/26/99				
		4	3/2/00				
		5	3/10/00				
		6	2/25/02				
ASP-3580A-94	Waste Dilution – Method 3580A	0	4/10/98			2/04	216
		1	2/1/99				
		2	8/4/99				
		3	3/2/00				
		4	2/25/02				
ASP-3620A-95	Method 3620A – Florisil Cartridge Cleanup	0	12/4/96			2/04	139
		1	2/1/99				
		2	2/3/00				
		3	2/25/02				
ASP-3640A-96	Method 3640A: Gel Permeation Chromatography	0	3/10/98	2/3/00	KA		210
		1	2/1/99				
		2	9/13/99				
		3	12/27/99				

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ASP-3665A-98	Method 3665A: Acid Cleanup	0 1 2 3 4	1/15/98 2/1/99 9/11/99 12/23/99 3/5/02			3/04	201
ASP-8151A,S-115	Method 8151A Herbicide Extraction-Soil	0 1 2 3 4 5	3/9/98 10/30/98 2/2/99 9/11/99 12/27/99 2/13/02			2/04	211
ASP-8151A,W-118	Method-8151A Herbicide Extraction – Water	0 1 2 3 4 5 6 7	4/27/98 10/30/98 3/8/99 5/18/99 9/13/99 12/27/99 3/8/02 5/20/02			5/04	213
AGE-504-05	**Previous Title:** 1,2-Dibromoethane (EDB) & 1,2-Dibromo-3-Chloropropane (DBCP) in Water – Method 504 **Current Title:** Method 504.1/8011 Microextractables in Water	0 1 2 3	9/6/95 8/19/98 2/4/99 8/23/00			8/02	058
AGE-508-20	Chlorinated Pesticide Analysis Method 508	0 1 2	3/24/94 2/4/99 7/1/00				057
AGE-608-45	Organochlorine Pesticides & PCBs – Method 608	0 1 2 3	8/10/92 8/19/98 2/4/99 7/19/00				039
AGE-8000A-46	Gas Chromatography – Method 8000A	0 1	4/10/94 10/30/98				047
AGE-8015DRO-50	Diesel Range Organics – Method 8015B	0 1 2 3	8/25/98 9/23/99 7/4/00 4/4/01			4/03	230
AGE-8081A-61	Organochlorine Pesticides – Method 8081A	0 1 2	8/14/98 1/26/99 7/6/00			7/02	228
AGE-8082-63	Analysis of PCBs – Method 8082	0 1	3/2/98 1/26/99				209
AGE-8151A-77	Chlorinated Herbicides – Method 8151A	0 1 2 3	8/19/98 10/8/99 3/8/01 5/21/01			5/03	227
AGE-310/13-90	NYSDOH Method 310-13/14: Petroleum Products in Water	0 1 2 3	4/11/97 7/20/98 2/9/99 7/29/00				044
AGE-GCPREV-90	Preventative Maintenance Schedule And Procedures-GC & HPLC	0	2/1/00				827
AGE-CLP-95	Analytic Method For Gc/Ecd Pesticides And Aroclors By Cipolm03.3	0	9/23/99				207
AGE-GLASS-100	Glassware Cleaning – GC Department	0 1	4/2/92 2/9/99				033

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AGE-MAINT-103	Maintenance Activities – GC Department	0 1	4/2/92 2/9/99				191
AGE-CALC-105	Calibration and Quantitation of Multicomponent Pesticides and PCBs	0 1 2	6/23/95 2/9/99 7/21/00				035
AGE-PCBID-110	Identification of Polychlorinated Biphenyls as Aroclors	0 1 2	12/22/97 2/9/99 7/21/00				032
AGE-INJLOG-115	Analytical Run-Injection Logbooks – GC Department	0 1 2	8/3/92 8/10/98 2/11/99				036
AGE-STD-120	Analytical Standards – GC Dept.	0 1	4/13/93 2/11/99				037
AGE-DATAACQ-130	Data Acquisition System Operation – GC Department	0 1	4/2/92 2/11/99				034
AGE-DELIV-135	GC Deliverables to GC Data Processing	0 1 2	4/2/92 8/10/98 2/11/99				038
AGE-REVIEW-142	Laboratory Data Review – Gas Chromatography	0 1	4/8/98 2/11/99				220
AGE-CLP-4.0/4.1/4.2-150	Analytical Methods for GC/ECD Pesticides and Aroclors by CLP OLM 04.0/4.1/4.2	0 1	9/23/99 01/26/00				812
AGE-531.1-155	Analysis of Carbamate Pesticides Method 531.1	0	6/22/02			6/04	894
AGV-601/602-10	Halogenated and Aromatic Volatile Organics (Methods 601-602 Individually or in Series)	0 1 2 3	4/1/98 2/11/99 2/28/00 4/17/01			4/03	048
AGV-8015B-21	Gasoline Range Organics Method 8015B	0 1	9/29/99 4/4/01			4/03	813
AGV-8021A-30	Halogenated & Aromatic Volatiles by Gas Chromatography using Electrolytic Conductivity and Photoionization Detectors in Series: Capillary Technique – Method 8021A	0 1 2 3	8/25/98 2/12/99 3/3/00 4/4/01			4/03	208
AGV-8021B-32	Halogenated and Aromatic Volatiles by Gas Chromatography using electrolytic conductivity and Photoionization Detectors in series: Capillary Technique Method 80021B	0	4/4/01			4/03	868
AGV-GRO-35	Gasoline Range Organics – GRO Method	0 1 2	4/20/94 2/12/99 4/4/01			4/03	041
AGV-GCVOAPREV-40	Preventative Maintenance Schedule And Procedures- GC Volatiles	0	2/3/00				828
AMB-MAN.INT-20	Manual Peak Addition – GC/MS Semivolatile Lab	0 1 2 3	8/3/92 2/12/99 3/10/00 2/28/02			2/04	013
AMB-INJ.LOG-25	GC/MS Semi-Volatile Injection Logbook	0 1 2 3	4/2/92 2/12/99 3/17/00 2/25/02			2/04	014
AMB-STREAMER-40	Loading Magnetic Streamer Tapes	0 1 2 3	4/2/92 2/15/99 3/10/00 4/16/01			4/03	018
AMB-525.2-50	Method 525.1-Determination of Organic Compounds	0	5/11/94				064

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	in Drinking Water by Capillary Column Gas Chromatography/Mass Spectrometry	1	2/15/99				
AMB-625-60	Analytical Method for GC/MS Semivolatiles by EPA– Method 625	0 1 2	3/18/98 2/15/99 3/6/01			3/03	015
AMB-8270C-66	Analytical Methods for GC/MS Semivolatile Samples by SW846 3rd Edition Method 8270C	0 1 2 3	8/28/98 2/16/99 3/13/00 4/3/01			4/03	206
AMB-CLP-70	Analytical Method For GC/MS Semivolatiles By OLMO 4.2 & ASP95-2	0 1	1/26/00 5/2/02			5/04	825
AMB-8270B-(low)-75	Analytical Methods for GC/MS Semivolatile Samples by SW846 3RD Edition Method 8270B (low)	0	9/29/00			9/02	852
AMV-GLASS-10	Syringes, Purge Tubes and Volumetrics – GC/MS Volatile Glassware Cleaning	0 1 2 3 4	4/2/92 4/10/98 2/17/99 10/28/99 2/7/01			2/03	001
AMV-MAN.INT-15	Manual Integration	0 1 2 3	1/19/98 2/17/99 10/28/99 2/14/01			2/03	002
AMV-INJ.LOG-20	Analytical Run-Injection Logbook	0 1 2 3 4	4/2/92 3/9/98 2/17/99 10/28/99 2/19/01			2/03	003
AMV-STD-25	Primary Standards Preparation	0 1 2 3	3/11/98 2/17/99 10/25/99 2/27/02			2/04	004
AMV-IDENT-35	Identification of Target Compounds – Volatiles	0 1 2	3/11/98 2/17/99 3/11/02			3/04	006
AMV-5030-42	Method 5030A: Purge and Trap	0 1 2 3	1/12/98 2/17/99 2/28/00 4/16/01			4/03	200
AMV-5035-43	Method 5035-Closed-System Purge & Trap & Extraction for Volatile Organics in Soil and Waste Samples	0 1 2 3 4	3/10/98 2/19/99 2/28/00 4/16/01 3/4/02			3/04	212
AMV-524.2-45	GC/MS Volatile Method 524.2	0 1 2 3	3/14/94 2/19/99 10/28/99 4/17/01			4/03	009

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AMV-624-50	Method 624	0	6/27/95			4/03	008
		1	2/19/99				
		2	10/28/99				
		3	4/4/01				
AMV-8260B-56	Analytical Methods for the Analysis of GC/MS Volatile Samples – 8260B	0	5/1/98			4/03	221
		1	1/26/99				
		2	3/1/00				
		3	9/11/00				
		4	12/14/00				
		5	4/6/01				
AMV-CLP-60	Analytical Method for GC/MS Volatiles by CLP OLM3.2	0	1/8/98				203
		1	2/19/99				
		2	9/16/99				
AMV-CLP-4.2-61	CLP OLM04.2 and ASP 2000	0	9/16/99			3/04	811
		1	01/27/00				
		2	3/18/02				
AMV-ASP951-62	Analytical Method for GC/MS Volatiles – ASP95-1	0	1/9/98			4/03	205
		1	2/19/99				
		2	4/17/01				
AMV-CLP/LC-64	Analytical Methods For The Low Concentration CLP/ASP Analysis Of GC/MS Volatile Samples	0	1/16/98			4/04	204
		1	2/19/99				
		2	9/30/99				
		3	2/28/00				
		4	4/23/02				
AMP-GLASS-05	Cleaning Procedure for Metals Glassware	0	4/28/97			6/04	066
		1	2/22/99				
		2	2/2/01				
		3	6/20/02				
AMP-BATCH-07	Metals Department Batching Procedure	0	5/12/97			2/03	067
		1	2/22/99				
		2	2/2/01				
AMP-3031-22	Procedure for Acid Digestion of Oils for Metals Analysis by Atomic Absorption or ICP Spectrometry Using Method 3031	0	4/2/98				218
		1	2/22/99				
		2	3/15/00				
AMP-3050A-25	Acid Digestion of Sediment, Sludges and Soils (Method 3050A)	0	6/25/97				069
		1	2/22/99				
AMP-3060A-30	Alkaline Digestion Method 3060A; Hexavalent Chromium in Solid Waste	0	3/18/98				072
		1	2/22/99				
		2	3/15/00				
AMP-CrVI-33	- Procedures for Extraction of Hexavalent Chromium in Aqueous Samples	0	8/10/92				071
	- Method 7195 Chromium Hexavalent (Coprecipitation)	1	1/16/98				071a
		2	2/2/99				
AMP-ASP/CLP,W-41	ASP/CLP Methods – Acid Digestion of Aqueous Samples & Extracts for Total Metals for Analysis by ICP Spectroscopy	0	5/6/98				223
		1	3/5/99				
		2	3/28/00				
AMP-ASP/CLP,S-42	Acid Digestion of Soil Samples for Total Metals For Analysis By ICP Spectroscopy (ASP/CLP)	0	5/6/98				222
		1	2/11/99				
		2	3/28/00				
AMP-ICPMS-46	Sample Preparation Procedure for ICP-MS Dissolved and Total Recoverable Metals in Water and Soil	0	3/17/00				823
AME-7000A-27	Method 7000A – Graphite Furnace Analysis	0	4/10/98			4/03	214
		1	1/26/99				
		2	4/14/01				

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AME-6010-30	Method 6010B/200.7/CLP Using the Thermo Jarrell Ash 61E Trace	1 2 3 4 5 6 7	12/4/96 1/26/99 9/30/99 10/8/99 3/30/00 4/6/01 5/21/02			5/04	080
AME-ICP/CLP-35	Methods ASP-91 and EPA 3/90 Using the Thermo Jarrell Ash 61E Trace	0 1	2/15/97 3/5/99				082
AME-LIN.RG-37	Establishment of Linear Ranges for ICP Analysis	0 1	8/10/92 3/5/99				081
AME-REVIEW-40	Laboratory Data Review	0 1 2	4/1/98 3/5/99 6/20/02			6/04	215
AME-ICPMS-45	ICP-MS Analysis Method 200.8/6020	0	3/17/00				824
AME-MERCURY-50	Method # 7470A, 7471A & Mercury Preparation and Analysis	0 1	8/9/00 4/6/01			4/03	841
AME-3005-55	Method 3005A/200.2 Sample Preparation of Waters for Total Recoverable or Dissolved Metals for analysis by ICP-AES, ICP-MS or GFAA	0	4/10/01			4/03	860
AME-3010A/3020A - 60	Method 310A/3020A Acid Digestion of aqueous samples and extracts for Total Metals for analysis by ICP-AES, ICP-MS and GFAA	0	4/10/01			4/03	861
AME-3050B-65	Method 3050B: Acid Digestion of sediments, sludges and soils	0 1	4/10/01 3/1/02			3/04	862
AWC-GLASS-01	Cleaning Procedure for Wet Chemistry Glassware	0 1	3/24/98 3/8/99				794
AWC-IC-O5	ION Chromatography; SM: 4110C, 300.0, 9056	0 1 2 3 4	9/29/99 3/17/00 10/4/00 2/12/02 4/22/02			04/04	815
AWC-O&G-07	Total Recoverable Oil and Grease (Gravimetric, Separatory Funnel Extraction) – Method 9070-413.1	0 1 2 3	10/27/97 3/8/99 5/17/01 2/28/02			2/04	761
AWC-CYANIDE-10	Total Cyanide 335.4, 335.2, 9012A and CLP CN	0 1 2 3	4/13/97 1/27/99 12/16/99 4/24/02			4/04	093
AWC-CHLORIDE-13	Chloride: Methods 325.2 & 9251 Automated Ferricyanide	0 1 2	6/5/98 1/27/99 3/5/02			3/04	226
AWC-405.1-14	Biochemical Oxygen Demand (5 day – Method 405.1) Carbonaceous Biochemical Oxygen Demand (CBOD)	0 1 2 3 4 5	10/15/97 3/8/99 11/4/99 12/1/00 01/19/01 2/15/02			02/04	798
AWC-TOC-15	Total Organic Carbon: Method 9060/415.1	0 1 2 3 4 5 6	4/1/93 6/15/98 3/8/99 11/15/99 3/7/01 10/29/01 3/26/02			3/04	095

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AWC-418.1-16	Total Recoverable Petroleum Hydrocarbons (Method 418.1)	0 1 2	1/31/94 3/8/99 2/15/02			2/04	096
AWC-310.1-17	Method 310.1 (Titrimetric, pH 4.5) Alkalinity	0 1 2 3 4	12/12/96 10/26/98 1/27/99 12/22/99 4/24/02			4/04	097
AWC-310.2-18	Alkalinity Method 310.2 (Colorimetric, Automated)	0 1	3/8/00 2/25/02			2/04	830
AWC-350.1-19	Ammonia Nitrogen Method 350.1 Automated Phenate	0 1 2 3	11/17/97 3/8/99 4/5/01 3/1/02			3/04	806
AWC-1311-21	Toxicity Characteristic Leaching Procedure (TCLP)	0 1 2 3 4 5 6	1/27/94 5/6/98 3/8/99 1/29/01 4/3/01 9/28/01 10/22/01			10/03	098
AWC-130.2-23	Total Hardness	0 1 2 3 4	2/9/94 10/26/98 3/8/99 10/10/00 2//10/02			02/04	100
AWC-353.2-24	Nitrate+Nitrite Nitrogen, Nitrite Nitrogen and Nitrate Nitrogen Method 353-2 – Automated Cadmium Reduction Method	0 1 3	6/1/98 1/27/99 2/28/02			2/04	225
AWC-pH-26	pH	0 1 2 3 4	11/8/94 3/9/99 10/5/00 4/12/01 2/28/02			2/04	102
AWC-305.1-27	Acidity	0 1 2	2/9/94 3/9/99 4/24/02			4/04	103
AWC-9095-29	Paint Filter Free Liquids Test	0 1 2 3	2/16/94 3/9/99 4/10/01 2/28/02			2/04	105
AWC-120.1-32	Specific Conductance	0 1 2	5/17/94 3/9/99 4/24/02			4/04	108
AWC-377.1-33	Sulfite – Method 377.1 (Titration, Iodometric)	0 1 2 3	8/19/97 3/9/99 6/1/01 2/15/02			2/04	797
AWC-180.1-34	Turbidity – Method 180.1	0 1 2 3	1/20/97 3/9/99 5/23/01 1/21/02			1/04	109
AWC-160.1-35	Total Filterable Residue (TDS)	0 1 2 3	2/28/94 3/9/99 9/11/00 3/4/02			3/04	110

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AWC-160.2-36	Total Non-Filterable Residue (TSS)	0 1 2 3 4 5	2/28/94 3/10/99 10/7/00 4/5/01 6/5/01 2/25/02			2/04	111
AWC-160.3-37	Total Residue	0 1 2 3	2/28/94 3/10/99 10/7/00 2/12/02			02/04	112
AWC-2540G-38	Method 2540G – Total/Fixed/Volatile Solids	0 1 2 3	7/21/97 3/10/99 6/22/01 2/12/02			02/04	790
AWC-425.1-39	Methylene Blue Active Substances (MBAS)	0 1 2 3	3/28/94 3/10/99 5/8/01 3/1/02			3/04	113
AWC-SULFIDE-41	Sulfide Method 376.1	0 1 3 4	5/5/94 3/10/99 6/22/01 2/12/02			02/04	115
AWC-375.4-42	Sulfate (Turbidimetric)Method 375.4	0 1 2 3 4	10/27/97 1/27/99 10/1/99 2/28/02 5/20/02			5/04	805
AWC-COD-44	Chemical Oxygen Demand (Colorimetric) – HACH 8000 Method	0 1 2 3 4 6 7	7/3/96 5/7/98 3/10/99 4/2/00 4/14/00 4/10/01 4/23/02			4/04	117
AWC-351.2-45	Total Kjeldahl Nitrogen – Method 351.2	0 1 2	8/6/97 3/10/99 3/19/02			3/04	800
AWC-1010-46	Method 1010 – Flashpoint	0 1 3 4	1/19/98 3/10/99 4/9/01 1/16/02			1/04	118
AWC-330.4-47	Total Residual Chlorine – Method 330.4	0 1 2 3	7/21/97 3/10/99 6/22/01 3/8/02			3/04	788
AWC-9020B-49	Total Organic Halides (TOX) Method 9020	0 1 2	7/21/97 3/10/99 12/22/99				789
AWC-9023-50	Extractable Organic Halides (EOX) Method 9023	0 1 2 3	7/21/97 3/10/99 10/26/01 4/24/02			4/04	795
AWC-160.5-51	Method 160.5 – Settleable Solids	0 1 2 3	7/21/97 3/10/99 10/5/00 2/12/02			02/04	793

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SOP No.	Title	Revision #	Date	Review Date	Reviewed By	Scheduled Review	Word ID#
AWC – 365.2-55	Method 365.2 – Total and Ortho Phosphorus	0 1	4/30/99 3/28/02			03/04	808
AWC-Iron-56	Total Iron & Ferrous Iron	0 1 2	12/15/99 6/22/01 2/28/02			2/04	817
AWC-HEXCr-58	Hexavalent Chromium	0 1	7/14/00 2/7/02			2/04	840
AWC-Phenolics-60	Total Recoverable Phenolics method 420.2/ 9066	0 1 2	9/28/00 4/5/01 2/12/02			2/04	832
AWC-9045C-65	Soil and Waste pH	1 2	4/12/01 2/25/02			2/04	834
AWC-420.2MOD-70	Total Recoverable Phenolics (Modified Method)	0	9/27/00			9/02	836
AWC-COLOR-75	Color Method 110.2	0 1	10/5/00 3/8/02			3/04	837
AWC-320.1-80	Bromide Method 320.1	0 1	10/10/00 02/12/02			02/04	844
AWC-345.1-85	Iodide-Method 345.1 (titrametric)	0	10/10/00			10/02	845
AWC-370.1-90	Total Silica –Method 370.1	0 1	10/10/00 2/12/02			2/04	846
AWC-340.2-90	Fluoride-Method 340.2	0	2/9/01			2/03	856
AWC-1664SPE-95	1664- n-hexane extractable material (hem) and silica gel treated n-hexane extractable material (sgt-hem) by solids phase extraction	0 1	6/1/01 2/12/02			02/04	855
AWC-Reactivity-100	Reactivity-Method Sect. 7.3	0 2 3	2/9/01 10/29/01 2/12/02			02/04	857
AWC-Density-115	Density	0 1	6/22/01 2/10/02			2/04	873
AWC-DO-120	Dissolved Oxygen	0 1	6/22/01 2/13/02			2/04	874
AWC-VISCOSITY-125	Viscosity	0 1	6/22/01 2/12/02			02/04	875
AWC-376.2-130	Sulfide Method 376.2	0 1	6/22/01 2/12/02			2/04	876
AWC-SPLP-1312	Synthetic Precipitation Leaching Procedure (SPLP)	0 1	12/15/99 5/2/02			5/04	818
AWC-Ignit-135	Ignitability of Solids	0	12/18/01			12/03	880
AWC-1030-145	Method 1030- Ignitability of Solids	0	12/14/01			12/03	886
AWC- Chlorine Demand-150	Chlorine Demand	0	3/18/02			3/04	893
ARP-ICLPREV-15	Inorganic CLP Data Review	0 1	6/6/95 3/11/99	4/29/98	KG/AMK		092
ARP-ICLPREV-16	Preparation and Review of Inorganic CLP Data Packages	0 1	3/3/93 3/11/99	4/29/98	KG/AMK		161
ARP-OCPRCV-20	Preparation and Review of Organic CLP Data Packages	0 1	9/28/92 3/11/99	4/30/98	KG/AMK		158
ARP-O/CSF-22	USEPA Complete SDG File (CSF)/Case File Purge; DC-2 Form	0 1	11/16/93 3/16/99	4/30/98	KG/AMK		160
ARP-I/CSF-23	USEPA Complete SDG File ILM03.0/Case File Purge	0	3/3/93	4/30/98	KG/AMK		162
ARP-MSVER-65	Verification of Qualitative Analysis by GC/MS Data Processing Analytes	0 1	4/2/92 3/16/99				024
ARP-VOAVER-70	Verification of Volatile 3/90 Forms 1 through 8	0 1	8/3/92 3/16/99				025
ARP-SVOAVER-75	Verification of Semi-Volatile 3/90 Forms 1 through 8	0 1	8/3/92 3/19/99				026

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ARP-MSDEL-80	Final Review and Assembly of GC/MS Data Deliverables	0 1	4/13/93 3/19/99				027
ARP-ENTRY-85	Level 2 Metals Entry Verification	0	4/16/01			4/03	863
ARP-MERCURY-90	Mercury Level 2 Entry into AIMS	0	4/16/01			4/03	864
ARP-FURNACE-95	Furnace Level 2 Metals Entry into AIMS	0	4/16/01			4/03	865
ARP-IMPORT-100	ICP/MS Level 2 Metals Import into AIMS	0	4/16/01			4/03	866
ARP-ICPIMPORT-105	ICP Level 2 Metals I,mport into AIMS	0	4/16/01			4/03	867
ARP-FIELD-110	Field Data Entry and Closure	0	1/24/02			1/04	884
ARP-Padep-110	Padep Forms	0	1/11/02			01/04	887
ARP-Level4Import-115	ICP and ICP/MS Level IV Import into Marrs	0	3/18/02			3/04	891
ARP-LevelIVMercury-120	Mercury Level IV Import into Marrs	0	3/18/02			3/04	892
ARP-WetChem-120	Review and Closure of Wet Chemistry Data	0	3/8/02			3/04	885
APM-PM-01	Program Management	0 1 2	8/1/95 3/29/99 01/21/00				193
APM-QUOTE TRACK-10	Tracking & Submitting Responses to Request for Proposal/Quotation	0 1	1/3/2000 3/11/02			3/04	816
APM-Correct-15	Correctness of Analysis	0 1 2	3/9/01 5/29/01 8/3/01			8/03	858
APM-Proj Info-20	Project Information Requirements	0	3/4/02			3/04	889
AQA-ETHICS-05	Ethics and Data Integrity	0 1 2	3/12/97 3/29/99 3/24/01			3/03	141
AQA-TRAIN-10	Laboratory Personnel Training	0 1 2	8/3/92 03/01/99 2/27/01			2/03	143
AQA-AUDIT-15	Performance and System Audit	0 1 3	4/3/93 4/1/99 5/18/01			5/03	153
AQA-QC Limits-17	Quality Control Limits	0	3/4/02			3/04	890
AQA-MDL-20	The Determination of Method Detection Limits	1 2 3 4	1/29/98 3/27/99 3/19/01 6/6/01			6/03	156
AQA-REC.RET-25	Record Retention	0 1 2	9/28/92 01/09/01 6/17/02			6/04	172
AQA-DOCCONT-30	Sample Tracking & Document Control	0 1	11/16/93 3/17/99				159
AQA-CA-35	Preventative and Corrective Action Procedure	0 1 2 3	9/13/97 3/17/99 3/24/01 1/9/02			1/04	801
AQA-Management Review-45	Management Review	0 1	2/1/00 6/21/02			6/04	826
AQA-SOP-55	Procedure for writing, Reviewing and revising SOP's	0 1 2	6/28/00 12/11/00 1/16/02			1/04	835
AQA-REANALYSIS-60	Reporting requirements for multiple sample analysis	0	7/10/00			7/02	850
AQA-DQR-65	Data Quality Request	0 1	1/3/01 12/27/01			12/03	853

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AQA-Subcontract-70	Certification of Subcontract Labs	0 1	7/3/01 8/3/01			8/03	877
AQA-Cert. Verif-75	Certification Verification	3 4	7/5/01 7/25/01			7/03	870
AFS-COC-01	Chain of Custody Documentation	0 1	3/16/94 3/16/99				194
ASF-SHIP-02	Sample Packaging and Shipment Off-Site	0 1	3/16/94 3/16/99				195
AFS-DECON-03	Equipment Decontamination	0 1	3/16/94 3/16/99				196
AFS-DATACOLL-10	Groundwater Sampling Field Data Collection	0 1	3/16/94 3/16/99				197
AFS-GW-12	Groundwater/Surface Water Sampling	0 1	3/16/94 3/16/99				198
AFS-SOIL-14	Surface and Subsurface Soil/Sediment Sampling	0 1	3/16/94 3/16/99				199
AHS-HSPROG-01	Health and Safety Program	0 1 2 3 4	8/19/96 4/13/98 2/17/99 6/20/00 3/4/02			3/04	185
AWM-HAZ.MG-01	Hazardous Waste Management	0 1 3 4 5	11/18/96 5/13/98 2/15/00 4/26/00 3/08/02			3/04	171
AFC-HSEKP-10	Facility Housekeeping & Maintenance	0 1	4/17/95 6/19/00			6/02	142
AFC-SECURITY-05	Facility Security	0 1	12/16/99 6/19/00			6/02	819
IS-001-01	Product Lifecycle	3	3/29/01			3/03	IS832
IS-002-01	AIMS System Management	2	3/28/01			3/03	IS833
IS-003-01	Workstation Rebooting and Powering off Procedures	3	3/27/01			4/03	IS834
IS-004-01	Logging out and Turning off Computer Equipment	3	3/27/01			4/03	IS835
IS-005-01	Virus Detection and Removal Procedures	3	3/27/01			4/03	IS836
IS-006-01	Data Backup Procedures	3	3/27/01			4/03	IS839
IS-007-01	Equipment Sign out Procedures	3	3/27/01			3/03	IS837
IS-008-01	Disaster Recovery Procedures	2 3	4/17/00 3/27/01			4/03	IS840
IS-009-01	Unauthorized Computer Configuration Changes	3	3/27/01			3/03	IS838
IS-010-01	Computer User Responsibilities	1 2	1/28/99 3/27/01			3/03	IS192
IS-011-01	Network Security	2 3	1/15/99 3/27/01			3/03	IS841
AIS-MARRS-12	Marrs Archive Process	0 1	7/7/00 4/5/01			4/03	IS842

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Total number of SOPs =
SOPs that need review in 2002 =
SOPS that need NELAP format =

% of our SOPs are complete
% of our SOPs need review

APPENDIX E

METHOD INDEX

SEVERN TRENT LABORATORIES, INC. - BUFFALO FACILITY
10 HAZELWOOD DRIVE
AMHERST, NEW YORK 14228-2298

ORGANIC ANALYSES - METHOD INDEX

PARAMETER/SAMPLE TYPE	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
GC/MS SEMIVOLATILES				
SVOA - Water	8270C	SW846, 3rd Edition	7 Days from Sample Date	(2) 1 Liter Amber Glass/Cool to 4°C (10% $Na_2S_2O_3$ [1])
SVOA - Soil	8270C	SW846, 3rd Edition	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
SVOA - Water	625	40 CFR 136	7 Days from Sample Date	(2) 1 Liter Amber Glass/Cool to 4°C[2] (10% $Na_2S_2O_3$ [1])
SVOA - Water	525.2	EPA 500 Series	7 Days from Sample Date	(2) 1 Liter Amber Glass/Cool to 4°C (10% $Na_2S_2O_3$ [1])
SVOA - Water	SVOA	OLM04.2 OLM03.2 ASP2000	5 Days VTSR	(2) 1 Liter Amber Glass/Cool to 4°C
SVOA - Soil	SVOA	OLM04.2 OLM03.2 ASP2000	10 Days VTSR	(1) 4 oz. Glass/Cool to 4°C
SVOA - Water	SVOA Low Level	OLC02.1 (3/95) ASP2000	5 Days VTSR	(2) 1 Liter Amber Glass/Cool to 4°C (10% $Na_2S_2O_3$ [1])
SVOA - Water	8270C	ASP2000	5 Days VTSR	(2) 1 Liter Amber Glass/Cool to 4°C
SVOA – Soil	8270C	ASP2000	10 Days VTSR	(1) 4 oz. Glass/Cool to 4°C

[1] Addition of $Na_2S_2O_3$ in presence of Free (Total Residual) Chlorine only

[2] Sample Control to verify that extraction will be completed within 72 hours of collection. If not, Sample Control is to ensure pH range of 5-9 (adjust if necessary)

ORGANIC ANALYSES - METHOD INDEX

PARAMETER/SAMPLE TYPE	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
SVOA - Water	625	ASP2000	5 Days VTSR	(2) 1 Liter Amber Glass/Cool to 4°C (10% $Na_2S_2O_3$ [1])
SVOA - Water	8270C	AFCEE	7 Days from Sample Date	(2) 1 Liter Amber Glass/Cool to 4°C (10% $Na_2S_2O_3$ [1])
SVOA - Soil	8270C	AFCEE	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
GC/MS VOLATILES				
VOA - Water	8260B	SW846, 3rd Edition	14 Days from Sample Date	(2-4) 40 ml Vials/HCl to pH<2, Cool to 4°C
VOA - Water	8260B	AFCEE	14 Days from Sample Date	(2) 40 ml Vials/HCl to pH<2, Cool to 4°C (10% $Na_2S_2O_3$ [1])
VOA - Soil	8260B	SW846, 3rd Edition	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
VOA - Soil	8260B	AFCEE	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
VOA - Water	624	40 CFR 136	14 Days from Sample Date	(2) 40 ml VOA Vials/HCl to pH<2, Cool to 4°C (10% $Na_2S_2O_3$ [1])
VOA - Water	524.2	EPA 500 Series	14 Days from Sample Date	(4) 40 ml VOA Vials/HCl to pH<2, Cool to 4°C (10% $Na_2S_2O_3$ [1])
VOA - Water	VOA	OLM04.2 OLM03.2 ASP2000	10 Days VTSR	(2) 40 ml VOA Vials/HCl to pH<2, Cool to 4°C (10% $Na_2S_2O_3$ [1])

[1] Addition of $Na_2S_2O_3$ in presence of Free (Total Residual) Chlorine only

[2] Sample Control to verify that extraction will be completed within 72 hours of collection. If not, Sample Control is to ensure pH range of 5-9 (adjust if necessary)

ORGANIC ANALYSES - METHOD INDEX

PARAMETER/SAMPLE TYPE	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
VOA - Soil	VOA	OLM04.2 OLM03.2 ASP2000	10 Days VTSR	(1) 4 oz. Glass/Cool to 4°C
VOA - Water	VOA Low Level	OLC02.1 (3/95) ASP2000	10 Days VTSR	(4) 40 ml VOA Vials/HCl to pH<2, Cool to 4°C (10% $Na_2S_2O_3$ [1])
VOA - Water	8260B	ASP2000	10 Days VTSR	(2-4) 40 ml Vials/HCl to pH<2, Cool to 4°C (10% $Na_2S_2O_3$ [1])
VOA - Soil	8260B	ASP2000	10 Days VTSR	(1) 4 oz. Glass/Cool to 4°C
VOA - Water	624	ASP2000	10 Days VTSR	(2) 40 ml VOA Vials/HCl to pH<2, Cool to 4°C (10% $Na_2S_2O_3$ [1])
GC EXTRACTABLES				
Organochlorine Pest - Water	8081A	SW846, 3rd Edition	7 Days from Sample Date	(2) Liter Amber Glass/Cool to 4°C
PCB – Water	8082	SW846, 3rd Edition	7 Days from Sample Date	(2) Liter Amber Glass/Cool to 4°C
Organochlorine Pest – Water	8081A	AFCEE	7 Days from Sample Date	(2) Liter Amber Glass/Cool to 4°C pH 5-9[2]
PCB - Water	8082	AFCEE	7 Days from Sample Date	(2) Liter Amber Glass/Cool to 4°C pH 5-9[2]
Organochlorine Pest - Soil	8081A	SW846, 3rd Edition	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
PCB – Soil	8082	SW846, 3rd Edition	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C

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[1] Addition of $Na_2S_2O_3$ in presence of Free (Total Residual) Chlorine only

[2] Sample Control to verify that extraction will be completed within 72 hours of collection. If not, Sample Control is to ensure pH range of 5-9 (adjust if necessary)

ORGANIC ANALYSES - METHOD INDEX

PARAMETER/SAMPLE TYPE	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Organochlorine Pest - Soil	8081A	AFCEE	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
PCB – Soil	8082	AFCEE	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Organophosphorous Pesticides - Water	8141A	SW846, 3rd Edition AFCEE	7 Days from Sample Date	(1) 1 Liter Amber Glass/Cool to 4°C pH 5-8[2]
Organophosphorous Pesticides - Soil	8141A	SW846, 3rd Edition AFCEE	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Chlorinated Herbicides - Water	8151	SW846, 3rd Edition	7 Days from Sample Date	(2) 1 Liter Amber Glass/Cool to 4°C
Chlorinated Herbicides - Water	8151	AFCEE	7 Days from Sample Date	(2) 1 Liter Amber Glass/Cool to 4°C pH 5-9[2]
Chlorinated Herbicides – Soil	8151	SW846, 3rd Edition	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Total Petroleum Hydrocarbons (DRO) - Water	8015B	SW846, 3rd Edition	7 Days from Sample Date	(1) 1 Liter Amber Glass/H_2SO_4 to pH<2/Cool to 4°C
Total Petroleum Hydrocarbons (DRO) – Soil	8015B	SW846, 3rd Edition	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Total Petroleum Hydrocarbons (DRO) – Water	8015 (Modified)	AFCEE	14 Days from Sample Date	(1) 1 Liter Amber Glass/Cool to 4°C
Total Petroleum Hydrocarbons (DRO) - Soil	8015 (Modified)	AFCEE	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Diesel Range Organics - Water (DRO by API)	8015 (Modified)	API	14 Days from Sample Date	(1) 1 Liter Amber Glass/Cool to 4°C

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[1] Addition of $Na_2S_2O_3$ in presence of Free (Total Residual) Chlorine only

[2] Sample Control to verify that extraction will be completed within 72 hours of collection. If not, Sample Control is to ensure pH range of 5-9 (adjust if necessary)

ORGANIC ANALYSES - METHOD INDEX

PARAMETER/SAMPLE TYPE	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Diesel Range Organics - Soil (DRO by API)	8015 (Modified)	API	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Organochlorine Pest/PCB - Water	608	40 CFR 136	7 Days from Sample Date	(1) 1 Liter Amber Glass/Cool to 4°C[2]
Chlorinated Pesticides - Water	508	EPA 500 Series	7 Days from Sample Date	(1) 1 Liter Amber Glass/ 80 mg Sodium Thiosulfate (if Residual Chlorine present) then 1 ml of 10 mg/ml Mercuric Acid. Cool to 4°C
Organochlorine Pest/PCB - Water	P/PCB	OLM04.2 OLM03.2 ASP2000	5 Days VTSR	(2) 1 Liter Amber Glass/Cool to 4°C
Organochlorine Pest/PCB - Soil	P/PCB	OLM04.2 OLM03.2 ASP2000	10 Days VTSR	(1) 4 oz. Glass/Cool to 4°C
Organochlorine Pest/PCB - Water	P/PCB Low Level	OLC02.1 (3/95) ASP2000	5 Days VTSR	(2) 1 Liter Amber Glass/Cool to 4°C
Organochlorine Pest - Water	8081A	ASP2000	5 Days VTSR	(2) 1 Liter Amber Glass/Cool to 4°C
PCB - Water	8082	ASP2000	5 Days VTSR	(2) 1 Liter Amber Glass/Cool to 4°C
Organochlorine Pest - Soil	8081A	ASP2000	10 Days VTSR	(1) 4 oz. Glass/Cool to 4°C
PCB – Soil	8082	ASP2000	10 Days VTSR	(1) 4 oz. Glass/Cool to 4°C

[1] Addition of $Na_2S_2O_3$ in presence of Free (Total Residual) Chlorine only

[2] Sample Control to verify that extraction will be completed within 72 hours of collection. If not, Sample Control is to ensure pH range of 5-9 (adjust if necessary)

ORGANIC ANALYSES - METHOD INDEX

PARAMETER/SAMPLE TYPE	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Organochlorine Pest/PCB - Water	608	ASP2000	5 Days VTSR	(1) 1 Liter Amber Glass/Cool to 4°C
Petroleum Products - Water	310-13	NYSDOH	7 Days from Sample Date	(1) 1 Liter Amber Glass/Cool to 4°C
Petroleum Products - Soil	310-13	NYSDOH	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Petroleum Products; Fingerprinting - Water	310-14	NYSDOH	7 Days from Sample Date	(1) 1 Liter Amber Glass/Cool to 4°C
Petroleum Products; Fingerprinting - Soil	310-14	NYSDOH	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
PCBs Transformer Fluids & Waste Oil - Oil	600481045	EPA 600 Series	14 Days from Sample Date	(1) 4 oz. Widemouth Glass/Cool to 4°C
GC VOLATILES				
Non-Halogenated Volatile Organics (Direct injection) - Water	8015B	SW846, 3rd Edition	14 Days from Sample Date	(2) 40 ml VOA Vials/Cool to 4°C
Non-Halogenated Volatile Organics - Soil	8015B	SW846, 3rd Edition	14 Days from Sample Date	(1) 4 oz. Widemouth Glass/Cool to 4°C
Aromatic Volatiles - Water	8021B	SW846, 3rd Edition AFCEE	14 Days from Sample Date	(2) 40 ml VOA Vials/HCl to pH<2, Cool to 4°C (10% $Na_2S_2O_3$ [1])
Halogenated Volatiles - Water	8021B	SW846, 3rd Edition AFCEE	14 Days from Sample Date	(2) 40 ml VOA Vials/HCl to pH<2, Cool to 4°C (10% $Na_2S_2O_3$ [1])
Aromatic Volatiles - Soil	8021B	SW846, 3rd Edition AFCEE	14 Days from Sample Date	(2) 4 oz. Widemouth Glass/Cool to 4°C

[1] Addition of $Na_2S_2O_3$ in presence of Free (Total Residual) Chlorine only

[2] Sample Control to verify that extraction will be completed within 72 hours of collection. If not, Sample Control is to ensure pH range of 5-9 (adjust if necessary)

ORGANIC ANALYSES - METHOD INDEX

PARAMETER/SAMPLE TYPE	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Gasoline Range Organics Total Petroleum Hydrocarbons – Water	8015B	SW846, 3rd Edition	14 Days from Sample Date	(2) 40 ml VOA Vials/HCl to pH<2, Cool to 4°C
Gasoline Range Organics Total Petroleum Hydrocarbons – Soil	8015B	SW846, 3rd Edition	14 Days from Sample Date	(1) 4 oz. Widemouth Glass/Cool to 4°C
Gasoline Range Organics - Water	8015 (Modified)	AFCEE	14 Days from Sample Date	(2) 40 ml VOA vials/HCL to pH<2
Gasoline Range Organics - Soil	8015 (Modified)	AFCEE	14 Days from Sample Date	(1) 4 oz. Widemouth Glass/Cool to 4°C
Gasoline Range Organics - Water (GRO by API)	8015 (Modified)	API	14 Days from Sample Date	(2) 40 ml VOA vials/HCL to pH<2
Gasoline Range Organics - Soil (GRO by API)	8015 (Modified)	API	14 Days from Sample Date	(1) 4 oz. Widemouth Glass/Cool to 4°C
Purgeable Halocarbons – Water	601	40 CFR 136	14 Days from Sample Date	(2) 40 ml VOA Vials/HCl to pH<2, Cool to 4°C (10% $Na_2S_2O_3$ [1])
Purgeable Aromatics – Water	602	40 CFR 136	14 Days from Sample Date	(2) 40 ml VOA Vials/HCl to pH<2, Cool to 4°C (10% $Na_2S_2O_3$ [1])
Purgeable Volatiles - Water	502.2	EPA 500 Series	14 Days from Sample Date	(2) 40 ml VOA Vials/HCl to pH<2, Cool to 4°C (10% $Na_2S_2O_3$ [1])
Microextractables - Water (1,2 DBE & 1,2 DB-3-CP)	504	EPA 500 Series	28 Days from Sample Date	(2) 40 ml VOA Vials/ 3 mg Sodium Thiosulfate (if Residual Chlorine is present) HCl to pH<2, Cool to 4°C

[1] Addition of $Na_2S_2O_3$ in presence of Free (Total Residual) Chlorine only

[2] Sample Control to verify that extraction will be completed within 72 hours of collection. If not, Sample Control is to ensure pH range of 5-9 (adjust if necessary)

ORGANIC ANALYSES - METHOD INDEX

PARAMETER/SAMPLE TYPE	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Aromatic & Halogenated Volatiles – Water	8021B	ASP2000	10 Days VTSR	(2) 40 ml VOA Vials/HCl to pH<2, Cool to 4°C (10% $Na_2S_2O_3$ [1])
Aromatic & Halogenated Volatiles - Soil	8021B	ASP2000	10 Days VTSR	(1) 4 oz. Widemouth Glass/Cool to 4°C
Purgeable Halocarbons - Water	601	ASP2000	10 Days VTSR	(2) 40 ml VOA Vials/HCl to pH<2, Cool to 4°C
Purgeable Aromatics - Water	602	ASP2000	10 Days VTSR	(1) 4 oz. Widemouth Glass/Cool to 4°C
Separatory Funnel Liquid-Liquid Extraction - Water	3510C	SW846, 3rd Edition ASP2000	N/A	N/A
Continuous Liquid-Liquid Extraction - Water	3520C	SW846, 3rd Edition ASP2000	N/A	N/A
Ultrasonic Extraction - Soil	3550B	SW846, 3rd Edition ASP2000	N/A	N/A
Waste Dilution - Waste	3580A	SW846, 3rd Edition ASP2000	N/A	N/A
Florisil Column Cleanup (Micro) Water & Soil	3620A/B	SW846, 3rd Edition ASP 2000	N/A	N/A
Gel Permeation Cleanup - Soil	3640A	SW846, 3rd Edition ASP2000	N/A	N/A
Sulfur Cleanup - Water & Soil	3660B	SW846, 3rd Edition ASP2000	N/A	N/A

[1] Addition of $Na_2S_2O_3$ in presence of Free (Total Residual) Chlorine only

[2] Sample Control to verify that extraction will be completed within 72 hours of collection. If not, Sample Control is to ensure pH range of 5-9 (adjust if necessary)

ORGANIC ANALYSES - METHOD INDEX

PARAMETER/SAMPLE TYPE	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Purge and Trap - Water & Soil	5030A/B	SW846, 3rd Edition ASP2000	N/A	N/A
Closed System Purge and Trap - Water	5035	SW846, 3rd Edition ASP2000	Extrude and freeze within 48 hours; analyze within 12 days of sampling	Low: (2) 40 ml tared vials containing 1 g Sodium bisulfate, 5 ml H_2O and stir rod High: (2) 40 ml tared vials with 10 ml Methanol Or (3) EnCore sample devices and (1) 4 oz. glass widemouth

* Please note: For environmental analyses\water, SPDES, according to New York State ELAP, Purgeable Aromatics (Methods 602 & 624) can be non-preserved with a holding time of 7 days from sample date. This only applies to New York State water samples – SPDES. For environmental analyses/water – NPDES, according to USEPA Region I, Purgeable Aromatics (Methods 602 and 624) can be run preserved with a holding time of 7 days from sample date. This only applies to EPA Region I – NPDES. It is recommended by STL that all VOA samples be preserved in the field according to the proper techniques as specified by the particular method.

[1] Addition of $Na_2S_2O_3$ in presence of Free (Total Residual) Chlorine only

[2] Sample Control to verify that extraction will be completed within 72 hours of collection. If not, Sample Control is to ensure pH range of 5-9 (adjust if necessary)

WET CHEMISTRY ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Acidity, Titrimetric - Water	305.1	40 CFR 136	14 Days from Sample date	(1) 4 oz. Plastic with zero headspace/ Cool to 4°C
Acidity, Titrimetric - Water	305.1	ASP2000	12 Days VTSR	(1) 4 oz. Plastic with zero headspace/ Cool to 4°C
Alkalinity, Total (Titrimetric) - Water	310.1	40CFR136 AFCEE	14 Days from Sample Date	(1) 4 oz. Plastic with zero headspace/ Cool to 4°C
	403	SM 18th Edition		
Alkalinity, Total (Titrimetric) – Water	310.1	ASP2000	12 Days VTSR	(1) 4 oz. Plastic with zero headspace/ Cool to 4°C
Alkalinity, Total (Automated)	310.2	40CFR136 AFCEE	14 days from Sample Date	(1) 4 oz. Plastic with zero headspace/ Cool to 4°C
		ASP2000	12 days VTSR	
Alkalinity, Bicarbonate - Water	403	SM 18th Edition	14 Days from Sample Date	(1) 4 oz. Plastic with zero headspace/ Cool to 4°C
	310.1	40CFR		
Alkalinity, Carbonate - Water	403	SM 18th Edition	14 Days from Sample Date	(1) 4 oz. Plastic with zero headspace/ Cool to 4°C
	310.1	40CFR		

WET CHEMISTRY ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Ash Content - Water	D-482-80	ASTM	N/A	(1) 4 oz. Plastic/Cool to 4°C
Ash Content - Soil	D-482-80	ASTM	N/A	(1) 4 oz. Glass Widemouth/Cool to 4°C
Biochemical Oxygen Demand (BOD 5) - Water	405.1	40 CFR 136	48 Hours from Sample Date	(1) 16 oz. Plastic/Cool to 4°C
Biochemical Oxygen Demand (BOD 5) - Water	405.1	ASP2000	24 Hours VTSR	(1) 16 oz. Plastic/Cool to 4°C
Carbonaceous Biochemical Oxygen Demand - Water	405.1	40 CFR 136	48 Hours from Sample Date	(1) 16 oz. Plastic/Cool to 4°C
Carbonaceous Biochemical Oxygen Demand - Water	405.1	ASP2000	24 Hours VTSR	(1) 16 oz. Plastic/Cool to 4°C
Bromide (IC) - Water	300.0	40CFR	28 days from Sample Date	(1) 4 oz. Plastic/Cool to 4°C
		ASP2000	26 days VTSR	
Bromide (Titrimetric) - Water	320.1	40 CFR 136	28 Days from Sample Date	(1) 16 oz. Plastic/Cool to 4°C
Bromide (Titrimetric) - Water	320.1	ASP2000	26 Days VTSR	(1) 16 oz. Plastic/Cool to 4°C
Chemical Oxygen Demand - COD	410.4	40 CFR 136	28 Days from Sample Date	(1) 4 oz. Plastic/Sulfuric Acid to pH<2, Cool to 4°C
Chemical Oxygen Demand - COD	410.4	ASP2000	26 Days VTSR	(1) 4 oz. Plastic/Sulfuric Acid to pH<2, Cool to 4°C
Chloride (Colorimetric, Ferri-cyanide AAII Automated) - Water	300.0	40 CFR 136	28 Days from Sample Date	(1) 4 oz. Plastic/Cool to 4°C
	325.2			
	9251	SW846, 3rd Edition		

WET CHEMISTRY ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Chlorine, Total Residual - Water	330.4	40 CFR 136	24 Hrs. from Sample Date	(1) 8 oz. Plastic/Cool to 4°C
Chlorine Demand - Water	2350B	Standard Methods, 18th Edition	14 days from Sample Date	(1) 8 oz. Plastic/Cool to 4°C
Chlorine, Total Organic - Water	D-808-81	ASTM	N/A	(1) 4 oz. Plastic/Cool to 4°C
Chlorine, Total Organic - Soil	D-808-81	ASTM	N/A	(1) 4 oz. Widemouth Glass/ Cool to 4°C
Chlorine, Percent - Water	D-1253-87	ASTM	N/A	(1) 4 oz. Plastic/Cool to 4°C
Chlorine, Percent - Soil	D-1253-87	ASTM	N/A	(1) 4 oz. Widemouth Glass/Cool to 4°C
Color (Colorimetric, Platinum, Cobalt) - Water	110.2	40 CFR 136	48 Hours from Sample Date	(1) 8 oz. Widemouth Glass/Cool to 4°C
Color (Colorimetric, Platinum, Cobalt) - Water	110.2	ASP2000	24 Hours VTSR	(1) 8 oz. Widemouth Glass/Cool to 4°C
Combustion, Heat of (Bomb) - Water	D-240-76	ASTM	N/A	(1) 4 oz. Plastic
Combustion, Heat of (Bomb) - Soil	D-240-76	ASTM	N/A	(1) 4 oz. Glass
Conductance, Specific (25°C) - Water	120.1	CFR 136	28 Days from Sample Date	(1) 4 oz. Plastic/Cool to 4°C
	9050A	SW846, 3rd Edition		
Conductance, Specific (25°C) - Water	120.1	ASP2000	26 Days VTSR	(1) 4 oz. Plastic/Cool to 4°C
	9050A			
Conductance	9050A	AFCEE	Analyze Immediately	(1) 4 oz. Plastic

WET CHEMISTRY ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Cyanide, Amenable - Water	335.1	40 CFR 136	14 Days from Sample Date	(1) 16 oz. Plastic/Sodium Hydroxide to pH>12, Cool to 4°C
	9010B 9012A	SW846, 3rd Edition/AFCEE		
Cyanide, Amenable - Water	335.1	ASP2000	12 Days VTSR	(1) 16 oz. Plastic/Sodium Hydroxide to pH>12, Cool to 4°C
	9010B 9012A			
Cyanide, Total - Water	335.2 335.4	40 CFR 136	14 Days from Sample Date	(1) 16 oz. Plastic/Sodium Hydroxide to pH>12, Cool to 4°C
	9010B 9012A	SW846, 3rd Edition/AFCEE		
Cyanide, Total - Water	CLP-WC	ASP2000 ILM04.1/5.2	12 Days VTSR	(1) 16 oz. Plastic/Sodium Hydroxide to pH>12, Cool to 4°C
	335.2			
	335.4			
	9010B/9012A			
Cyanide, Total - Soil	9010B 9012A	SW846, 3rd Edition AFCEE	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Cyanide, Total - Soil	CLP-WC	ASP2000	12 Days VTSR	(1) 4 oz. Glass/Cool to 4°C
		ILM04.1/5.2		
Density – Water	D-1298-80	ASTM	N/A	(1) 4 oz. Plastic

WET CHEMISTRY ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Dissolved Oxygen - Water	360.1	40 CFR 136	Immediate	(1) 4 oz. Plastic/Cool to 4°C
Dissolved Oxygen	360.1	AFCEE	Analyze immediately	N/A
Dry Weight – Soil	D2216-19	ASTM	N/A	(1) 4 oz. Glass
EP Toxicity Extraction Procedure (Pesticides, Herbicides & Metals) - Soil	1310	SW846, 3rd Edition	14 Days from Sample Date	(1) 16 oz. Glass/Cool to 4°C
Ferrous Iron - Water	3500D	SM18	24 Hours from Sample Date	(1) 8 oz. Plastic/Cool to 4°C
Flashpoint - Water	1010	SW846, 3rd Edition	N/A	(1) 4 oz. Glass
		ASP2000		
Flashpoint - Soil	1010 1030	SW846, 3rd Edition	N/A	(1) 4 oz. Glass
		ASP2000		
Fluoride - Water	300.0 340.2	40 CFR 136	28 Days from Sample Date	(1) 4 oz. Plastic/Cool to 4°C
Fluoride - Water	300.0 340.2	ASP2000	26 Days VTSR	(1) 4 oz. Plastic/Cool to 4°C
Gravity, Specific - Water	D-1429-87	ASTM	N/A	(1) 4 oz. Plastic
Hardness, Total as $CaCO_3$ - Water	130.2	40 CFR 136	6 Mos. from Sample Date	(1) 4 oz. Plastic/Nitric Acid to pH<2
		ASP2000		
Methylene Blue Active Substances - Surfactants (Colorimetric) - Water	425.1	40CFR136	48 Hours from Sample Date	(1) 16 oz. Plastic/Cool to 4°C

WET CHEMISTRY ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Methylene Blue Active Substances (Colorimetric) - Water	425.1	ASP2000	24 Hours VTSR	(1) 16 oz. Plastic/Cool to 4°C
Moisture Content, Total - Soil	D2216-90	ASTM	N/A	(1) 4 oz. Glass
Nitrate – Water <u>or</u> Nitrite - Water	300.0	40 CFR 136	48 Hrs. from Sample Date	(1) 4 oz. Plastic/Cool to 4°C
	353.2			
Nitrate - Water <u>or</u> Nitrite - Water	300.0	ASP2000	24 Hours VTSR	(1) 4 oz. Plastic/Cool to 4°C
	353.2			
Nitrate-Nitrite - Water	353.2	40 CFR 136	28 Days from Sample Date	(1) 4 oz. Plastic/Sulfuric Acid to pH<2, Cool to 4°C
Nitrate-Nitrite - Water	353.2	ASP2000	26 Days VTSR	(1) 4 oz. Plastic/Sulfuric Acid to pH<2, Cool to 4°C
Nitrogen-Nitrate Nitrite	353.2	AFCEE	28 Days from Sample Date	(1) 4 oz. Plastic/Sulfuric Acid to pH<2, Cool to 4°C
Nitrogen, Ammonia - Water	350.1	40 CFR 136	28 Days from Sample Date	(1) 4 oz. Plastic/Sulfuric Acid to pH<2, Cool to 4°C
Nitrogen, Ammonia - Water	350.1	ASP2000	26 Days VTSR	(1) 4 oz. Plastic/Sulfuric Acid to pH<2, Cool to 4°C
Nitrogen, Total Kjeldahl - Water	351.2	40 CFR 136	28 Days from Sample Date	(1) 4 oz. Plastic/Sulfuric Acid to pH<2, Cool to 4°C
Nitrogen, Total Kjeldahl - Water	351.2	ASP2000	26 Days VTSR	(1) 4 oz. Plastic/Sulfuric Acid to pH<2, Cool to 4°C

WET CHEMISTRY ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Odor - Water	140.1	40 CFR 136 ASP2000	24 Hrs. from Sample Date	(1) 16 oz. Glass/Cool to 4°C
Oil and Grease, Total Recoverable - Water	413.1 1664A (HEM)	40 CFR 136	28 Days from Sample Date	(1) 1 Liter Glass/Sulfuric Acid to pH<2, Cool to 4°C
Oil and Grease, Total Recoverable - Water	413.1 1664A (HEM)	ASP2000	26 Days VTSR	(1) 1 Liter Glass/Sulfuric Acid to pH<2, Cool to 4°C
Oil and Grease, Total Recoverable - Water	(9070) 1664A (HEM)	SW846, 3rd Edition	28 Days from Sample Date	(1) 1 Liter Glass/Sulfuric Acid to pH<2, Cool to 4°C
Oil and Grease, Total Recoverable - Water	(9070) 1664A (HEM)	ASP2000	26 Days VTSR	(1) 1 Liter Glass/Sulfuric Acid to pH<2, Cool to 4°C
Oil and Grease, Total Recoverable - Soil	9071/9070	SW846, 3rd Edition	28 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Oil and Grease, Total Recoverable – Soil	9071/9070	ASP2000	26 Days VTSR	(1) 4 oz. Glass/Cool to 4°C
Organic Carbon, Total - Water	415.1	40 CFR 136	28 Days from Sample Date	(2) 40 ml Vial/HCL to pH<2, Cool to 4°C
	9060	SW846, 3rd Edition/AFCEE		
Organic Carbon, Total - Water	415.1 9060	ASP2000	26 Days VTSR	(2) 40 ml Vial/HCL to pH<2, Cool to 4°C

WET CHEMISTRY ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Organic Nitrogen, Total - Water	TKN-NH_3 351.2–350.1	40 CFR 136	28 Days from Sample Date	(1) 8 oz. Plastic/Sulfuric Acid to pH<2, Cool to 4°C
Oxidizer Spot Test - Soil	Sect 7.1	SW846, 3rd Edition	N/A	(1) 4 oz. Glass
Paint Filter Test - Soil	9095A	SW846, 3rd Edition	N/A	(1) 4 oz. Glass
Petroleum Hydrocarbons, Total Recoverable - Water	418.1 1664A (SGT)	40 CFR 136	28 Days from Sample Date	(1) 1 Liter Glass/Sulfuric Acid to pH<2, Cool to 4°C
Petroleum Hydrocarbons, Total Recoverable - Water	418.1 1664A (SGT)	ASP2000	26 Days VTSR	(1) 1 Liter Glass/Sulfuric Acid to pH<2, Cool to 4°C
Petroleum Hydrocarbons, Total Recoverable - Soil	418.1	40 CFR 136	28 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Petroleum Hydrocarbons, Total Recoverable - Soil	418.1	ASP2000	26 Days VTSR	(1) 4 oz. Glass/Cool to 4°C
pH - Water	150.1	40 CFR 136	24 Hrs. from Sample Date	(1) 4 oz. Plastic/Cool to 4°C
	9040A/B	SW846, 3rd Edition		
pH - Water	150.1	ASP2000	24 Hours VTSR	(1) 4 oz. Plastic/Cool to 4°C
	9040B			
pH - Soil	9045C	SW846, 3rd Edition	14 Days from Sample Date	(1) 4 oz. Glass/Cool to 4°C
pH - Soil	9045C	ASP2000	14 Days VTSR	(1) 4 oz. Glass/Cool to 4°C
pH - Hydrogen Ion Water/Soil	9040B 9045C	AFCEE	Analyze immediately	N/A
Phenolics, Total Recoverable - Water	420.2	ASP2000	26 Days VTSR	(1) 4 oz. Glass Wide/Sulfuric Acid to pH<2, Cool to 4°C
	9066			

WET CHEMISTRY ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Phenolics, Total Recoverable - Water	420.2	40 CFR 136	26 Days VTSR	(1) 4 oz. Glass Wide/Sulfuric Acid to pH<2, Cool to 4°C
	9066	SW846, 3rd Edition		
Phosphate, Ortho - Water	365.2	40 CFR 136	48 Hours from Sample Time	(1) 4 oz. Glass/Sulfuric Acid to pH<2, Cool to 4°C
Phosphorus, Total - Water	365.2	40 CFR 136	28 Days from Sample Date	(1) 4 oz. Plastic/Sulfuric Acid to pH<2, Cool to 4°C
Phosphorus, Total - Water	365.2	ASP2000	26 Days VTSR	(1) 4 oz. Plastic/Sulfuric Acid to pH<2, Cool to 4°C
Reactivity, Hydrogen Cyanide Released from Waste - Water	Sect 7.3	SW846, 3rd Edition	N/A	(1) 4 oz. Plastic
Reactivity, Hydrogen Cyanide Released from Waste - Soil	Sect 7.3	SW846, 3rd Edition	N/A	(1) 4 oz. Glass
Reactivity, Hydrogen Sulfide Released from Waste - Water	Sect 7.3	SW846, 3rd Edition	N/A	(1) 4 oz. Plastic
Reactivity, Hydrogen Sulfide Released from Waste - Soil	Sect 7.3	SW846, 3rd Edition	N/A	(1) 4 oz. Glass
Redox Potential - Water	D-1498-76	ASTM	N/A	(1) 4 oz. Plastic
Residue, Filterable; TDS - Water	160.1	40 CFR 136/AFCEE	7 Days from Sample Date	(1) 16 oz. Plastic/Cool to 4°C
Residue, Filterable; TDS - Water	160.1	ASP2000	5 Days VTSR	(1) 16 oz. Plastic/Cool to 4°C
Residue, Non-Filterable; TSS - Water	160.2	40 CFR 136/AFCEE	7 Days from Sample Date	(1) 16 oz. Plastic/Cool to 4°C

WET CHEMISTRY ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Residue, Non-Filterable; TSS - Water	160.2	ASP2000	5 Days VTSR	(1) 16 oz. Plastic/Cool to 4°C
Residue, Settleable - Water	160.5	40 CFR 136	48 Hours from Sample Date	(1) 1 Liter Plastic/Cool to 4°C
Residue, Settleable - Water	160.5	ASP2000	24 Hours VTSR	(1) 1 Liter Plastic/Cool to 4°C
Residue, Total	160.3	40 CFR 136	7 Days from Sample Date	(1) 16 oz. Plastic/Cool to 4°C
Residue, Total (Gravimetric, 103-105°C)	160.3	ASP2000	5 Days VTSR	(1) 16 oz. Plastic/Cool to 4°C
Residue, Volatile - Water	160.4	40 CFR 136	7 Days from Sample Date	(1) 16 oz. Plastic/Cool to 4°C
Shake Extraction of Solid Waste with Water - Soil	D3987-85	ASTM	14 Days from Sample Date	(1) 16 oz. Glass/Cool to 4°C
Solids, Fixed - Soil	2540G	SM18	N/A	(1) 4 oz. Glass/Cool to 4°C
Solids, Total - Soil	2540G	SM18	N/A	(1) 4 oz. Glass/Cool to 4°C
Solids, Volatile - Soil	2540G	SM18	N/A	(1) 4 oz. Glass/Cool to 4°C
Sulfate - Water	375.4	40 CFR 136	28 Days from Sample Date	(1) 8 oz. Plastic/Cool to 4°C
	9038	SW846, 3rd Edition		
Sulfate - Water	375.4	ASP2000	26 Days VTSR	(1) 8 oz. Plastic/Cool to 4°C
	9038			
Sulfate - Water	300.0	40 CFR 136	28 Days from Sample Date	(1) 4 oz. Plastic/Cool to 4°C
		ASP2000	26 Days VTSR	

WET CHEMISTRY ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Sulfide - Water	376.2	40 CFR 136	7 Days from Sample Date	(1) 16 oz. Plastic/Sodium Hydroxide to pH>9, 20 drops of Zinc Acetate/ Cool to 4°C
Sulfide - Water	376.1	ASP2000	5 Days VTSR	(1) 16 oz. Plastic/Sodium Hydroxide to pH>9, 20 drops of Zinc Acetate/ Cool to 4°C
Sulfite - Water	377.1	40 CFR 136	24 Hours from Sample Date	(1) 4 oz. Plastic/Cool to 4°C
Sulfur, Percent - Water	D-4239-85	ASTM	N/A	(1) 4 oz. Plastic
Sulfur, Percent - Soil	D-4239-85	ASTM	N/A	(1) 4 oz. Glass
Synthetic Leaching Procedure - SPLP (VOA) - Water	1312	SW846, 3rd Edition	14 Days from Sample Date	(4) 40 ml VOA Vials/Cool to 4°C
Synthetic Leaching Procedure - SPLP (SVOA, Pest, Herb, Metals) - Water	1312	SW846, 3rd Edition	Org = 14 Days from Sample Date Metals = 180 Days from Sample Date Mercury = 28 Days from Sample Date	(5) 1 Liter Amber Glass/Cool to 4°C
Synthetic Leaching Procedure - SPLP (VOA) - Soil	1312	SW846, 3rd Edition	14 Days from Sample Date	(2) 4 oz. Glass/Cool to 4°C
Synthetic Leaching Procedure – SPLP (SVOA, Pest, Herb, Metals) – Soil	1312	SW846, 3rd Edition	Org = 14 Days from Sample Date Metals = 180 Days from Sample Date Mercury = 28 Days from Sample Date	(1) 32 oz. Glass/Cool to 4°C

WET CHEMISTRY ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
TCLP Extraction Procedure (VOA, SVOA, Pest, Herb, Metals) - Water	1311	SW846, 3rd Edition	Org = 14 Days from Sample Date Metals = 180 Days from Sample Date Mercury = 28 Days from Sample Date	(4) 40 ml VOA Vials & (5) 1 Liter Amber Glass/Cool to 4°C
TCLP Extraction Procedure (VOA) - Water	1311	ASP2000	7 Days VTSR	(2) 40 ml VOA Vials/Cool to 4°C
TCLP Extraction Procedure (SVOA, Pest, Herb, Metals) - Water	1311	ASP2000	Org = 5 Days VTSR Metals = 180 Days VTSR Mercury = 26 Days VTSR	(5) 1 Liter Amber Glass/Cool to 4°C
TCLP Extraction Procedure (VOA, SVOA, Pest, Herb, Metals) - Soil	1311	SW846, 3rd Edition	Org = 14 Days from Sample Date Metals = 180 Days from Sample Date Mercury = 28 Days from Sample Date	(1) 32 oz. Glass & (2) 4 oz. Glass/Cool to 4°C
TCLP Extraction Procedure (VOA) - Soil	1311	ASP2000	7 Days VTSR	(2) 4 oz. Glass/Cool to 4°C
TCLP Extraction Procedure (SVOA, Pest, Herb, Metals) - Soil	1311	ASP2000	Org = 5 Days VTSR Metals = 180 Days VTSR Mercury = 26 Days VTSR	(1) 32 oz. Glass/Cool to 4°C
Turbidity - Water	180.1	40 CFR 136/AFCEE	48 Hours from Sample Date	(1) 8 oz. Plastic/Cool to 4°C
Turbidity (Nephelometric) – Water	180.1	ASP2000	24 Hours VTSR	(1) 8 oz. Plastic/Cool to 4°C

WET CHEMISTRY ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION
Temperature	170.1	40 CFR 136 AFCEE	Analyze Immediately	N/A
Viscosity - Water	D2983-25	ASTM	N/A	(1) 4 oz. Glass

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PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Aluminum, Total - Water	200.7 200.8	40 CFR 136	6 Mos. from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Aluminum, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Aluminum, Soluble - Water	200.7 200.8	40 CFR 136	6 Mos. from Sample Date	(1) 8 oz. Plastic/Filter on Site with .45um membrane, Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Aluminum, Soluble - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Filter with .45um membrane, Nitric to pH<2
		ILMO4.1/5.2		
Aluminum, Total - Soil	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Aluminum, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		

* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

METALS ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Antimony, Total - Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Antimony, Total - Water (GFAA)	204.2	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	7041	SW846, 3rd Edition AFCEE		
Antimony, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Antimony, Soluble - Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Filter with .45um membrane, Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Antimony, Soluble - Water (GFAA)	204.2	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Filter with .45um membrane, Nitric to pH<2
	7041	SW846, 3rd Edition AFCEE		
Antimony, Soluble - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Filter with .45um membrane, Nitric to pH<2
		ILMO4.1/5.2		
Antimony, Total - Soil	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C

* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

METALS ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Antimony, Total - Soil (GFAA)	7041	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Arsenic, Total - Water (ICP)	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Arsenic, Total - Water (GFAA)	206.2	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	7060/A	SW846, 3rd Edition AFCEE		
Arsenic, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Arsenic, Total - Soil (ICP)	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Arsenic, Total - Soil (GFAA)	7060/A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Arsenic, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Barium, Total - Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		

* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

METALS ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Barium, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Barium, Total - Soil (ICP)	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Barium, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Beryllium, Total - Water)	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Beryllium, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Beryllium, Total - Soil	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Beryllium, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Boron, Total - Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		

* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

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PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Boron, Total - Soil	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Cadmium, Total - Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Cadmium, Total - Water	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Cadmium, Total - Soil	6010B 6020A	SW846, 3rd Edition/AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Cadmium, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Calcium, Total - Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Calcium, Total - Water	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Calcium, Total - Soil	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C

* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

METALS ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Calcium, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Chromium, Total - Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Chromium, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Chromium, Total - Soil	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Chromium, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Chromium, Hexavalent - Water	7196A	SW846, 3rd Edition AFCEE	24 Hours from Sample Date	(1) 4 oz. Plastic/Cool to 4°C
Chromium, Hexavalent - Soil	3060A/ 7196A	SW846, 3rd Edition AFCEE	30 Days Extraction/ 7 Days Analysis	(1) 4 oz. Glass/Cool to 4°C
Cobalt, Total - Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Cool to 4°C
	6010B 6020A	SW846, 3rd Edition AFCEE		

* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

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PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Cobalt, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Cobalt, Total - Soil	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Cobalt, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Copper, Total - Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Copper, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Copper, Total - Soil	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Copper, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Iron, Total - Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		

* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

METALS ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Iron, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Iron, Total - Soil	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
	6010B 6020A	SW846, 3rd Edition AFCEE		
Iron, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Nitric to pH<2
		ILMO4.1/5.2		
Lead, Total - Water (ICP)	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Lead, Total - Water (GFAA)	239.2	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	7421	SW846, 3rd Edition AFCEE		
Lead, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Lead, Total - Soil	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Lead, Total - Soil (GFAA)	7421	SW846, 3rd Edition AFCEE	6 Months form Sample Date	(1) 4 oz. Glass/Cool to 4°C

* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

METALS ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Lead, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Lithium, Total - Water	200.7	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B	SW846, 3rd Edition AFCEE		
Lithium, Total - Soil	200.7	40 CFR 136	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
	6010B	SW846, 3rd Edition AFCEE		
Magnesium, Total - Water	200.7	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B	SW846, 3rd Edition AFCEE		
Magnesium, Total - Water (CLP)	CLP-M	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Magnesium, Total - Soil	6010B	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Magnesium, Total - Soil (CLP)	CLP-M	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Manganese, Total - Water (ICP)	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		

* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

METALS ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Manganese, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Manganese, Total - Soil	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Manganese, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Mercury, Total - Water (CV)	245.2	40 CFR 136	28 Days from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	7470A	SW846, 3rd Edition AFCEE		
Mercury, Total - Water (CLP)	CLP-M	ASP2000	26 Days from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Mercury, Total - Soil (CV)	7471A	SW846, 3rd Edition AFCEE	28 Days from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
Mercury, Total - Soil (CLP)	CLP-M	ASP2000	26 Days from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Molybdenum, Total - Water	200.7 200.8 246.1	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A 7480	SW846, 3rd Edition AFCEE		

* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

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PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Molybdenum, Total – Soil	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Nickel, Total - Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Nickel, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Nickel, Total - Soil (ICP)	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Nickel, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Potassium, Total - Water	200.7	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B	SW846, 3rd Edition AFCEE		
Potassium, Total - Water (CLP)	CLP-M	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH<2
		ILMO4.1/5.2		
Potassium, Total – Soil	6010B	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C

* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

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PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Potassium, Total - Soil (CLP)	CLP-M	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Selenium, Total - Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Selenium, Total - Water (GFAA)	270.2	40CFR136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH <2
	7740	SW846, 3rd Edition AFCEE		
Selenium, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Selenium, Total – Soil	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool 4°C
Selenium, Total – Soil (GFAA)	7740	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool 4°C
Selenium, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Silver, Total - Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH <2
	6010B 6020A	SW846, 3rd Edition AFCEE		

* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

METALS ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Silver, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH <2
		ILMO4.1/5.2		
Silver, Total - Soil	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Silver, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Sodium, Total - Water (ICP)	200.7	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH <2
	6010B	SW846, 3rd Edition AFCEE		
Sodium, Total - Water (CLP)	CLP-M	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH <2
		ILMO4.1/5.2		
Sodium, Total - Soil	6010B	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Sodium, Total - Soil (CLP)	CLP-M	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Strontium, Total – Water	200.7 6010B	40 CFR 136 SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Plastic/Nitric to pH <2

* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

METALS ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Strontium, Total - Soil	200.7 6010B	40 CFR 136 SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz Glass/Cool to 4°C
Thallium, Total – Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH<2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Thallium, Total – Water (GFAA)	279.2	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH <2
	7841	SW846, 3rd Edition AFCEE		
Thallium, Total – Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH <2
		ILMO4.1/5.2		
Thallium, Total - Soil (ICP)	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Thallium, Total - Soil (GFAA)	7841	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(4 oz. Glass/Cool to 4°C
Thallium, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Tin, Total - Water	200.7	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH <2
	6010B	SW846, 3rd Edition AFCEE		

* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

METALS ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Tin, Total – Soil	6010B	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. glass/Cool to 4°C
Titanium, Total – Water	200.7 6010B	40 CFR 136 SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH 2
Vanadium, Total - Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic/Nitric to pH <2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Vanadium, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH <2
		ILMO4.1/5.2		
Vanadium, Total - Soil	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Vanadium, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		
Zinc, Total - Water	200.7 200.8	40 CFR 136	6 Months from Sample Date	(1) 8 oz. Plastic Nitric to pH <2
	6010B 6020A	SW846, 3rd Edition AFCEE		
Zinc, Total - Water (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 8 oz. Plastic/Nitric to pH <2
		ILMO4.1/5.2		

* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

METALS ANALYSES - METHOD INDEX

PARAMETER/ SAMPLE TYPE/SOP #	METHOD	PROTOCOL	HOLDING TIME	CONTAINER & PRESERVATION*
Zinc, Total - Soil	6010B 6020A	SW846, 3rd Edition AFCEE	6 Months from Sample Date	(1) 4 oz. Glass/Cool to 4°C
Zinc, Total - Soil (CLP)	CLP-M CLP-MS	ASP2000	6 Mos. from Sample Receipt	(1) 4 oz. Glass/Cool to 4°C
		ILMO4.1/5.2		

ICP = Inductively Coupled Argon Plasma Emission Spectrometer
GFAA = Graphite Furnace Atomic Absorption

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* Minimum volume of 16 oz. when multiple methods/multiple analysts required for water samples.

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WADSWORTH CENTER
Antonia C. Novello, M.D., M.P.H., Dr.P.H.

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Issued April 01, 2004
Revised October 14, 2004

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. CHRISTOPHER OPRANDI
STL BUFFALO
10 HAZELWOOD DRIVE SUITE 106
AMHERST NY 14228 United States

NY Lab Id No: 10026
EPA Lab Code: NY00044

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER
All approved analytes are listed below:

Acrolein and Acrylonitrile

Acrolein	EPA 624
	SW-846 8260B
Acrylonitrile	EPA 624
	SW-846 8260B

Benzidines

3,3 -Dichlorobenzidine	EPA 625
	SW-846 8270C
Benzidine	EPA 625
	SW-846 8270C

Chlorinated Hydrocarbon Pesticides

4,4 -DDE	EPA 608
	SW-846 8081A
4,4 -DDT	EPA 608
	SW-846 8081A
4,4-DDD	EPA 608
	SW-846 8081A
Aldrin	EPA 608
	SW-846 8081A
	SW-846 8270C
alpha-BHC	EPA 608
	SW-846 8081A
beta-BHC	EPA 608

Chlorinated Hydrocarbon Pesticides

beta-BHC	SW-846 8081A
Chlordane Total	EPA 608
	SW-846 8081A
delta-BHC	EPA 608
	SW-846 8081A
Dieldrin	EPA 608
	SW-846 8081A
Endosulfan I	EPA 608
	SW-846 8081A
Endosulfan II	EPA 608
	SW-846 8081A
Endosulfan sulfate	EPA 608
	SW-846 8081A
Endrin	EPA 608
	SW-846 8081A
Endrin aldehyde	EPA 608
	SW-846 8081A
Heptachlor	EPA 608
	SW-846 8081A
Heptachlor epoxide	EPA 608
	SW-846 8081A
Lindane	EPA 608
	SW-846 8081A

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Chlorinated Hydrocarbon Pesticides

Methoxychlor	EPA 608
	SW-846 8081A
Mirex	SM 18-20 6630C
Toxaphene	EPA 608
	SW-846 8081A

Chlorinated Hydrocarbons

1,2,4-Trichlorobenzene	EPA 625
	SW-846 8270C
2-Chloronaphthalene	EPA 625
	SW-846 8270C
Hexachlorobenzene	EPA 625
	SW-846 8081A
	SW-846 8270C
Hexachlorobutadiene	EPA 625
	SW-846 8021B
	SW-846 8260B
	SW-846 8270C
Hexachlorocyclopentadiene	EPA 625
	SW-846 8270C
Hexachloroethane	EPA 625
	SW-846 8270C

Chlorophenoxy Acid Pesticides

2,4,5-T	EPA 1978, p.115
	SW-846 8151A
2,4,5-TP (Silvex)	EPA 1978, p.115
	SW-846 8151A
2,4-D	EPA 1978, p.115
	SW-846 8151A
Dicamba	EPA 1978, p.115
	SW-846 8151A

Demand

Biochemical Oxygen Demand	EPA 405.1
	SM 18-20 5210 B
Chemical Oxygen Demand	EPA 410.4
	HACH 8000

Haloethers

4-Bromophenylphenyl ether	EPA 625
	SW-846 8270C
4-Chlorophenylphenyl ether	EPA 625
	SW-846 8270C
Bis (2-chloroisopropyl) ether	EPA 625
	SW-846 8270C
Bis(2-chloroethoxy)methane	EPA 625
	SW-846 8270C

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Haloethers

Bis(2-chloroethyl)ether	EPA 625
	SW-846 8270C

Mineral

Acidity	EPA 305.1
Alkalinity	EPA 310.1
	EPA 310.2
Calcium Hardness	EPA 130.2
Chloride	EPA 300.0
	EPA 325.2
Fluoride, Total	EPA 300.0
	EPA 340.2
Hardness, Total	EPA 130.2
Sulfate (as SO4)	EPA 300.0
	EPA 375.4

Nitroaromatics and Isophorone

2,4-Dinitrotoluene	EPA 625
	SW-846 8270C
2,6-Dinitrotoluene	EPA 625
	SW-846 8270C
Isophorone	EPA 625
	SW-846 8270C
Nitrobenzene	EPA 625

Nitroaromatics and Isophorone

Nitrobenzene	SW-846 8270C

Nitrosoamines

N-Nitrosodimethylamine	EPA 625
	SW-846 8270C
N-Nitrosodi-n-propylamine	EPA 625
	SW-846 8270C
N-Nitrosodiphenylamine	EPA 625
	SW-846 8270C

Nutrient

Ammonia (as N)	EPA 350.1
Kjeldahl Nitrogen, Total	EPA 351.2
Nitrate (as N)	EPA 300.0
	EPA 353.2
	SM 18-20 4500-NO3 F
Nitrite (as N)	EPA 353.2
	SM 18-20 4500 NO2 B
Orthophosphate (as P)	EPA 365.2
Phosphorus, Total	EPA 365.2

Phthalate Esters

Benzyl butyl phthalate	EPA 625
	SW-846 8270C
Bis(2-ethylhexyl) phthalate	EPA 625

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Phthalate Esters	
Bis(2-ethylhexyl) phthalate	SW-846 8270C
Diethyl phthalate	EPA 625
	SW-846 8270C
Dimethyl phthalate	EPA 625
	SW-846 8270C
Di-n-butyl phthalate	EPA 625
	SW-846 8270C
Di-n-octyl phthalate	EPA 625
	SW-846 8270C
Polychlorinated Biphenyls	
PCB-1016	EPA 608
	SW-846 8082
PCB-1221	EPA 608
	SW-846 8082
PCB-1232	EPA 608
	SW-846 8082
PCB-1242	EPA 608
	SW-846 8082
PCB-1248	EPA 608
	SW-846 8082
PCB-1254	EPA 608
	SW-846 8082
PCB-1260	EPA 608

Polychlorinated Biphenyls	
PCB-1260	SW-846 8082
Polynuclear Aromatics	
Acenaphthene	EPA 625
	SW-846 8270C
Acenaphthylene	EPA 625
	SW-846 8270C
Anthracene	EPA 625
	SW-846 8270C
Benzo(a)anthracene	EPA 625
	SW-846 8270C
Benzo(a)pyrene	EPA 625
	SW-846 8270C
Benzo(b)fluoranthene	EPA 625
	SW-846 8270C
Benzo(ghi)perylene	EPA 625
	SW-846 8270C
Benzo(k)fluoranthene	EPA 625
	SW-846 8270C
Chrysene	EPA 625
	SW-846 8270C
Dibenzo(a,h)anthracene	EPA 625
	SW-846 8270C
Fluoranthene	EPA 625

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Polynuclear Aromatics

Fluoranthene	SW-846 8270C
Fluorene	EPA 625
	SW-846 8270C
Indeno(1,2,3-cd)pyrene	EPA 625
	SW-846 8270C
Naphthalene	EPA 625
	SW-846 8270C
Phenanthrene	EPA 625
	SW-846 8270C
Pyrene	EPA 625
	SW-846 8270C

Priority Pollutant Phenols

2,4,5-Trichlorophenol	EPA 625
	SW-846 8270C
2,4,6-Trichlorophenol	EPA 625
	SW-846 8270C
2,4-Dichlorophenol	EPA 625
	SW-846 8270C
2,4-Dimethylphenol	EPA 625
	SW-846 8270C
2,4-Dinitrophenol	EPA 625
	SW-846 8270C
2-Chlorophenol	EPA 625

Priority Pollutant Phenols

2-Chlorophenol	SW-846 8270C
2-Methyl-4,6-dinitrophenol	EPA 625
	SW-846 8270C
2-Nitrophenol	EPA 625
	SW-846 8270C
4-Chloro-3-methylphenol	EPA 625
	SW-846 8270C
4-Nitrophenol	EPA 625
	SW-846 8270C
Pentachlorophenol	EPA 625
	SW-846 8270C
Phenol	EPA 625
	SW-846 8270C

Purgeable Aromatics

1,2-Dichlorobenzene	EPA 601
	EPA 602
	EPA 624
	EPA 625
	SW-846 8021B
	SW-846 8260B
	SW-846 8270C
1,3-Dichlorobenzene	EPA 601
	EPA 602

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Purgeable Aromatics

1,3-Dichlorobenzene	EPA 624
	EPA 625
	SW-846 8021B
	SW-846 8260B
	SW-846 8270C
1,4-Dichlorobenzene	EPA 601
	EPA 602
	EPA 624
	EPA 625
	SW-846 8021B
	SW-846 8260B
	SW-846 8270C
Benzene	EPA 602
	EPA 624
	SW-846 8021B
	SW-846 8260B
Chlorobenzene	EPA 601
	EPA 602
	EPA 624
	SW-846 8021B
	SW-846 8260B
Ethyl benzene	EPA 602
	EPA 624

Purgeable Aromatics

Ethyl benzene	SW-846 8021B
	SW-846 8260B
Toluene	EPA 602
	EPA 624
	SW-846 8021B
	SW-846 8260B
Total Xylenes	EPA 602
	EPA 624
	SW-846 8021B
	SW-846 8260B

Purgeable Halocarbons

1,1,1-Trichloroethane	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
1,1,2,2-Tetrachloroethane	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
1,1,2-Trichloroethane	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B

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Purgeable Halocarbons	
1,1-Dichloroethane	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
1,1-Dichloroethene	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
1,2-Dichloroethane	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
1,2-Dichloropropane	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
2-Chloroethylvinyl ether	EPA 601
	EPA 624
	SW-846 8260B
Bromodichloromethane	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B

Purgeable Halocarbons	
Bromoform	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
Bromomethane	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
Carbon tetrachloride	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
Chloroethane	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
Chloroform	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
Chloromethane	EPA 601
	EPA 624
	SW-846 8021B

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Purgeable Halocarbons

Chloromethane	SW-846 8260B
cis-1,3-Dichloropropene	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
Dibromochloromethane	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
Dichlorodifluoromethane	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
Methylene chloride	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
Tetrachloroethene	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
trans-1,2-Dichloroethene	EPA 601
	EPA 624

Purgeable Halocarbons

trans-1,2-Dichloroethene	SW-846 8021B
	SW-846 8260B
trans-1,3-Dichloropropene	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
Trichloroethene	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
Trichlorofluoromethane	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B
Vinyl chloride	EPA 601
	EPA 624
	SW-846 8021B
	SW-846 8260B

Residue

Solids, Total	EPA 160.3
Solids, Total Dissolved	EPA 160.1
Solids, Total Suspended	EPA 160.2

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TCLP Additional Compounds

Cresol	SW-846 8270C
Methylethyl ketone (2-butanone)	SW-846 8260B
Pyridine	SW-846 8270C

Wastewater Metals I

Barium, Total	EPA 200.7
	EPA 200.8
	SW-846 3005A
	SW-846 3010A
	SW-846 6010B
	SW-846 6020
Cadmium, Total	EPA 200.7
	EPA 200.8
	SW-846 3005A
	SW-846 3010A
	SW-846 3020-A
	SW-846 6010B
	SW-846 6020
Calcium, Total	EPA 200.7
	SW-846 3005A
	SW-846 3010A
	SW-846 6010B
Chromium, Total	EPA 200.7
	EPA 200.8

Wastewater Metals I

Chromium, Total	SW-846 3005A
	SW-846 3010A
	SW-846 3020-A
	SW-846 6010B
	SW-846 6020
Copper, Total	EPA 200.7
	EPA 200.8
	SW-846 3005A
	SW-846 3010A
	SW-846 6010B
	SW-846 6020
Iron, Total	EPA 200.7
	SW-846 3005A
	SW-846 3010A
	SW-846 6010B
Lead, Total	EPA 200.7
	EPA 200.8
	SW-846 3005A
	SW-846 3010A
	SW-846 3020-A
	SW-846 6010B
	SW-846 6020
Magnesium, Total	EPA 200.7

Serial No.: 24163

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NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER

Antonia C. Novello, M.D., M.P.H., Dr.P.H.

Expires 12:01 AM April 01, 2005
Issued April 01, 2004
Revised October 14, 2004

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. CHRISTOPHER OPRANDI
STL BUFFALO
10 HAZELWOOD DRIVE SUITE 106
AMHERST NY 14228 United States

NY Lab Id No: 10026
EPA Lab Code: NY00044

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards for the category ENVIRONMENTAL ANALYSES NON POTABLE WATER All approved analytes are listed below:

Wastewater Metals I

Magnesium, Total	SW-846 3005A
	SW-846 3010A
	SW-846 6010B
Manganese, Total	EPA 200.7
	EPA 200.8
	SW-846 3005A
	SW-846 3010A
	SW-846 6010B
	SW-846 6020
Nickel, Total	EPA 200.7
	EPA 200.8
	SW-846 3005A
	SW-846 3010A
	SW-846 3020-A
	SW-846 6010B
	SW-846 6020
Potassium, Total	EPA 200.7
	SW-846 3005A
	SW-846 3010A
	SW-846 6010B
Silver, Total	EPA 200.7
	EPA 200.8
	SW-846 3005A

Wastewater Metals I

Silver, Total	SW-846 6010B
	SW-846 6020
Sodium, Total	EPA 200.7
	SW-846 3005A
	SW-846 3010A
	SW-846 6010B

Wastewater Metals II

Aluminum, Total	EPA 200.7
	SW-846 3005A
	SW-846 3010A
	SW-846 6010B
Antimony, Total	EPA 200.7
	EPA 200.8
	SW-846 3005A
	SW-846 6010B
	SW-846 6020
Arsenic, Total	EPA 200.7
	EPA 200.8
	SW-846 3005A
	SW-846 3010A
	SW-846 6010B
	SW-846 6020
Beryllium, Total	EPA 200.7

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Wastewater Metals II

Beryllium, Total	EPA 200.8
	SW-846 3005A
	SW-846 3010A
	SW-846 3020-A
	SW-846 6010B
	SW-846 6020
Chromium VI	SM 18-19 3500-Cr D
	SW-846 7196A
Mercury, Total	EPA 245.1
	SW-846 7470A
Selenium, Total	EPA 200.7
	EPA 200.8
	SW-846 3005A
	SW-846 3010A
	SW-846 6010B
	SW-846 6020
Vanadium, Total	EPA 200.7
	EPA 200.8
	SW-846 3005A
	SW-846 3010A
	SW-846 3020-A
	SW-846 6010B
	SW-846 6020

Wastewater Metals II

Zinc, Total	EPA 200.7
	EPA 200.8
	SW-846 3005A
	SW-846 3010A
	SW-846 6010B
	SW-846 6020

Wastewater Metals III

Cobalt, Total	EPA 200.7
	EPA 200.8
	SW-846 3005A
	SW-846 3010A
	SW-846 3020-A
	SW-846 6010B
	SW-846 6020
Molybdenum, Total	EPA 200.7
	EPA 200.8
	SW-846 3005A
	SW-846 3020-A
	SW-846 6010B
	SW-846 6020
Thallium, Total	EPA 200.7
	EPA 200.8
	SW-846 3005A

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Wastewater Metals III

Thallium, Total	SW-846 3010A
	SW-846 3020-A
	SW-846 6010B
	SW-846 6020
Tin, Total	EPA 200.7
	SW-846 6010B
Titanium, Total	EPA 200.7
	SW-846 6010B

Wastewater Miscellaneous

Boron, Total	EPA 200.7
	SW-846 6010B
Bromide	EPA 300.0
Color	EPA 110.2
Cyanide, Total	EPA 335.1
	EPA 335.2
	EPA 335.4
	LACHAT 10-204-00-1-A
	SW-846 9010B
	SW-846 9012A
Hydrogen Ion (pH)	EPA 150.1
	SW-846 9040B
Oil & Grease Total Recoverable	EPA 1664-A
Organic Carbon, Total	EPA 415.1

Wastewater Miscellaneous

Phenols	EPA 420.2
Silica, Dissolved	EPA 370.1
Specific Conductance	EPA 120.1
	SM 18-20 2510B
Sulfide (as S)	EPA 376.1
	EPA 376.2
Surfactant (MBAS)	EPA 425.1
Temperature	EPA 170.1

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All approved analytes are listed below:

Acrolein and Acrylonitrile

Acrolein	SW-846 8260B
Acrylonitrile	SW-846 8260B

Characteristic Testing

Corrosivity	SW-846 9040B SW-846 9045C
E.P. Toxicity	SW-846 1310
Ignitability	SW-846 1010
Reactivity	SW-846 Ch7, Sec. 7.3
TCLP	SW-846 1311

Chlorinated Hydrocarbon Pesticides

4,4 -DDE	SW-846 8081A
4,4 -DDT	SW-846 8081A
4,4-DDD	SW-846 8081A
Aldrin	SW-846 8081A SW-846 8270C
alpha-BHC	SW-846 8081A
beta-BHC	SW-846 8081A
Chlordane Total	SW-846 8081A
delta-BHC	SW-846 8081A
Dieldrin	SW-846 8081A
Endosulfan I	SW-846 8081A
Endosulfan II	SW-846 8081A

Chlorinated Hydrocarbon Pesticides

Endosulfan sulfate	SW-846 8081A
Endrin	SW-846 8081A
Endrin aldehyde	SW-846 8081A
Heptachlor	SW-846 8081A
Heptachlor epoxide	SW-846 8081A
Lindane	SW-846 8081A
Methoxychlor	SW-846 8081A
Toxaphene	SW-846 8081A

Chlorinated Hydrocarbons

1,2,4-Trichlorobenzene	SW-846 8270C
2-Chloronaphthalene	SW-846 8270C
Hexachlorobenzene	SW-846 8270C
Hexachlorobutadiene	SW-846 8270C
Hexachlorocyclopentadiene	SW-846 8270C
Hexachloroethane	SW-846 8270C

Chlorophenoxy Acid Pesticides

2,4,5-T	SW-846 8151A
2,4,5-TP (Silvex)	SW-846 8151A
2,4-D	SW-846 8151A
Dicamba	SW-846 8151A

Haloethers

Bis (2-chloroisopropyl) ether	SW-846 8270C

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Haloethers	
Bis(2-chloroethoxy)methane	SW-846 8270C
Metals I	
Barium, Total	SW-846 6010B
	SW-846 6020
Cadmium, Total	SW-846 6010B
	SW-846 6020
Chromium, Total	SW-846 6010B
	SW-846 6020
Lead, Total	SW-846 6010B
	SW-846 6020
Nickel, Total	SW-846 6010B
	SW-846 6020
Silver, Total	SW-846 6010B
	SW-846 6020
Metals II	
Antimony, Total	SW-846 6010B
	SW-846 6020
Arsenic, Total	SW-846 6010B
	SW-846 6020
Chromium VI	SW-846 7196A
Mercury, Total	SW-846 7471A
Selenium, Total	SW-846 6010B

Metals II	
Selenium, Total	SW-846 6020
Miscellaneous	
Cyanide, Total	SW-846 9010B
	SW-846 9012A
Hydrogen Ion (pH)	SW-846 9040B
	SW-846 9045C
Nitroaromatics and Isophorone	
2,4-Dinitrotoluene	SW-846 8270C
2,6-Dinitrotoluene	SW-846 8270C
Isophorone	SW-846 8270C
Nitrobenzene	SW-846 8270C
Phthalate Esters	
Benzyl butyl phthalate	SW-846 8270C
Bis(2-ethylhexyl) phthalate	SW-846 8270C
Diethyl phthalate	SW-846 8270C
Dimethyl phthalate	SW-846 8270C
Di-n-butyl phthalate	SW-846 8270C
Di-n-octyl phthalate	SW-846 8270C
Polychlorinated Biphenyls	
PCB-1016	SW-846 8082
PCB-1221	SW-846 8082

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Polychlorinated Biphenyls

PCB-1232	SW-846 8082
PCB-1242	SW-846 8082
PCB-1248	SW-846 8082
PCB-1254	SW-846 8082
PCB-1260	SW-846 8082

Polynuclear Aromatic Hydrocarbons

Acenaphthene	SW-846 8270C
Acenaphthylene	SW-846 8270C
Anthracene	SW-846 8270C
Benzo(a)anthracene	SW-846 8270C
Benzo(a)pyrene	SW-846 8270C
Benzo(b)fluoranthene	SW-846 8270C
Benzo(ghi)perylene	SW-846 8270C
Chrysene	SW-846 8270C
Dibenzo(a,h)anthracene	SW-846 8270C
Fluoranthene	SW-846 8270C
Fluorene	SW-846 8270C
Indeno(1,2,3-cd)pyrene	SW-846 8270C
Naphthalene	SW-846 8270C
Phenanthrene	SW-846 8270C
Pyrene	SW-846 8270C

Priority Pollutant Phenols

2,4,6-Trichlorophenol	SW-846 8270C
2,4-Dichlorophenol	SW-846 8270C
2,4-Dimethylphenol	SW-846 8270C
2,4-Dinitrophenol	SW-846 8270C
2-Chlorophenol	SW-846 8270C
2-Methyl-4,6-dinitrophenol	SW-846 8270C
2-Nitrophenol	SW-846 8270C
4-Chloro-3-methylphenol	SW-846 8270C
4-Nitrophenol	SW-846 8270C
Pentachlorophenol	SW-846 8270C
Phenol	SW-846 8270C

Purgeable Aromatics

1,2-Dichlorobenzene	SW-846 8021B
	SW-846 8260B
	SW-846 8270C
1,3-Dichlorobenzene	SW-846 8021B
	SW-846 8260B
	SW-846 8270C
1,4-Dichlorobenzene	SW-846 8021B
	SW-846 8260B
	SW-846 8270C
Benzene	SW-846 8021B
	SW-846 8260B

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Purgeable Aromatics

Chlorobenzene	SW-846 8021B
	SW-846 8260B
Ethyl benzene	SW-846 8021B
	SW-846 8260B
Toluene	SW-846 8021B
	SW-846 8260B
Total Xylenes	SW-846 8021B
	SW-846 8260B

Purgeable Halocarbons

1,1,1-Trichloroethane	SW-846 8021B
	SW-846 8260B
1,1,2,2-Tetrachloroethane	SW-846 8021B
	SW-846 8260B
1,1,2-Trichloroethane	SW-846 8021B
	SW-846 8260B
1,1-Dichloroethane	SW-846 8021B
	SW-846 8260B
1,1-Dichloroethene	SW-846 8021B
	SW-846 8260B
1,2-Dichloroethane	SW-846 8021B
	SW-846 8260B
1,2-Dichloropropane	SW-846 8021B
	SW-846 8260B

Purgeable Halocarbons

2-Chloroethylvinyl ether	SW-846 8021B
	SW-846 8260B
Bromodichloromethane	SW-846 8021B
	SW-846 8260B
Bromoform	SW-846 8021B
	SW-846 8260B
Bromomethane	SW-846 8021B
	SW-846 8260B
Carbon tetrachloride	SW-846 8021B
	SW-846 8260B
Chloroethane	SW-846 8021B
	SW-846 8260B
Chloroform	SW-846 8021B
	SW-846 8260B
Chloromethane	SW-846 8021B
	SW-846 8260B
cis-1,3-Dichloropropene	SW-846 8021B
	SW-846 8260B
Dibromochloromethane	SW-846 8021B
	SW-846 8260B
Dichlorodifluoromethane	SW-846 8021B
	SW-846 8260B
Methylene chloride	SW-846 8021B

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All approved analytes are listed below:

Purgeable Halocarbons	
Methylene chloride	SW-846 8260B
Tetrachloroethene	SW-846 8021B
	SW-846 8260B
trans-1,3-Dichloropropene	SW-846 8021B
	SW-846 8260B
Trichloroethene	SW-846 8021B
	SW-846 8260B
Trichlorofluoromethane	SW-846 8021B
	SW-846 8260B
Vinyl chloride	SW-846 8021B
	SW-846 8260B

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ENVIRONMENTAL ANALYSES SOLID AND HAZARDOUS WASTE
All approved subcategories and/or analytes are listed below:

Organophosphate Pesticides

Disulfoton	SW-846 8270C
Parathion methyl	SW-846 8270C

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ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

D. W. Methylcarbamate Pesticides

3-Hydroxy Carbofuran	EPA 531.1
Aldicarb	EPA 531.1
Aldicarb Sulfone	EPA 531.1
Aldicarb Sulfoxide	EPA 531.1
Carbaryl	EPA 531.1
Carbofuran	EPA 531.1
Methomyl	EPA 531.1
Oxamyl	EPA 531.1

Drinking Water Metals I

Arsenic, Total	EPA 200.7
	EPA 200.8
Barium, Total	EPA 200.7
	EPA 200.8
Cadmium, Total	EPA 200.7
	EPA 200.8
Chromium, Total	EPA 200.7
	EPA 200.8
Copper, Total	EPA 200.7
	EPA 200.8
Iron, Total	EPA 200.7
Lead, Total	EPA 200.8
Manganese, Total	EPA 200.7
	EPA 200.8

Drinking Water Metals I

Mercury, Total	EPA 245.1
Selenium, Total	EPA 200.8
Silver, Total	EPA 200.7
	EPA 200.8
Sodium, Total	EPA 200.7
Zinc, Total	EPA 200.7
	EPA 200.8

Drinking Water Metals II

Antimony, Total	EPA 200.8
Beryllium, Total	EPA 200.7
	EPA 200.8
Nickel, Total	EPA 200.7
	EPA 200.8
Thallium, Total	EPA 200.8

Drinking Water Miscellaneous

Methyl tert-butyl ether	EPA 524.2

Drinking Water Non-Metals

Alkalinity	EPA 310.1
	EPA 310.2
	SM 18-20 2320-B
Calcium Hardness	EPA 200.7
Chloride	EPA 300.0

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ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Drinking Water Non-Metals	
Chloride	EPA 325.2
Color	EPA 110.2
Cyanide	EPA 335.4
Fluoride, Total	EPA 300.0
	EPA 340.2
Hydrogen Ion (pH)	EPA 150.1
Nitrate (as N)	EPA 300.0
	EPA 353.2
Nitrite (as N)	EPA 353.2
Orthophosphate (as P)	EPA 365.2
Solids, Total Dissolved	EPA 160.1
	SM 18-20 2540C
Sulfate (as SO4)	EPA 300.0
	EPA 375.4
Drinking Water Trihalomethanes	
Bromodichloromethane	EPA 524.2
Bromoform	EPA 524.2
Chloroform	EPA 524.2
Dibromochloromethane	EPA 524.2
Microextractibles	
1,2-Dibromo-3-chloropropane	EPA 504.1
1,2-Dibromoethene	EPA 504.1

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
Isopropylbenzene	EPA 524.2
m-Xylene	EPA 524.2
n-Butylbenzene	EPA 524.2
n-Propylbenzene	EPA 524.2
o-Xylene	EPA 524.2
p-Isopropyltoluene (P-Cymene)	EPA 524.2
p-Xylene	EPA 524.2
sec-Butylbenzene	EPA 524.2
Styrene	EPA 524.2

Serial No.: 23970

Property of the New York State Department of Health. Valid only at the address shown. Must be conspicuously posted. Valid certificates have a raised seal. Continued accreditation depends on successful ongoing participation in the Program. Consumers are urged to call (518) 485-5570 to verify laboratory's accreditation status.

NEW YORK STATE DEPARTMENT OF HEALTH
WADSWORTH CENTER
Antonia C. Novello, M.D., M.P.H., Dr.P.H.

Expires 12:01 AM April 01, 2005
Issued April 01, 2004
Revised September 07, 2004

CERTIFICATE OF APPROVAL FOR LABORATORY SERVICE

Issued in accordance with and pursuant to section 502 Public Health Law of New York State

MR. CHRISTOPHER OPRANDI
STL BUFFALO
10 HAZELWOOD DRIVE SUITE 106
AMHERST NY 14228 United States

NY Lab Id No: 10026
EPA Lab Code: NY00044

is hereby APPROVED as an Environmental Laboratory in conformance with the National Environmental Laboratory Accreditation Conference Standards for the category
ENVIRONMENTAL ANALYSES POTABLE WATER
All approved analytes are listed below:

Volatile Aromatics

tert-Butylbenzene	EPA 524.2
Toluene	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 504.1 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

Volatile Halocarbons

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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B
LABORATORY METHOD DETECTION LIMITS (MDLS)

Date: 02/14/05
Time: 13:20

Test Profile: ST001794 Detection Limits

Soil 8260

Page: 1
Rept: AN1061

ug/kg

Parameter	Description	Seqno	TDL Calc	TDL Type	CDL	MDL	EQL
67-64-1	Acetone	10	ADL	EQL	0.000	22.573	25.000
71-43-2	Benzene	20	ADL	EQL	0.000	0.813	5.000
75-27-4	Bromodichloromethane	30	ADL	EQL	0.000	0.719	5.000
75-25-2	Bromoform	40	ADL	EQL	0.000	1.127	5.000
74-83-9	Bromomethane	50	ADL	EQL	0.000	1.466	5.000
78-93-3	2-Butanone	60	ADL	EQL	0.000	3.488	25.000
75-15-0	Carbon Disulfide	70	ADL	EQL	0.000	1.240	5.000
56-23-5	Carbon Tetrachloride	80	ADL	EQL	0.000	0.844	5.000
108-90-7	Chlorobenzene	90	ADL	EQL	0.000	0.598	5.000
75-00-3	Chloroethane	100	ADL	EQL	0.000	0.841	5.000
67-66-3	Chloroform	120	ADL	EQL	0.000	1.263	5.000
74-87-3	Chloromethane	130	ADL	EQL	0.000	0.731	5.000
110-82-7	Cyclohexane	132	ADL	EQL	0.000	0.876	5.000
106-93-4	1,2-Dibromoethane	135	ADL	EQL	0.000	0.781	5.000
124-48-1	Dibromochloromethane	140	ADL	EQL	0.000	0.910	5.000
96-12-8	1,2-Dibromo-3-chloropropane	141	ADL	EQL	0.000	1.030	5.000
95-50-1	1,2-Dichlorobenzene	143	ADL	EQL	0.000	0.565	5.000
541-73-1	1,3-Dichlorobenzene	145	ADL	EQL	0.000	0.575	5.000
106-46-7	1,4-Dichlorobenzene	146	ADL	EQL	0.000	0.566	5.000
75-71-8	Dichlorodifluoromethane	147	ADL	EQL	0.000	1.152	5.000
75-34-3	1,1-Dichloroethane	150	ADL	EQL	0.000	1.021	5.000
107-06-2	1,2-Dichloroethane	160	ADL	EQL	0.000	0.884	5.000
75-35-4	1,1-Dichloroethene	170	ADL	EQL	0.000	0.612	5.000
156-59-2	cis-1,2-Dichloroethene	180	ADL	EQL	0.000	1.189	5.000
156-60-5	trans-1,2-Dichloroethene	185	ADL	EQL	0.000	1.426	5.000
78-87-5	1,2-Dichloropropane	190	ADL	EQL	0.000	0.950	5.000
10061-01-5	cis-1,3-Dichloropropene	200	ADL	EQL	0.000	0.795	5.000
10061-02-6	trans-1,3-Dichloropropene	210	ADL	EQL	0.000	0.965	5.000
100-41-4	Ethylbenzene	220	ADL	EQL	0.000	0.625	5.000
591-78-6	2-Hexanone	230	ADL	EQL	0.000	4.718	25.000
98-82-8	Isopropylbenzene	235	ADL	EQL	0.000	0.575	5.000
79-20-9	Methyl acetate	237	ADL	EQL	0.000	1.949	5.000
108-87-2	Methylcyclohexane	238	ADL	EQL	0.000	0.917	5.000
75-09-2	Methylene chloride	240	ADL	EQL	0.000	4.420	5.000
108-10-1	4-Methyl-2-pentanone	250	ADL	EQL	0.000	4.211	25.000
1634-04-4	Methyl tert butyl ether	255	ADL	EQL	0.000	0.551	5.000
100-42-5	Styrene	260	ADL	EQL	0.000	1.203	5.000
79-34-5	1,1,2,2-Tetrachloroethane	270	ADL	EQL	0.000	1.112	5.000
127-18-4	Tetrachloroethene	280	ADL	EQL	0.000	0.803	5.000
108-88-3	Toluene	290	ADL	EQL	0.000	1.619	5.000
120-82-1	1,2,4-Trichlorobenzene	295	ADL	EQL	0.000	0.930	5.000
71-55-6	1,1,1-Trichloroethane	300	ADL	EQL	0.000	0.689	5.000

Parameter	Description	Seqno	TDL Calc	TDL Type	CDL	MDL	EQL
79-00-5	1,1,2-Trichloroethane	310	ADL	EQL	0.000	0.918	5.000
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	314	ADL	EQL	0.000	0.967	5.000
75-69-4	Trichlorofluoromethane	315	ADL	EQL	0.000	0.943	5.000
79-01-6	Trichloroethene	320	ADL	EQL	0.000	0.638	5.000
108-05-4	Vinyl acetate	330	ADL	EQL	0.000	5.555	25.000
75-01-4	Vinyl chloride	340	ADL	EQL	0.000	0.776	10.000
1330-20-7	Total Xylenes	350	ADL	EQL	0.000	2.937	15.000

Date: 02/14/05
Time: 13:20

Test Profile: ST001793 Detection Limits

25ml Purge 8260 volatiles
Aqueous

ug/l

Parameter	Description	Seqno	TDL Calc	TDL Type	CDL	MDL	EQL
67-64-1	Acetone	10	ADL	EQL	0.000	2.303	5.000
71-43-2	Benzene	20	ADL	EQL	0.000	0.285	1.000
75-27-4	Bromodichloromethane	30	ADL	EQL	0.000	0.220	1.000
75-25-2	Bromoform	40	ADL	EQL	0.000	0.425	1.000
74-83-9	Bromomethane	50	ADL	EQL	0.000	0.491	1.000
78-93-3	2-Butanone	60	ADL	EQL	0.000	2.869	5.000
75-15-0	Carbon Disulfide	70	ADL	EQL	0.000	0.205	1.000
56-23-5	Carbon Tetrachloride	80	ADL	EQL	0.000	0.190	1.000
108-90-7	Chlorobenzene	90	ADL	EQL	0.000	0.208	1.000
75-00-3	Chloroethane	100	ADL	EQL	0.000	0.474	1.000
67-66-3	Chloroform	120	ADL	EQL	0.000	0.319	1.000
74-87-3	Chloromethane	130	ADL	EQL	0.000	0.382	1.000
110-82-7	Cyclohexane	132	ADL	EQL	0.000	0.240	1.000
106-93-4	1,2-Dibromoethane	135	ADL	EQL	0.000	0.348	1.000
124-48-1	Dibromochloromethane	140	ADL	EQL	0.000	0.321	1.000
96-12-8	1,2-Dibromo-3-chloropropane	141	ADL	EQL	0.000	0.939	1.000
95-50-1	1,2-Dichlorobenzene	143	ADL	EQL	0.000	0.224	1.000
541-73-1	1,3-Dichlorobenzene	145	ADL	EQL	0.000	0.206	1.000
106-46-7	1,4-Dichlorobenzene	146	ADL	EQL	0.000	0.250	1.000
75-71-8	Dichlorodifluoromethane	147	ADL	EQL	0.000	0.486	1.000
75-34-3	1,1-Dichloroethane	150	ADL	EQL	0.000	0.379	1.000
107-06-2	1,2-Dichloroethane	160	ADL	EQL	0.000	0.433	1.000
75-35-4	1,1-Dichloroethene	170	ADL	EQL	0.000	0.189	1.000
156-59-2	cis-1,2-Dichloroethene	180	ADL	EQL	0.000	0.322	1.000
156-60-5	trans-1,2-Dichloroethene	185	ADL	EQL	0.000	0.324	1.000
78-87-5	1,2-Dichloropropane	190	ADL	EQL	0.000	0.315	1.000
10061-01-5	cis-1,3-Dichloropropene	200	ADL	EQL	0.000	0.273	1.000
10061-02-6	trans-1,3-Dichloropropene	210	ADL	EQL	0.000	0.413	1.000
100-41-4	Ethylbenzene	220	ADL	EQL	0.000	0.320	1.000
591-78-6	2-Hexanone	230	ADL	EQL	0.000	1.868	5.000
98-82-8	Isopropylbenzene	235	ADL	EQL	0.000	0.192	1.000
79-20-9	Methyl acetate	237	ADL	EQL	0.000	0.718	1.000
108-87-2	Methylcyclohexane	238	ADL	EQL	0.000	0.314	1.000
75-09-2	Methylene chloride	240	ADL	EQL	0.000	0.395	1.000
108-10-1	4-Methyl-2-pentanone	250	ADL	EQL	0.000	1.875	5.000
1634-04-4	Methyl tert butyl ether	255	ADL	EQL	0.000	0.373	1.000
100-42-5	Styrene	260	ADL	EQL	0.000	0.378	1.000
79-34-5	1,1,2,2-Tetrachloroethane	270	ADL	EQL	0.000	0.362	1.000
127-18-4	Tetrachloroethene	280	ADL	EQL	0.000	0.255	1.000
108-88-3	Toluene	290	ADL	EQL	0.000	0.355	1.000
120-82-1	1,2,4-Trichlorobenzene	295	ADL	EQL	0.000	0.180	1.000
71-55-6	1,1,1-Trichloroethane	300	ADL	EQL	0.000	0.253	1.000

Parameter	Description	Seqno	TDL Calc	TDL Type	CDL	MDL	EQL
79-00-5	1,1,2-Trichloroethane	310	ADL	EQL	0.000	0.473	1.000
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	314	ADL	EQL	0.000	0.229	1.000
75-69-4	Trichlorofluoromethane	315	ADL	EQL	0.000	0.364	1.000
79-01-6	Trichloroethene	320	ADL	EQL	0.000	0.258	1.000
75-01-4	Vinyl chloride	340	ADL	EQL	0.000	0.590	1.000
1330-20-7	Total Xylenes	350	ADL	EQL	0.000	0.630	3.000

8260 Volatiles 5ml Purge
Aqueous

ug/l

Parameter	Description	Seqno	TDL Calc	TDL Type	CDL	MDL	EQL
67-64-1	Acetone	10	ADL	EQL	0.000	20.086	25.000
71-43-2	Benzene	20	ADL	EQL	0.000	0.815	5.000
75-27-4	Bromodichloromethane	30	ADL	EQL	0.000	0.841	5.000
75-25-2	Bromoform	40	ADL	EQL	0.000	1.402	5.000
74-83-9	Bromomethane	50	ADL	EQL	0.000	3.331	5.000
78-93-3	2-Butanone	60	ADL	EQL	0.000	6.533	25.000
75-15-0	Carbon Disulfide	70	ADL	EQL	0.000	1.639	5.000
56-23-5	Carbon Tetrachloride	80	ADL	EQL	0.000	2.110	5.000
108-90-7	Chlorobenzene	90	ADL	EQL	0.000	0.850	5.000
75-00-3	Chloroethane	100	ADL	EQL	0.000	1.319	5.000
67-66-3	Chloroform	120	ADL	EQL	0.000	0.534	5.000
74-87-3	Chloromethane	130	ADL	EQL	0.000	1.838	5.000
110-82-7	Cyclohexane	132	ADL	EQL	0.000	2.246	5.000
106-93-4	1,2-Dibromoethane	135	ADL	EQL	0.000	1.444	5.000
124-48-1	Dibromochloromethane	140	ADL	EQL	0.000	1.309	5.000
96-12-8	1,2-Dibromo-3-chloropropane	141	ADL	EQL	0.000	1.699	5.000
95-50-1	1,2-Dichlorobenzene	143	ADL	EQL	0.000	1.474	5.000
541-73-1	1,3-Dichlorobenzene	145	ADL	EQL	0.000	1.098	5.000
106-46-7	1,4-Dichlorobenzene	146	ADL	EQL	0.000	1.258	5.000
75-71-8	Dichlorodifluoromethane	147	ADL	EQL	0.000	1.581	5.000
75-34-3	1,1-Dichloroethane	150	ADL	EQL	0.000	0.620	5.000
107-06-2	1,2-Dichloroethane	160	ADL	EQL	0.000	0.900	5.000
75-35-4	1,1-Dichloroethene	170	ADL	EQL	0.000	2.339	5.000
156-59-2	cis-1,2-Dichloroethene	180	ADL	EQL	0.000	0.918	5.000
156-60-5	trans-1,2-Dichloroethene	185	ADL	EQL	0.000	0.394	5.000
78-87-5	1,2-Dichloropropane	190	ADL	EQL	0.000	0.781	5.000
10061-01-5	cis-1,3-Dichloropropene	200	ADL	EQL	0.000	1.459	5.000
10061-02-6	trans-1,3-Dichloropropene	210	ADL	EQL	0.000	1.718	5.000
100-41-4	Ethylbenzene	220	ADL	EQL	0.000	1.278	5.000
591-78-6	2-Hexanone	230	ADL	EQL	0.000	7.161	25.000
98-82-8	Isopropylbenzene	235	ADL	EQL	0.000	2.391	5.000
79-20-9	Methyl acetate	237	ADL	EQL	0.000	3.741	5.000
108-87-2	Methylcyclohexane	238	ADL	EQL	0.000	2.553	5.000
75-09-2	Methylene chloride	240	ADL	EQL	0.000	3.708	5.000
108-10-1	4-Methyl-2-pentanone	250	ADL	EQL	0.000	7.307	25.000
1634-04-4	Methyl tert butyl ether	255	ADL	EQL	0.000	1.010	5.000
100-42-5	Styrene	260	ADL	EQL	0.000	2.171	5.000
79-34-5	1,1,2,2-Tetrachloroethane	270	ADL	EQL	0.000	1.708	5.000
127-18-4	Tetrachloroethene	280	ADL	EQL	0.000	1.259	5.000
108-88-3	Toluene	290	ADL	EQL	0.000	1.043	5.000
120-82-1	1,2,4-Trichlorobenzene	295	ADL	EQL	0.000	2.541	5.000
71-55-6	1,1,1-Trichloroethane	300	ADL	EQL	0.000	1.044	5.000

Parameter	Description	Seqno	TDL Calc	TDL Type	CDL	MDL	EQL
79-00-5	1,1,2-Trichloroethane	310	ADL	EQL	0.000	1.412	5.000
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	314	ADL	EQL	0.000	0.135	5.000
75-69-4	Trichlorofluoromethane	315	ADL	EQL	0.000	0.979	5.000
79-01-6	Trichloroethene	320	ADL	EQL	0.000	0.917	5.000
75-01-4	Vinyl chloride	340	ADL	EQL	0.000	1.686	5.000
1330-20-7	Total Xylenes	350	ADL	EQL	0.000	5.950	15.000

Date: 02/14/05
Time: 13:21

Test Profile: ST000639 Detection Limits
8270 soil

Rept: AN1061

ug/kg

Parameter	Description	Seqno	TDL Calc	TDL Type	CDL	MDL	EQL
83-32-9	Acenaphthene	20	ADL	EQL	0.000	114.006	330.000
208-96-8	Acenaphthylene	25	ADL	EQL	0.000	101.678	330.000
98-86-2	Acetophenone	26	ADL	EQL	0.000	78.360	330.000
120-12-7	Anthracene	30	ADL	EQL	0.000	135.661	330.000
1912-24-9	Atrazine	32	ADL	EQL	0.000	93.599	330.000
100-52-7	Benzaldehyde	35	ADL	EQL	0.000	31.124	330.000
56-55-3	Benzo(a)anthracene	40	ADL	EQL	0.000	165.626	330.000
205-99-2	Benzo(b)fluoranthene	50	ADL	EQL	0.000	149.750	330.000
207-08-9	Benzo(k)fluoranthene	60	ADL	EQL	0.000	164.214	330.000
191-24-2	Benzo(ghi)perylene	70	ADL	EQL	0.000	224.067	330.000
50-32-8	Benzo(a)pyrene	80	ADL	EQL	0.000	121.305	330.000
92-52-4	Biphenyl	105	ADL	EQL	0.000	61.190	330.000
111-91-1	Bis(2-chloroethoxy) methane	110	ADL	EQL	0.000	90.634	330.000
111-44-4	Bis(2-chloroethyl) ether	120	ADL	EQL	0.000	105.247	330.000
108-60-1	2,2'-Oxybis(1-Chloropropane)	130	ADL	EQL	0.000	158.907	330.000
117-81-7	Bis(2-ethylhexyl) phthalate	140	ADL	EQL	0.000	139.373	330.000
101-55-3	4-Bromophenyl phenyl ether	150	ADL	EQL	0.000	121.015	330.000
85-68-7	Butyl benzyl phthalate	160	ADL	EQL	0.000	128.343	330.000
105-60-2	Caprolactam	165	ADL	EQL	0.000	49.999	330.000
106-47-8	4-Chloroaniline	170	ADL	EQL	0.000	78.761	330.000
59-50-7	4-Chloro-3-methylphenol	180	ADL	EQL	0.000	78.154	330.000
91-58-7	2-Chloronaphthalene	190	ADL	EQL	0.000	106.643	330.000
95-57-8	2-Chlorophenol	200	ADL	EQL	0.000	97.279	330.000
7005-72-3	4-Chlorophenyl phenyl ether	210	ADL	EQL	0.000	115.268	330.000
86-74-8	Carbazole	215	ADL	EQL	0.000	94.865	330.000
218-01-9	Chrysene	220	ADL	EQL	0.000	126.181	330.000
53-70-3	Dibenzo(a,h)anthracene	230	ADL	EQL	0.000	226.803	330.000
132-64-9	Dibenzofuran	240	ADL	EQL	0.000	108.784	330.000
84-74-2	Di-n-butyl phthalate	245	ADL	EQL	0.000	139.331	330.000
91-94-1	3,3'-Dichlorobenzidine	280	ADL	EQL	0.000	175.772	660.000
120-83-2	2,4-Dichlorophenol	290	ADL	EQL	0.000	104.174	330.000
84-66-2	Diethyl phthalate	300	ADL	EQL	0.000	140.292	330.000
105-67-9	2,4-Dimethylphenol	310	ADL	EQL	0.000	159.402	330.000
131-11-3	Dimethyl phthalate	320	ADL	EQL	0.000	90.037	330.000
534-52-1	4,6-Dinitro-2-methylphenol	330	ADL	EQL	0.000	551.797	1600.000
51-28-5	2,4-Dinitrophenol	340	ADL	EQL	0.000	1465.995	1600.000
121-14-2	2,4-Dinitrotoluene	350	ADL	EQL	0.000	73.832	330.000
606-20-2	2,6-Dinitrotoluene	360	ADL	EQL	0.000	176.654	330.000
117-84-0	Di-n-octyl phthalate	380	ADL	EQL	0.000	30.780	330.000
206-44-0	Fluoranthene	390	ADL	EQL	0.000	133.879	330.000
86-73-7	Fluorene	400	ADL	EQL	0.000	127.301	330.000
118-74-1	Hexachlorobenzene	410	ADL	EQL	0.000	132.856	330.000

Parameter	Description	Seqno	TDL Calc	TDL Type	CDL	MDL	EQL
87-68-3	Hexachlorobutadiene	420	ADL	EQL	0.000	152.572	330.000
77-47-4	Hexachlorocyclopentadiene	430	ADL	EQL	0.000	196.929	330.000
67-72-1	Hexachloroethane	440	ADL	EQL	0.000	182.263	330.000
193-39-5	Indeno(1,2,3-cd)pyrene	450	ADL	EQL	0.000	203.848	330.000
78-59-1	Isophorone	460	ADL	EQL	0.000	79.049	330.000
91-57-6	2-Methylnaphthalene	470	ADL	EQL	0.000	93.563	330.000
95-48-7	2-Methylphenol	480	ADL	EQL	0.000	90.400	330.000
106-44-5	4-Methylphenol	490	ADL	EQL	0.000	115.751	330.000
91-20-3	Naphthalene	500	ADL	EQL	0.000	113.046	330.000
88-74-4	2-Nitroaniline	510	ADL	EQL	0.000	219.009	1600.000
99-09-2	3-Nitroaniline	511	ADL	EQL	0.000	178.460	1600.000
100-01-6	4-Nitroaniline	512	ADL	EQL	0.000	220.319	1600.000
98-95-3	Nitrobenzene	513	ADL	EQL	0.000	100.689	330.000
88-75-5	2-Nitrophenol	514	ADL	EQL	0.000	74.014	330.000
100-02-7	4-Nitrophenol	515	ADL	EQL	0.000	562.203	1600.000
86-30-6	N-nitrosodiphenylamine	520	ADL	EQL	0.000	116.179	330.000
621-64-7	N-Nitroso-Di-n-propylamine	525	ADL	EQL	0.000	100.258	330.000
87-86-5	Pentachlorophenol	530	ADL	EQL	0.000	690.640	1600.000
85-01-8	Phenanthrene	540	ADL	EQL	0.000	96.704	330.000
108-95-2	Phenol	550	ADL	EQL	0.000	91.702	330.000
129-00-0	Pyrene	560	ADL	EQL	0.000	124.571	330.000
95-95-4	2,4,5-Trichlorophenol	580	ADL	EQL	0.000	79.139	800.000
88-06-2	2,4,6-Trichlorophenol	590	ADL	EQL	0.000	76.847	330.000

Date: 02/14/05
Time: 13:21

Test Profile: ST000636 Detection Limits

8270 Aqueous

ug/l

Parameter	Description	Seqno	TDL Calc	TDL Type	CDL	MDL	EQL
83-32-9	Acenaphthene	10	ADL	EQL	0.000	1.614	10.000
208-96-8	Acenaphthylene	20	ADL	EQL	0.000	2.813	10.000
98-86-2	Acetophenone	25	ADL	EQL	0.000	5.857	10.000
120-12-7	Anthracene	30	ADL	EQL	0.000	3.299	10.000
1912-24-9	Atrazine	32	ADL	EQL	0.000	2.219	10.000
100-52-7	Benzaldehyde	35	ADL	EQL	0.000	20.500	50.000
56-55-3	Benzo(a)anthracene	40	ADL	EQL	0.000	3.140	10.000
205-99-2	Benzo(b)fluoranthene	50	ADL	EQL	0.000	3.220	10.000
207-08-9	Benzo(k)fluoranthene	60	ADL	EQL	0.000	3.271	10.000
191-24-2	Benzo(ghi)perylene	70	ADL	EQL	0.000	1.731	10.000
50-32-8	Benzo(a)pyrene	80	ADL	EQL	0.000	3.352	10.000
65-85-0	Benzoic acid	90	ADL	EQL	0.000	7.308	150.000
100-51-6	Benzyl alcohol	100	ADL	EQL	0.000	1.790	20.000
92-52-4	Biphenyl	105	ADL	EQL	0.000	2.435	10.000
111-91-1	Bis(2-chloroethoxy) methane	110	ADL	EQL	0.000	2.099	10.000
111-44-4	Bis(2-chloroethyl) ether	120	ADL	EQL	0.000	2.438	10.000
108-60-1	2,2'-Oxybis(1-Chloropropane)	130	ADL	EQL	0.000	1.777	10.000
117-81-7	Bis(2-ethylhexyl) phthalate	140	ADL	EQL	0.000	7.176	10.000
101-55-3	4-Bromophenyl phenyl ether	150	ADL	EQL	0.000	2.500	10.000
85-68-7	Butyl benzyl phthalate	160	ADL	EQL	0.000	7.472	10.000
106-47-8	4-Chloroaniline	170	ADL	EQL	0.000	1.052	10.000
59-50-7	4-Chloro-3-methylphenol	180	ADL	EQL	0.000	2.728	10.000
91-58-7	2-Chloronaphthalene	190	ADL	EQL	0.000	1.937	10.000
95-57-8	2-Chlorophenol	200	ADL	EQL	0.000	1.002	10.000
7005-72-3	4-Chlorophenyl phenyl ether	210	ADL	EQL	0.000	2.416	10.000
105-60-2	Caprolactam	215	ADL	EQL	0.000	4.590	10.000
218-01-9	Chrysene	220	ADL	EQL	0.000	1.791	10.000
53-70-3	Dibenzo(a,h)anthracene	230	ADL	EQL	0.000	3.232	10.000
132-64-9	Dibenzofuran	240	ADL	EQL	0.000	2.510	10.000
84-74-2	Di-n-butyl phthalate	245	ADL	EQL	0.000	6.641	10.000
95-50-1	1,2-Dichlorobenzene	250	ADL	EQL	10.000	2.500	10.000
541-73-1	1,3-Dichlorobenzene	260	ADL	EQL	10.000	2.432	10.000
106-46-7	1,4-Dichlorobenzene	270	ADL	EQL	10.000	2.452	10.000
91-94-1	3,3'-Dichlorobenzidine	280	ADL	EQL	0.000	7.432	20.000
120-83-2	2,4-Dichlorophenol	290	ADL	EQL	0.000	2.131	10.000
84-66-2	Diethyl phthalate	300	ADL	EQL	0.000	2.989	10.000
105-67-9	2,4-Dimethylphenol	310	ADL	EQL	0.000	1.601	10.000
131-11-3	Dimethyl phthalate	320	ADL	EQL	0.000	2.525	10.000
534-52-1	4,6-Dinitro-2-methylphenol	330	ADL	EQL	0.000	7.621	50.000
51-28-5	2,4-Dinitrophenol	340	ADL	EQL	0.000	10.508	50.000
121-14-2	2,4-Dinitrotoluene	350	ADL	EQL	0.000	3.525	10.000
606-20-2	2,6-Dinitrotoluene	360	ADL	EQL	0.000	2.667	10.000

Parameter	Description	Seqno	TDL Calc	TDL Type	CDL	MDL	EQL
117-84-0	Di-n-octyl phthalate	380	ADL	EQL	0.000	6.953	10.000
206-44-0	Fluoranthene	390	ADL	EQL	0.000	2.200	10.000
86-73-7	Fluorene	400	ADL	EQL	0.000	2.715	10.000
118-74-1	Hexachlorobenzene	410	ADL	EQL	0.000	1.143	10.000
87-68-3	Hexachlorobutadiene	420	ADL	EQL	0.000	3.496	10.000
77-47-4	Hexachlorocyclopentadiene	430	ADL	EQL	0.000	23.666	45.000
67-72-1	Hexachloroethane	440	ADL	EQL	0.000	3.473	10.000
193-39-5	Indeno(1,2,3-cd)pyrene	450	ADL	EQL	0.000	6.262	10.000
78-59-1	Isophorone	460	ADL	EQL	0.000	2.509	10.000
91-57-6	2-Methylnaphthalene	470	ADL	EQL	0.000	2.190	10.000
95-48-7	2-Methylphenol	480	ADL	EQL	0.000	2.070	10.000
106-44-5	4-Methylphenol	490	ADL	EQL	0.000	1.093	10.000
91-20-3	Naphthalene	500	ADL	EQL	0.000	2.100	10.000
88-74-4	2-Nitroaniline	510	ADL	EQL	0.000	4.497	50.000
99-09-2	3-Nitroaniline	511	ADL	EQL	0.000	3.503	50.000
100-01-6	4-Nitroaniline	512	ADL	EQL	0.000	3.137	50.000
98-95-3	Nitrobenzene	513	ADL	EQL	0.000	2.275	10.000
88-75-5	2-Nitrophenol	514	ADL	EQL	0.000	1.995	10.000
100-02-7	4-Nitrophenol	515	ADL	EQL	0.000	15.000	50.000
86-30-6	N-nitrosodiphenylamine	516	ADL	EQL	0.000	2.288	10.000
621-64-7	N-Nitroso-Di-n-propylamine	521	ADL	EQL	0.000	1.660	10.000
87-86-5	Pentachlorophenol	530	ADL	EQL	0.000	9.536	50.000
85-01-8	Phenanthrene	540	ADL	EQL	0.000	2.450	10.000
108-95-2	Phenol	550	ADL	EQL	0.000	1.100	10.000
129-00-0	Pyrene	560	ADL	EQL	0.000	1.142	10.000
120-82-1	1,2,4-Trichlorobenzene	570	ADL	EQL	10.000	2.453	10.000
95-95-4	2,4,5-Trichlorophenol	580	ADL	EQL	0.000	3.214	10.000
88-06-2	2,4,6-Trichlorophenol	590	ADL	EQL	0.000	1.916	10.000

Date: 02/14/05
Time: 13:21

Test Profile: STA00557 Detection Limits

Cyanide in soil

Page: 1
Rept: AN1061

Parameter	Description	Seqno	TDL Calc	TDL Type	CDL	MDL	EQL
T57-12-5	Cyanide - Total	10	ADL	EQL	0.000	~~0.000~~ 0.17	1.000

Test Profile: ST000952 Detection Limits

Cyanide Aqueous

ug/l

Parameter	Description	Segno	TDL Calc	TDL Type	CDL	MDL	EQL
T57-12-5	Cyanide - Total	10	ADL	EQL	0.000	0.006	0.010

STL Buffalo
Analytical Test Group Profile

Test Group #: SG000011 Type: S

Client: NA Client Not Applicable

Description: AQUEOUS-SW8463 - TOTAL HSL METALS
Report Title: TOTAL HSL METALS
Product Abbr: HSL ME

Fraction: ME
Matrix: W
CLP Input? N
TCLP? N
Lab Location: A

Prep Type: D
Protocol: SW8463
Method: 6010
Units of Measure: MG/L
Active: Y
QC Approver: DJK 11/02/1994

Test No	Description	EQL	MDL	Unit of Measure	Spike Code
ST001042	ALUMINUM - TOTAL - W	0.20	0.03	MG/L	A00067
ST001041	ANTIMONY - TOTAL - W	0.02	0.0055	MG/L	A00067
ST000962	ARSENIC - TOTAL - W	0.01	0.0049	MG/L	A00067
ST001039	BARIUM - TOTAL - W	.002	.001	MG/L	A00067
ST001038	BERYLLIUM - TOTAL - W	.002	.001	MG/L	A00067
ST001037	CADMIUM - TOTAL - W	.001	.00059	MG/L	A00067
ST001036	CALCIUM - TOTAL - W	0.50	0.021	MG/L	A00067
ST001035	CHROMIUM - TOTAL - W	.004	.0009	MG/L	A00067
ST001034	COBALT - TOTAL - W	.004	.002	MG/L	A00067
ST001033	COPPER - TOTAL - W	.01	.002	MG/L	A00067
ST001032	IRON - TOTAL - W	.05	0.017	MG/L	A00067
ST000945	LEAD - TOTAL - W	0.005	0.0013	MG/L	A00067
ST001031	MAGNESIUM - TOTAL - W	0.20	0.0196	MG/L	A00067
ST001030	MANGANESE - TOTAL - W	0.003	0.00033	MG/L	A00067
ST000973	MERCURY - TOTAL - W	.002	.00015	MG/L	A00067
ST001028	NICKEL - TOTAL - W	.01	.0016	MG/L	A00067
ST001027	POTASSIUM - TOTAL - W	0.5	0.1	MG/L	A00067
ST001026	SELENIUM - TOTAL - W	0.015	0.0056	MG/L	A00087
ST001025	SILVER - TOTAL - W	0.003	0.0009	MG/L	A00067
ST001024	SODIUM - TOTAL - W	1.00	0.339	MG/L	A00067
ST001023	THALLIUM - TOTAL - W	0.02	0.0057	MG/L	A00087
ST001044	VANADIUM - TOTAL - W	0.005	0.00098	MG/L	A00067
ST001043	ZINC - TOTAL - W	0.02	0.0014	MG/L	A00067

STL Buffalo
Analytical Test Group Profile

Test Group #: SG000060 Type: S

Client: NA Client Not Applicable

Description: SOIL-SW8463 - TOTAL HSL METALS
Report Title: TOTAL HSL METALS
Product Abbr: HSL ME

Fraction: ME	Prep Type: D
Matrix: S	Protocol: SW8463
CLP Input? Y	Method:
TCLP? N	Units of Measure: MG/KG
Lab Location: A	Active: Y
	QC Approver: AMK 11/19/1998

Test No	Description	EQL	MDL		Unit of Measure	Spike Code
ST000188	ALUMINUM - TOTAL - S	10	2.2		MG/KG	A00066
ST000190	ANTIMONY - TOTAL - S	15	3.65		MG/KG	A00066
ST000720	ARSENIC - TOTAL - S	2	0.64		MG/KG	A00066
ST000718	BARIUM - TOTAL - S	0.5	0.13		MG/KG	A00066
ST000716	BERYLLIUM - TOTAL - S	0.2	0.04		MG/KG	A00066
ST001144	CADMIUM - TOTAL - S	0.2	0.063		MG/KG	A00066
ST000710	CALCIUM - TOTAL - S	10	4.4		MG/KG	A00066
ST001145	CHROMIUM - TOTAL - S	0.5	0.139		MG/KG	A00066
ST000364	COBALT - TOTAL - S	0.5	0.107		MG/KG	A00066
ST000704	COPPER - TOTAL - S	1.00	0.238		MG/KG	A00066
ST000702	IRON - TOTAL - S	10.0	3.1		MG/KG	A00066
ST000944	LEAD - TOTAL - S	1.00	0.307		MG/KG	A00066
ST000698	MAGNESIUM - TOTAL - S	20.0	0.9		MG/KG	A00066
ST000696	MANGANESE - TOTAL - S	0.2	0.053		MG/KG	A00066
ST001045	MERCURY - TOTAL - S	0.02	0.0071		MG/KG	A00066
ST001147	NICKEL - TOTAL - S	0.5	0.12		MG/KG	A00066
ST000690	POTASSIUM - TOTAL - S	30.0	8.40		MG/KG	A00066
STA00173	SELENIUM - TOTAL - S	4.0	1.10		MG/KG	A00066
ST001148	SILVER - TOTAL - S	0.5	0.145		MG/KG	A00066
ST000682	SODIUM - TOTAL - S	140	41.7		MG/KG	A00066
STA00157	THALLIUM - TOTAL - S	6.00	2.468	← 2.468	MG/KG	A00066
ST000676	VANADIUM - TOTAL - S	0.5	0.095		MG/KG	A00066
ST000674	ZINC - TOTAL - S	2.00	0.64		MG/KG	A00066

C
HEALTH AND SAFETY PLAN

FINAL HEALTH AND SAFETY PLAN FOR THE WORK PLAN FOR CHARACTERIZATION AND DESIGN OF INTERIM REMEDIAL MEASURE FOR THE OIL/TAR SEPARATOR AREA AT THE RG&E WEST STATION FORMER MGP SITE ROCHESTER, NEW YORK

SITE #: V00593-8

INDEX #: B8-0535-98-07

Prepared for:

Rochester Gas and Electric Corporation
Mr. Steve Mullin
89 East Avenue
Rochester, NY 14649

Prepared by:

Ish Inc.
804 Salem Woods Drive, Suite 201B
Raleigh, NC 27615-3313

and

META Environmental, Inc.
49 Clarendon Street
Watertown, MA 02472

February 2006

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LIST OF FIGURES

LIST OF TABLES

1
INTRODUCTION

This Health and Safety Plan (HASP) addresses the health and safety practices that will be employed by site workers participating in the soil and groundwater program at the Rochester Gas and Electric Corporation (RG&E), West Station former manufactured gas plant (MGP) site (site) located at 254 Mill Street in Rochester, New York. The HASP takes into account the specific hazards inherent to the West Station former MGP site and presents detailed procedures to be followed by Ish Inc. and any subcontractors it may retain in order to prevent or, if necessary, respond to potential health and/or safety concerns. Activities performed under this HASP will comply with OSHA regulations 29 CFR § 1910 and 1926, as amended. This HASP will be made available to any other contractor or subcontractor working on the site, in order to inform the party of any site characteristics or hazards.

It is the responsibility of officers, supervisors, and other employees in charge of company operations to see that work is carried out in a safe manner, and in accordance with safe operating practices and the instructions set forth in this manual. **It is also the responsibility of each worker to conform to the safe work methods contained in this manual, as well as the RG&E Contractor Safety and Health Obligations (Appendix G).**

As outlined in 29 CFR § 1910.120, a preliminary assessment of health and safety risks, based on a historical review of the characteristics of the West Station former MGP site was performed to aid in the selection of appropriate worker protection methods prior to site entry. The plan will be updated if any further hazards are identified during the initial site entry or any additional information is obtained concerning the materials at this site and their associated health and safety risks. For example, additional hazardous substance data sheets may need to be included as more data are gathered or appropriate engineering controls and personal protective equipment may be updated for the tasks to be performed.

Included in this HASP are five sections covering the Medical Surveillance Program, Site Safety Plan, Personal Protection and Monitoring, Work Zones and Decontamination, Training, and Emergency Procedures. The Site Safety Plan is written in a format such that it can be separated from this HASP and posted at the site for general use.

Ms. Lara Gray of META Environmental, Inc. has been designated the Ish Inc./META in-field Site Safety Supervisor for the work at the West Station former MGP site. When mentioned in the following plan, Site Safety Supervisor refers to Ms. Gray or her designee. If personnel changes are required to those designated at the time of the writing of this HASP, the changes will be identified during the on-site project kick-off meeting.

2
MEDICAL SURVEILLANCE PROGRAM

Workers handling or participating in hazardous waste operations can experience high levels of stress. Their daily tasks may expose them to toxic chemicals, safety hazards, biologic hazards, and physical hazards. They may develop heat stress while wearing personal protective equipment or working in extreme temperatures, or face life-threatening emergencies such as explosions and fires. Therefore, a medical program (29 CFR § 1910.120) is essential to assess and monitor workers' health and fitness both prior to employment and during the course of work, to provide emergency and other treatment as needed, and to keep accurate records for future reference. In addition, OSHA recommends a medical evaluation for workers required to wear a respirator (29 CFR § 1910.120).

Prior to entry on site, personnel working within the exclusion or work zone shall provide to the Site Safety Supervisor evidence of participation in a medical surveillance program, a fit test record, and current certification of training in accordance with the requirements of 29 CFR § 1910.120.

META Environmental, Inc. (META), an Ish Inc. team member, maintains continuous in-house medical surveillance programs designed specifically for field personnel engaged in work at sites where hazardous or toxic materials may be present. META employs Mount Auburn Hospital for its occupational medical monitoring program. Their address and phone number is:

Mount Auburn Hospital
Occupational Health Services
777 Concord Avenue
Cambridge, MA 02138
617/354-0546

Under Mount Auburn Hospital supervision, all field personnel undergo a complete physical examination, including a detailed medical and occupational history before they participate in any field studies. The medical program is maintained on an annual basis during their employment and upon the termination of employment with META. The following tests are performed as part of the examination:

- Complete blood workup, including screens for particular toxic substances anticipated at hazardous waste sites;
- Urine analysis screens for heavy metals and indicators of proper kidney and liver functions;
- Pulmonary function tests;
- Electrocardiogram (EKG);
- Hearing and eye exam;
- History and physical examination; and
- Chest x-ray (2 views for initial test).

Upon completion of these tests, the doctors certify whether personnel are fit for field work, in general, and fit to use levels of respiratory protection, in particular.

In the event that an employee of META or any other member of the field team is exposed to some form of hazardous substance and/or shows symptoms of exposure, he/she must inform the Site Safety Supervisor who will arrange an examination for that worker. In addition, each member of the field team is required to maintain current personnel Medical Data Sheets (MDS) which will be held by the Site Safety Supervisor during site activities. The MDS will be filled out prior to the field activities and placed in a sealed envelope to maintain medical confidentially. The MDS will only be accessed in the case of an emergency to alert emergency officials of any preexisting medical conditions.

3
SITE SAFETY PLAN

The plan presented in this section covers field investigation activities at the West Station former MGP site and establishes policies and procedures to protect workers and the public from the potential hazards posed by investigation activities at the site. In addition, the plan identifies measures to minimize accidents and injuries which have the potential to occur during normal daily activities or during adverse weather conditions.

3.1 GENERAL INFORMATION

- Utility Name: Rochester Gas and Electric Corporation
- Site Name: West Station former MGP site
- Site Location 254 Mill Street, Rochester, NY
- Date Prepared: February 2005
- Plan Prepared by: Lara Gray
- Scheduled Period of Plan Use: Through duration of project

The site can be described as follows:

1. Location and Access: The West Station former MGP site is located at 254 Mill Street on a rectangular-shaped parcel of land bordered by Mill Street, Falls Street, and the Genesee River. The Genesee River trends north-south along the eastern property fence line. The site can be accessed from Falls Street. The gate is accessed with a sensor badge by RG&E personnel and authorized contractors.

2. Existing Information for Site: Detailed site information is presented in Section 2 of the Work Plan for this investigation.
3. Site History/Status: The site operated as a gas manufacturing plant between 1910 and 1952 and used coal and water gasification as the gas producing process. RG&E currently maintains an oil-fired electric generating turbine, which is used during times of high peak demand. In addition a Central Water Treatment Facility, a screen house and water intake/discharge structure, oil storage tanks, an oil separator building, a transformer yard, an oil pump house, and multiple buildings which support site operations remain on-site. A former coal-fired power generation facility (Beebee Station) is also still present on-site, but not in operation.
4. Facilities and Utilities on Site: Several buildings on site are currently used for storage, offices, and maintenance activities. Utilities on site include electrical power lines and substation, telephone lines, water and sewer pipes, active steam pipes, and fuel oil storage and pipelines.
5. Buried Utilities: Underground utilities will be cleared by notifying Dig Safely New York (formerly UFPO) to mark the locations of underground utilities on-site.
6. Topography: The topography of the site is generally flat, and much of the site is paved or covered with crushed gravel.
7. Surrounding Population: The West Station former MGP Site is situated in a mostly commercial area in downtown Rochester.
8. Perimeter Control: The site is surrounded by a chain link fence, with access on Falls Street.
9. Emergency Response Capabilities: The site is accessible to emergency responders. Strong Memorial Hospital has an emergency room and is located on Elmwood Avenue, approximately 2.5 miles south of the site.

3.2 AUTHORIZED SITE PERSONNEL AND THEIR RESPONSIBILITIES

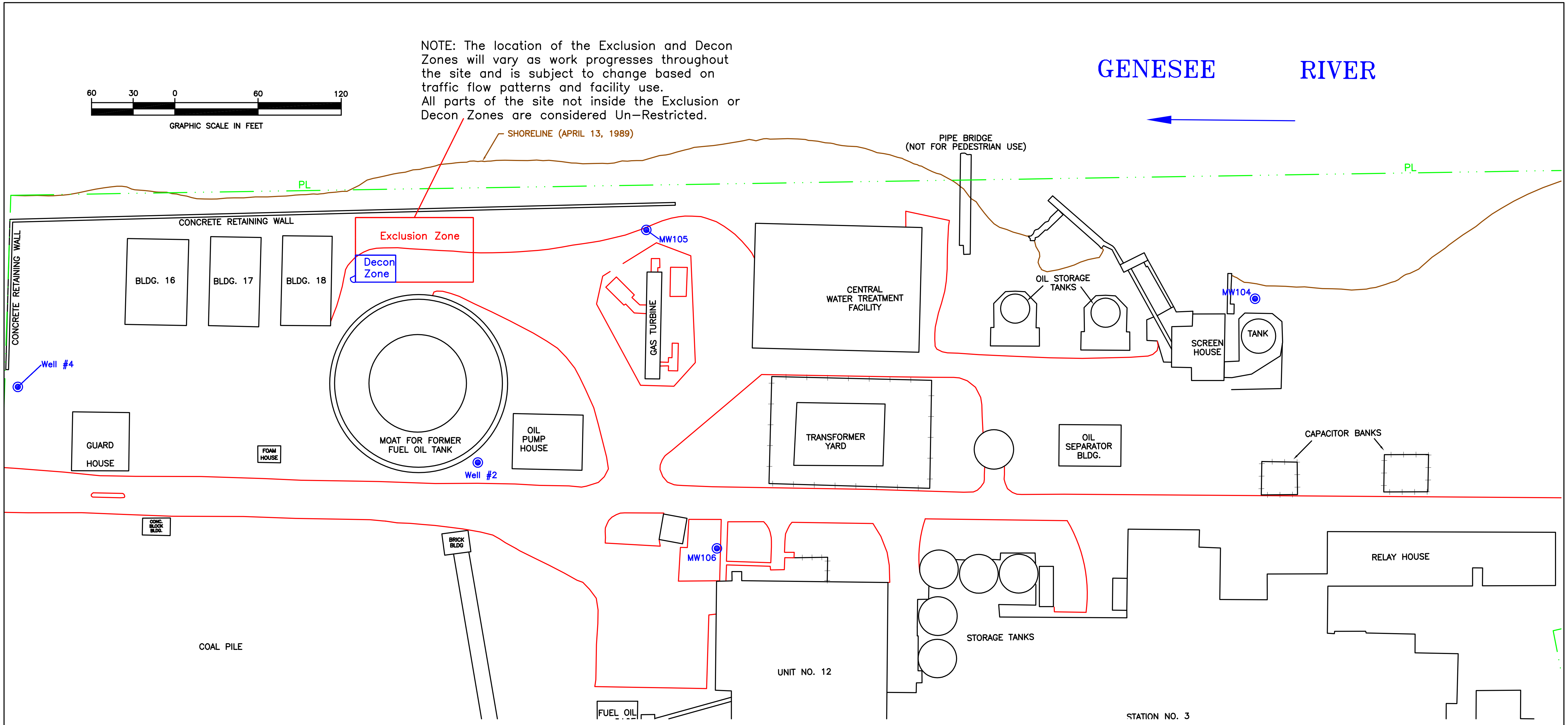
Responsibilities have been assigned to the personnel indicated in Table 3-1: (Note: One person may be responsible for more than one job function). Personnel arriving at or departing from the remedial investigation area of the site will log in and out with the record keeper. Activities on-site must be cleared through the project Field Team Leader or Project Manager (if on-site).

Table 3-1
Authorized Site Personnel and Responsibilities

Principal Investigator	Dr. Ishwar Murarka
Project Manager	Mr. Peter DeClercq
Field Team Leader	Ms. Lara Gray
Site Safety Supervisor	Ms. Lara Gray
Record Keeper	Ms. Lara Gray or designee
RG&E Project Field Coordinator	Mr. Daniel Kennedy
RG&E Project Manager	Mr. Steve Mullin

3.3 CONTROL OF SITE ACCESS

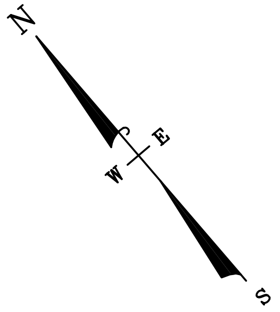
The site is secured by a chain link fence. The site is an active operating service center, so vehicles and personnel will be coming and going on the site during the IRM field activities. The Field Team Leader will be responsible for controlling access to the work areas and contaminated zones on the site. Work zone boundaries will be clearly defined for the different areas and unauthorized personnel will not be permitted entry. Site workers will check in with the Site Safety Supervisor as necessary when they move on and off the work area. Good housekeeping at and around the job site shall be practiced to avoid tripping, falling, or other hazards. Equipment and materials which may have to be left on the job site shall be placed out of the way to eliminate hazards. Figure 3-1 shows the site base map. Work zones will be moved around the site as needed during the field activities associated with the project.



NOTE: The location of the Exclusion and Decon Zones will vary as work progresses throughout the site and is subject to change based on traffic flow patterns and facility use.
All parts of the site not inside the Exclusion or Decon Zones are considered Un-Restricted.

LEGEND

— Existing Structures	● Existing Well Locations
— Paved Areas	



Note: Drawing based on Figure 1 by Atlantic Environmental Services titled "Soil Gas Locations" dated October 1991. Scale 1"=60'; Project No. 1309-02-21; Drawn by A.C.G.. Atlantic's drawing was based on "A Map Showing Rochester Gas & Electric Corporation's Property No. 3; Situated in Original Lot 48 of the 20,000 Acre Tract Township 1; Short Range Gates; City of Rochester; Monroe County; State of New York" dated June 13, 1989. Scale 1"=40'; Drawing No. 31570-19; Drawn by Thomas M. Sheehan N.Y.S.P.L.S.

Project:	Client:	
West Station/I03039	RG&E	Ish Inc./META

Figure 3-1
Site Map

Filename:	Drawn by:	Approved by:	Date:
West Station RI Work Plan	LMG	PJD	02/11/2005

3.4 HOURS OF ON-SITE ACTIVITIES

Field team members are expected to be on the site at 07:00, with work commencing shortly thereafter. Work will continue through the sunlight hours of the day and will end prior to sunset. Should RG&E or the local community prefer alternative hours the field team can accommodate as needed. The Field Team Leader or a designee will remain on-site until decontamination work has been completed.

3.5 EXCAVATION AND STAKE-OUTS

Before any subsurface investigation activity is to begin, a utility stake-out shall be requested at least two, but not more than ten, working days in advance. In addition to obtaining subsurface utility markings and clearance, the area will also be visually examined for overhead and other above grade utilities.

Excavations greater than five feet in depth, which workers may be required to enter, shall be sloped, shored, sheeted, braced, or otherwise supported in accordance with OSHA regulations subpart P of 27 CFR. In addition, these excavations will conform to OSHA regulations subpart P of 27 CFR and be certified by a "competent person" and/or a site engineer. Excavated or other material shall be effectively stored and retained at least three feet or more from the edge of the excavation. **Under no circumstances, will excavations greater than 4 feet be entered during the work at the West Station Site.**

When possible, trenches or excavations will be backfilled the same working day. When this is not possible, daily inspection of excavations shall be made by a competent person before work begins. If evidence of possible cave-ins or slides is apparent, work in the excavation shall cease until the necessary precautions have been taken to safeguard the employees. Trench observations will be made from a distance of several feet away from the narrow end wall of each trench. Special care will be taken to maintain a safe distance from the excavation so as not to collapse the open trench.

3.6 COMMUNICATION PROCEDURES

A cellular telephone will be available for use by Ish Inc./META personnel and all on-site personnel for on-site emergency use.

3.7 CONFINED SPACE ENTRY

The field activity will not involve any confined space entry as defined by 29 CFR § 1910.146.

3.8 FIELD OBJECTIVES

This plan is written specifically to cover field activities for the IRM field work at the West Station former MGP site. The following tasks are planned for the field activities:

- excavating test trenches,
- drilling of soil borings and installation of monitoring wells,
- well development,
- collection of groundwater samples,
- collection of subsurface soil samples, and
- sampling of wastewater/soil drums.

Potentially contaminated media associated with these activities may include site groundwater, surface water, decontamination fluids, extraneous fill material, and soil.

3.9 EVALUATION OF POTENTIAL HAZARDS

3.9.1 Hazardous Chemical Waste

The waste types that may be encountered at the West Station former MGP site include free tars, oils, lampblack, soil contaminated with organic chemicals, contaminated water, purifier waste (spent iron oxide impregnated wood chips), and other mixed wastes produced as by-products of the MGP process and petroleum residuals. The primary hazards of each are identified in the Table 3-2.

Table 3-2
Hazardous Chemical Waste Table

Waste Form:	**Tar/Creosote**							
	X	Gas	X	Liquid	X	Soil (adsorbed)	X	Sludge
Characteristic		Corrosive		Ignitable		Radioactive	X	Volatile
	X	Toxic		Reactive	X	Other: Carcinogenic		
Source		Drum	X	Pit (buried)		Pond		Lagoon
		AST		UST	X	Soils	X	Groundwater
	X	Debris	X	Other: Piping				

Waste Form:	**Purifier Waste**							
		Gas		Liquid	X	Soil (adsorbed)		Sludge
Characteristic		Corrosive		Ignitable		Radioactive		Volatile
	X	Toxic	X	Reactive	X	Other:		
Source		Drum	X	Pit (buried)		Pond		Lagoon
		AST		UST	X	Soils	X	Groundwater
	X	Debris		Other:				

Waste Form:	**SVOCs**							
		Gas	X	Liquid	X	Soil (adsorbed)		Sludge
Characteristic		Corrosive		Ignitable		Radioactive		Volatile
	X	Toxic		Reactive	X	Other: Carcinogenic		
Source		Drum	X	Pit (buried)		Pond		Lagoon
		AST	X	UST	X	Soils	X	Groundwater
	X	Debris		Other:				

Waste Form:	**VOCs**							
	X	Gas	X	Liquid	X	Soil (adsorbed)		Sludge
Characteristic		Corrosive	X	Ignitable		Radioactive	X	Volatile
	X	Toxic		Reactive	X	Other: Carcinogenic		
Source		Drum	X	Pit (buried)		Pond		Lagoon
		AST	X	UST	X	Soils	X	Groundwater
	X	Debris		Other:				

"X" = A characteristic or source that may be associated with the waste type at the West Station site.

3.9.2 Electrical/Physical Hazards

A main priority of the field team will be proper housekeeping to avoid trip and fall hazards. In addition, hand and power tools may be used for various tasks and can present a variety of hazards, both from flying objects and electrocution. Power sources will be equipped with a ground fault current interrupter (GFCI).

In addition, over head power lines are present at the site and care will be taken during field activities using a drill rig so that proper clearance is maintained. Downed power lines are extremely hazardous and should be avoided. If electric shock results from contact with a downed power line, the power line must be turned off before a rescuer approaches anyone who may be in contact with the wire. If the victim is in a car with a power line fallen across it, tell them to stay in the car until the power can be shut off. The only exception to this rule is when fire threatens the car. In this case, tell the victim to jump out of the car without making contact with the car or wire.

If you approach a victim and you feel a tingling sensation in your legs and lower body, stop. This sensation signals you are on energized ground and that an electrical current is entering through one foot, passing through your lower body and leaving through your other foot. If this happens, raise a foot off the ground, turn around and hop to a safe place. Prevent bystanders from entering the danger area.

4
PERSONAL PROTECTION AND MONITORING

4.1 GENERAL

Personnel shall wear suitable clothing and proper protection in the performance of their jobs to afford protection against the environment and work hazards. Proper protection consists of, but is not limited to, approved goggles, spectacles, face shields, helmets, gloves, ear protection, steel toed safety shoes, and respiratory or ventilation systems. No person shall be permitted to wear contact lenses where eye protection is required without a recommendation from a doctor and approval of the Site Safety Supervisor.

4.1.1 Personal Protection Equipment (PPE - 29 CFR § 1910.132)

In accordance with 29 CFR § 1910.132, protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of process or environment, chemical hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation, or physical contact.

4.1.2 Eye and Face Protection (29 CFR § 1910.133)

Protective eye and face equipment shall be required where there is a reasonable probability of injury that can be prevented by such equipment. In such cases, employers shall make conveniently available a type of protector suitable for work to be performed, and workers shall use such protectors. No unprotected person shall knowingly be subjected to a hazardous environmental condition. Suitable eye protectors shall be provided where machines or moving parts present the hazard of flying objects, glare, liquids, metal filings, gases or vapors, or a combination of these hazards.

Each affected person shall use eye protection that provides side protection when there is a hazard from flying objects. Detachable side protectors (e.g. clip-on, or slide-on side shields) meeting the pertinent requirements of this section are acceptable.

4.1.3 Head Protection (29 CFR § 1910.135)

Each affected person shall wear protective helmets when working in areas where there is a potential for injury to the head from falling objects. Protective helmets shall comply with the American National Standard for Personnel Protection Requirements (ANSI), ANSI Z89.1.

4.1.4 Hand Protection (29 CFR § 1910.138)

Employers shall select and require personnel to use appropriate hand protection when workers' hands are exposed to hazards such as those from the skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns, and harmful temperature extremes.

4.1.5 Foot Protection (29 CFR § 1910.136)

Each affected person shall wear protective footwear when working at the site. Protective footwear shall comply with ANSI Z41 and as required by RG&E safety rules (see Appendix G)

Metal toe guards should be worn when using or in the area of heavy equipment. Sneakers or open-toed shoes shall not be worn on any job site or any area where the worker is exposed to a potential foot injury.

4.1.6 Hearing Protection (29 CFR § 1910.95)

Per OSHA regulations (29 CFR § 1926.101), hearing protection shall be provided to personnel working in areas of high decibel noise. Hearing protection shall be worn by persons working in high noise areas with an intensity of 85 dBA (decibel average for 8 hours) or greater. If you would have to raise your voice to be heard by someone less than two (2) feet away, you should be wearing hearing protection.

4.1.7 Respiratory Protection (29 CFR § 1910.134)

In the control of those occupational diseases caused by breathing air contaminated with harmful dust, fogs, fumes, mists, gases, smokes, sprays, or vapors, the primary objective shall be to prevent atmospheric contamination. This shall be accomplished as much as feasible by acceptable engineering control measures. When effective engineering controls are not feasible, or while they are being instituted, appropriate respirators shall be used pursuant to OSHA requirements.

Air-purifying respirators have limited use at hazardous waste sites and can be used only when the ambient atmosphere contains sufficient oxygen (≥19.5%) (20 CFR § 11.90). Also, for the respirator cartridge to be effective, the types of air contaminants have to be identified, and concentrations measured to determine if the cartridge can remove the contaminants.

4.2 LEVELS OF PROTECTION FOR SPECIFIC SITE ACTIVITIES

Table 4-1 stipulates protective equipment that will be required for different tasks during the work. Table 4-2 indicates the specific protective equipment for each level of protection.

Table 4-1
Levels of Protection for Planned Site Activities

Site Activity	Health Risk	Level of Protection	Backup Level of Protection
Boring/Well Drilling	Low	Modified D	C
Test Trenches	Low	Modified D	C
Groundwater Sampling	Low	Modified D	C
Drum Sampling	Low	Modified D	C
Soil Sampling	Low	Modified D	C

Table 4-2
Details of Levels of Protection

Level C*	**Modified Level D***
Full face respirator or half face respirator with safety glasses, depending on site conditions (with appropriate filters)	Safety glasses or chemical splash goggles
Tyvek^{TM} suit or other chemical resistant clothing	Tyvek^{TM} suit or other chemical resistant clothing (optional)
Hard hat	Hard hat
Steel-toe footwear	Steel-toe footwear
Sound protectors (optional)	Sound protectors (optional)
Disposable, nitrile or latex inner gloves	Disposable, nitrile or latex inner gloves
Chemical resistant outer gloves	Leather or chemical resistant outer gloves (optional)
Two-way radio (worn outside protective clothing) (optional)	Two-way radio (worn outside protective clothing) (optional)

*Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities

4.3 AIR MONITORING

This HASP is designed for a field program which requires a level of protection not to surpass Level C for personal protection. Based upon previous MGP site investigations, it is unlikely that levels of protection other than Level D will be necessary. However, field team members will be prepared to use Level C protection should the situation warrant. If protection beyond Level C is needed, the field team will suspend activities until the proper protective equipment is acquired and the HASP is updated. The Site Safety Supervisor may increase or decrease the requirements of a level of protection as he/she deems fit based on sound safety principles and prevailing conditions. The basis for decreasing the protection standards established herein shall be recorded in the daily logbook prior to use of a decreased level of protection.

4.3.1 Action Levels

To make a conservative assessment of when different levels of respiratory protection are needed during the field work, it will be assumed that the organic vapors detected by the air monitoring instruments consists of the most toxic volatile compounds expected to be found on the site. Preliminary evaluation of the risks expected at the site indicates that the most toxic volatile compounds that are probably present are VOCs (particularly BTEX). Based on data published by OSHA, ACGIH, and NIOSH, along with contractor knowledge of site contaminants, the levels of personal protection shown in Table 4-3 will be employed when the given concentrations of organic vapor are detected in the breathing zone

Odors or dusts derived from site contaminants may cause nausea in some workers, although the contaminants are at low levels, well below the safety limits as previously defined. In such cases, workers may use respirators or dust masks to mitigate the impact of nuisance odors or dusts. In addition, dust masks may be worn when airborne dust is originating from uncontaminated sources (e.g., clean backfill). Note that, when practical, work areas should be positioned upwind of organic vapor and dust sources to reduce the potential for worker exposure.

Level D protection should be used when the atmosphere contains no known hazard and work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.

Level C protection should be used when the atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin. Also, the types of air contaminants must be identified, concentrations measured, and an air-purifying respirator must be available that can remove the contaminants within the requirements set for air-purifying respirators.

Combinations of personal protection equipment other than those described for Level A, B, C, and D protection may be more appropriate and may be used to provide the proper level of protection.

Table 4-3
Air Monitoring Action Levels

Instrument	Reading	Level of Respiratory Protection/Action
FID/PID	Background – 1 ppm in Breathing Zone	Level D
FID/PID	> 1 ppm in Breathing Zone, confirm with Benzene detector tube (15 minute average)	Level C
FID/PID	1-25 ppm (confirmed absence of Benzene)	Level D
FID/PID	>25 and <500 ppm above background in Breathing Zone (15 minute average)	Level C
FID/PID	> 500 ppm above background (15 minute average)	Level B, Institute Vapor Suppression Measures
CGI/O2 meter	> 10% LEL, borehole	Proceed with Caution
CGI/O2 meter	> 20% LEL, borehole	Stop work, allow to vent
CGI/O2 meter	> 5% LEL, in Breathing Zone	Limit activities to those which do not generate sparks
CGI/O2 meter	> 20% LEL, in Breathing Zone	Stop work, allow to vent
CGI/O2 meter	< 19.5% O_2, in Breathing Zone	Level B
CGI/O2 meter	> 23.5% O_2, borehole surrounding area or borehole	Stop work and evacuate the work area. Eliminate all ignition sources. Purge borehole if necessary. Identify source of oxygen
Dust meter	< 0.2 mg/m^3, 15 minute average	Level D
Dust meter	0.2 – $5/m^3$, C 15 minute average or 1.5 x above background	Instrument dust suppression measures
Dust meter	> 5 mg/m^3	Level B

The Site Safety Supervisor will keep close track of the work schedules listed in the work plan in order to be sure that workers entering the site have had their safety briefing and that the amount of safety equipment kept on-site is sufficient for workers and observers present at any time. Each field team member is responsible for his/her own respirator.

4.3.2 Air Monitoring Protocols

4.3.2.1 On-site Monitoring

The following monitoring instruments will be available for use during field operations as necessary:

- Photo-ionization Detector (PID), Thermo 580B with a 10.6eV lamp or equivalent,
- Colorimetric detector tube for Benzene;
- Miniram dust meter, MIE model PDM-3 or equivalent, and
- Combustible Gas Indicator (CGI)/Oxygen (O_2) meter, MSA 361 or equivalent.

These instruments will be used to monitor the action levels shown in Table 4-3. Organic vapor concentrations in the air shall be measured using the PID during the sampling and drilling activities. During drilling operations, organic vapor concentrations shall be measured continuously; during other activities, readings shall be taken at least once every 15 minutes. Organic vapor concentrations shall be measured upwind of the work site to determine background concentrations at least twice per day, (once in the morning and once in the afternoon). Measurements will be monitored from the breathing zone height (4 to 5 feet above ground level) at worker locations for determining the actual safety conditions and whether there is a need to change to a higher level of safety (or whether the level of safety can be lowered). The Field Team Leader will interpret monitoring results using professional judgment.

Colorimetric detector tubes shall be used to determine the potential presence of benzene when action levels have been exceeded.

A dust meter shall be used to measure airborne particulate matter during intrusive activities. Monitoring will be continuous and readings will be averaged over a 15 minute period for comparison with action levels.

A CGI/O_2 meter shall be used to monitor for combustible gases and oxygen content in the boreholes and surrounding areas and elsewhere as necessary. During drilling operations, combustible gas readings shall be taken each time the auger bit is removed from the borehole.

Guidelines have been established by the National Institute for Occupational Safety and Health (NIOSH) concerning the action levels for work in a potentially explosive environment. These guidelines are as follows:

10% LEL – Limit activities to those which can not generate sparks.

20% LEL – Cease activities in order to allow time for the combustible gases to vent.

4.3.3 Air Monitoring Equipment Calibration and Maintenance

Air monitoring equipment will be maintained and calibrated in accordance with the manufacturer's instructions.

Monitoring instruments must be calibrated and maintained periodically. The limitations and possible sources of errors for each instrument must be understood by the operator. It is important that the operator ensures that the instrument responds properly to the substances it was designed to monitor. Portable air quality monitoring equipment that measures total ionizables present, such as the Thermo 580B, must be calibrated twice per day, before commencing work and at approximately midway through of each workday. Combustible gas/oxygen/%LEL meters (explosimeters) such as the MSA 360 must also be calibrated twice each day. Real time aerosol monitors, such as the Miniram, must also be zeroed at the beginning of each sampling period. The specific instructions for calibration and maintenance provided for each instrument should be followed.

5
WORK ZONES AND DECONTAMINATION

5.1 SITE WORK ZONES

To reduce the spread of hazardous materials by workers from the contaminated areas to the cleaner areas, work zones will be delineated at the site. The flow of personnel between the zones will be controlled. The establishment of the work zones will help ensure that: personnel are properly protected against the hazards present where they are working, work activities and contamination are confined to the appropriate areas, and personnel can be located and evacuated in an emergency.

5.1.1 Exclusion Zone

The exclusion zone will be established at the site for drilling activities; unprotected onlookers should be located 50 feet upwind of drilling or soil sampling activities. In the event that volatile organics are detected in the breathing zone as discussed in Section 4, personnel within the exclusion zone must upgrade to Level C protection. Exclusion zones will also be established during any activity when Level C protection is established as a result of conditions discussed in Section 4.

Personnel within the exclusion zone will be required to use the specified level of protection. No eating, drinking or smoking will be allowed in the exclusion or decontamination zones.

5.1.2 Decontamination Zone

If appropriate, a decontamination zone will be established between the exclusion zone and the support zone, and will include the personnel and equipment necessary for decontamination, as discussed below. Personnel and equipment in the exclusion zone must pass through the decontamination zone before entering the support zone. This zone should always be located upwind of the exclusion zone.

5.1.3 Support Zone

The support zone will include the remaining areas of the job site. Break areas, operational direction and support facilities (to include supplies, equipment storage and maintenance areas) will be located in this area. No equipment or personnel will be permitted to enter the support zone from the exclusion zone without passing through the personnel or equipment decontamination station. Eating, smoking, and drinking will be allowed only in this area. Smoking will only be allowed in smoking areas designated by RG&E.

5.2 DECONTAMINATION PROCEDURES

Decontamination areas will be established for the following activities:

- Equipment decontamination
- Personnel decontamination

5.2.1 Large Equipment, Drill Rig and Backhoe Decontamination Pad

Equipment used in intrusive work, including backhoe, drilling rig, augers, and bits will be cleaned with high pressure hot water and scrubbed with a wire brush to remove dirt, grease, and oil before beginning field work and before leaving the project site upon completion of the last sampling activity.

A decontamination pad will be constructed of high density polyethylene sheeting on a prepared surface sloped to a sump. The size of the pad will accommodate the equipment to be cleaned without tearing of the plastic sheet. The sides of the pad will be bermed to contain decon water. Upon completion of field activities, the decontamination pad will be properly decommissioned by removing liquid from the sheeting, including the sump area, and allowing area to dry. The sheeting will then be folded and placed in the waste container. The earthen material or wood timbers used to construct the containment berm will be inspected to ascertain if the material has come in contact with decon liquids during use. If they have, the materials will be disposed of in the waste container for subsequent disposal at an appropriate facility. If the materials have not been in contact with decon liquids, they may be reused.

The drill rig, augers, well supplies, etc. needed for the drilling operations will be staged in an area selected under direction from RG&E personnel. The decon pad will be located proximate to this area to facilitate efficient cleaning and organization of equipment and supplies. This area will be located within the security fence surrounding the site and will not be accessible to the public.

5.2.2 Small Equipment Decontamination Station

An equipment decontamination station will be established in the decontamination area where small sampling equipment (split spoons, spatulas, bowls) will be cleaned and checked before they are used. The decontamination station will be equipped with water for washing, detergent, spray bottles of methanol and distilled water, and brushes for scrubbing. Once cleaned, the equipment will be transferred to a "clean" carrying tray or wrapped in aluminum foil.

The following is a specific equipment decontamination procedure to be used by site workers wearing protective clothing and equipment from Level D through Level C.

1. knock, scrape, or wipe off excess soil
2. pre-rinse with tap water
3. wash with non-phosphate detergent and tap water
4. rinse with tap water
5. rinse with 10% nitric acid
6. rinse with distilled water
7. rinse with methanol
8. rinse with distilled water
9. air dry on a clean surface and wrap in foil.

5.2.3 Personnel Decontamination Station

A personnel decontamination station will be set up in the decontamination area, the contamination reduction zone (CRZ), to provide an area for workers to clean and remove their protective clothing (e.g., boots and gloves) and other equipment, such as respirators. It will be equipped with basins of water, detergent, and other decontamination fluids. Once personnel have gone through decontamination at this station and taken off their protective gear, they will be able to leave the site and proceed to the field office where they will wash any areas potentially exposed to contaminants.

The following is a specific personnel decontamination procedure to be used by site workers wearing protective clothing and equipment from Level D through Level C.

1. equipment drop
2. outer boot and glove wash and rinse, tape removal, and drop (wash with non-foaming detergent, rinse with fresh water spray (29 CFR § 1910.141), methanol, then fresh water spray)
3. respirator wash, rinse, and drop (use same wash and rinse sequence as in Step 2 with a soft-bristle brush and a sponge)
4. hard hat and goggle removal (use same wash as in Step 2)
5. Tyvek^{TM} (or appropriate personal protective clothing) suit removal
6. remove inner gloves
7. wash potentially exposed skin (use water and soap at indoor sink)

Items that cannot be decontaminated will be disposed of properly in a solid waste drum. Visibly clean items will be disposed of in trash containers.

5.2.4 Decontamination Equipment Checklist

The following is a list of decontamination equipment which should be kept on-site:

Table 5-1
Decontamination Equipment Checklist

Item	Quantity
Alconox detergent concentrate	~ 10 oz., dry
Hand pump sprayers	5
Long-handle, soft bristle brushes	3
Cleanser for respirators	Several packages
Plastic bags	1 box
Methanol	4 liters
Paper towels	4 rolls
Distilled water	~3 gallons

6
TRAINING

Formal health and safety training and specific on-site training are essential aspects of any program designed to protect workers in areas suspected of containing hazardous or potentially hazardous materials. The following subsections address both formal health and safety training requirements and a specific on-site training program.

6.1 HEALTH AND SAFETY TRAINING

All of the Ish Inc./META field personnel have attended 40-hour health and safety training course (29 CFR § 1910.120) in which they were taught the potential hazards of site work, how to minimize exposure, and how to initiate response actions. A list of the META personnel who may work at the West Station former MGP site are provided below with dates of the most recent safety courses they attended.

Table 6-1
Site Personnel Safety Training Summary

Ish Inc./META Personnel	OSHA Courses	Date
Peter De Clercq	Health and Safety Training Supervisor Training	7/93 – updated 6/04 1/99
Lara Gray	Health and Safety Training Supervisor Training	7/02 – updated 7/04 7/04

The training course consists of classroom instruction, field demonstration, use of respirators, and use of appropriate protective clothing, written tests, and field tests. The major topics covered in this course are:

- Identification of hazardous substances
- Properties of hazardous substances
- Routes of exposure
- Toxicity of different substances, and their individual and synergistic effects
- Practical considerations in health and safety management
- Physical properties of chemicals
- References for threshold limit values (TLV), lower explosion limits (LEL), toxicity data, cross references
- Technical assistance organization
- Air monitoring and survey instruments
- Site entry and egress procedures
- Heat stress monitoring
- Levels of personnel protection
- Controlling access of work zones and other contaminated areas
- Personnel decontamination
- Equipment decontamination
- Site/area safety planning

Everyone attending the course is fit tested for his/her personal respirator and is trained in using a self-contained breathing apparatus and a Level A suit. The course also emphasizes the importance and procedures of decontamination.

6.2 FIRST AID AND CPR TRAINING

One or more of the field team members shall be trained in first aid fundamentals including cardiopulmonary resuscitation. Injury response procedures shall conform to OSHA regulation 29 CFR § 1926.950(e).

6.3 ON-SITE TRAINING PROGRAM

After the field office has been set-up at the West Station former MGP site, but before any field activities begin, the Site Safety Supervisor (or designee) will conduct an on-site training meeting for personnel and observers who will be involved in the remedial investigation. This program will cover specific practices and potential problems inherent to the site. No person will be allowed to work at the site unless he/she has attended this training meeting. During the training program, the site HASP will be reviewed and copies made available to those attending. Copies will be kept in the field vehicle throughout the investigation. The major components of the on-site training include a review of:

1. suspected chemical hazards, their form (e.g. vapor, gas, liquid), and the warning signs of their presence;
2. potential hazards posed by drilling, well installation, and sampling operations;
3. potential hazards of conducting operations in the presence of underground and overhead utilities;
4. operational procedures:
    - control of site activities
    - control of site access and perimeter
    - zones of hazard
    - levels of protection
    - detection equipment
    - decontamination procedures
5. emergency procedures:
    - first aid
    - emergency communications' procedures, and responsible parties
    - location of emergency equipment
    - local response groups and their phone numbers
    - evacuation procedures

In addition, personnel must fit test their respirators prior to commencing work in the exclusion zone at the site and confirm in writing that they have read the entire site HASP.

Any new personnel who join the field investigation team later in the study are required to attend a similar health and safety briefing before they may participate in any aspect of the field program.

Site-specific rules and regulations will be emphasized during the on-site safety meeting. The following rules will also be posted in conspicuous areas around the site, if available:

1. No smoking, drinking, or eating is permitted within restricted (contaminated) zones.
2. Personnel, clothing, and equipment in contact with contaminated soils, fuel, or other contamination materials within the restricted area must go through full decontamination before moving into a "clean" area.
3. The Site Safety Supervisor has full authority over start-up and shutdown of operations from a safety perspective. He/she will determine whether conditions are too extreme for work and he/she will establish the working hours at the site.

Additional training meetings will be held if necessitated by changing site conditions, new operational procedures, or the entry of new personnel unfamiliar with important daily safety topics. A record will be kept of safety meeting dates and topics discussed. A sample record is provided as Attachment F. Each morning before work commences, a brief safety meeting will be conducted to review safety procedures and discuss any pertinent safety issues.

7
EMERGENCY PROCEDURES

This section establishes procedures and provides necessary information should an emergency occur during site field activities. Since emergencies happen unexpectedly and quickly and require an immediate response, contingency planning and advanced training of staff are essential. Specific elements of emergency support procedures which are addressed in the following subsections include: communications, local emergency support units, preparations for medical emergencies, and first aid for injuries incurred on-site.

7.1 COMMUNICATIONS

A mobile telephone will be available on-site for the field team and subcontractor use. It will be located in the rental van, "command post" that will be parked directly outside the study area, or will be maintained by the Field Team Leader or designated representative. If the field team divides into two or more groups within the study area, a series of two-way radios will be available on-site to maintain verbal communication. Should verbal communication methods breakdown or be hindered by required safety measures, i.e., respirators, standard hand signals will be used to communicate within the study area. The standard hand signals include:

Table 7-1
Standard Hand Signals

Standard Hand Signals	
One or two hands on top of head	I'm all right
Thumbs up	I understand, OK
Thumbs down	No, negative
Grip partners wrist or both hands around wrist	Leave area immediately
Waving hands over head	Come over here, quickly
Hand gripping throat	Can't breathe

7.2 LOCAL EMERGENCY SUPPORT UNITS

In order to be able to deal with any emergency that might occur during the site investigation, the following information has been obtained and will be posted prominently by the mobile phone:

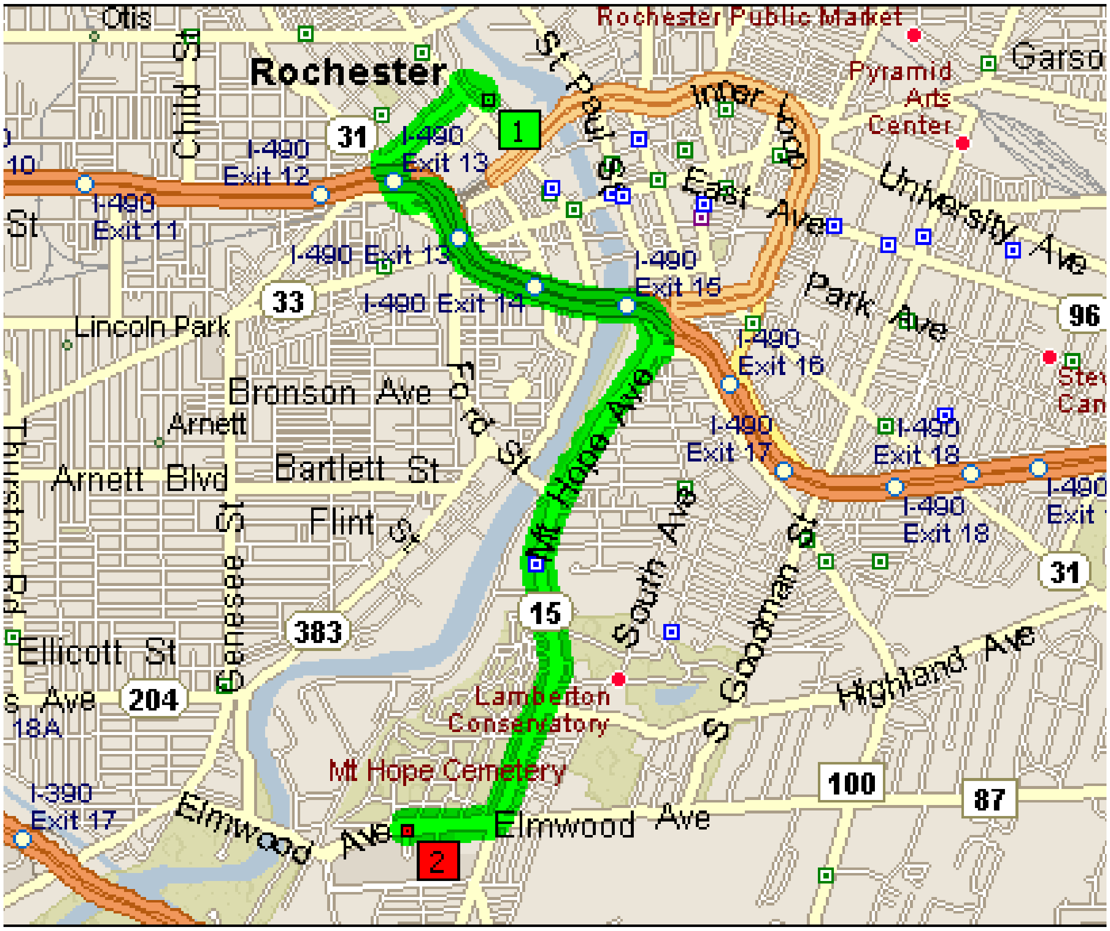
911 Center		**911**
Local emergency medical team:		
	Emergency Ambulance	**911**
Nearest emergency room:		**585/275-4551**
	Strong Memorial Hospital **Rochester, NY**	
Rochester Police Department:		**911**
Fire Department		**911**
Utility Contacts:	**RG&E Emergency Control Center**	**585/724-8917**
	Dan Kennedy	**585/315-0950**
	Steve Mullin (RG&E)	**585/771-4556**
Utility Emergencies:	**Dig Safely New York (UFPO)**	**800/962-7962**
NYSDEC Spill Hotline		**800/457-7362**
National Information Centers:		
	National Response Center	**800/424-8802**
	Central New York Regional Poison Control Center	**800/222-1222**

7.3 PREPARATION FOR MEDICAL EMERGENCIES

In the event of an accident, personnel from the hospital emergency room will be informed of the events and actions leading up to the incident, as well as being given any pertinent site related Material Safety Data Sheets. This information will assure the proper treatment needed to handle cases of overexposure to any of the contaminants or hazardous materials found or used at the site. These chemicals are described in detail in the appended Material Safety Data Sheets (see Attachment A). Instructions for finding the Emergency Room will be posted conspicuously in the site vehicle. Figure 7-1 shows the location of the Hospital with respect to the site.

Figure 7-1
Route to Local Medical Facility, Strong Memorial Hospital Emergency Room Located at 601 Elmwood Ave., Rochester, NY 14642

Mile	Instruction
0.0	**Depart 254 Mill St, Rochester, NY 14614 on Mill St (North-West)**
0.1	Turn LEFT (South-West) onto Brown St
0.5	Turn LEFT (South-East) onto SR-31 [W Broad St]
0.6	Turn off onto Ramp toward I-490
0.8	Merge onto I-490 (South)
1.6	At I-490 Exit 15, turn off onto Ramp toward Inner Loop / South Ave / RT-15
1.8	Continue (South) on South Ave
1.8	Turn RIGHT (West) onto SR-15 [Mt Hope Ave]
3.6	Turn RIGHT (West) onto Elmwood Ave
4.0	Turn LEFT (South) onto Hospital Dr
4.0	**Arrive 601 Elmwood Ave, Rochester, NY 14620**



Before field work on the site commences, personnel who will be working there or observing the operations will complete a medical data sheet to include the following information:

- Name, address, and home telephone number
- Age, height, weight
- Name of person to be notified in the case of an emergency
- All prescription and non-prescription medications currently being used
- Allergies
- Particular sensitivities
- Use of contact lenses or eyeglasses
- Short medical history including list of previous illnesses
- Name of personal physician and telephone number

These data sheets will be filled out by each worker during his/her initial site safety training meeting and before he/she performs any work on-site. Medical Data Sheets will be filed in the field vehicle, and maintained by the Site Safety Supervisor or his/her designee (see Attachment B for a sample medical data sheet).

If a team member becomes exposed to or suffers from a symptom of exposure to site materials and is taken to the hospital, a copy of his/her medical data sheet will be presented to the attending physician.

7.4 FIRST AID FOR INJURIES INCURRED DURING FIELD WORK

Injuries, no matter how slight, will be reported to the Site Safety Supervisor immediately. An accident report (Attachment C) will be completed for every accident by the Site Safety Supervisor. The following first-aid equipment will be available at the site office/command post:

- First aid kit
- Emergency eye wash

During the site safety briefing, project personnel will be informed of the location of the first aid station that will be set up at the command post.

When possible, site workers will refrain from administering first aid for serious injury or illness and wait for the arrival of professional paramedics at the site to take the appropriate action. Unless they are in immediate danger, injured persons will not be moved until paramedics can attend to them. Some injuries, such as severe cuts and lacerations or burns, may require immediate treatment. At least one Ish Inc./META team member having training in first aid and CPR will be on-site at times during the investigation. He/she may be called upon to respond to such injuries. Ish Inc./META team members will closely follow any first aid instructions given by doctors or paramedics before an emergency medical unit arrives at the site, or before the injured person is transported to the hospital.

7.4.1 First Aid Equipment List

The first aid kit(s) kept at the site will consist of a weatherproof container with individual sealed packages of each type of item listed below:

- Gauze roller bandages 1" and 2"
- Gauze compressed bandages, 4"
- Adhesive tape, 1"
- Bandages, 1"
- Butterfly bandages
- Triangular bandages, 40"
- Ampules of ammonia inhalants
- Burn dressing and sterilized towels
- Surgical scissors
- Eye dressing
- Emergency eye wash
- First Aid Cream
- Tourniquet
- Alcohol
- Hydrogen peroxide

7.4.2 Portable Fire Extinguishers (29 CFR § 1910.157)

Portable ABC rated fire extinguisher(s) and sorbent pads will be located near a drill rig or other heavy equipment during on-site activities. Fire extinguisher(s) will be properly maintained and tagged.

An emergency at any site, such as a fire or chemical release, might require that some appropriately trained site workers direct traffic on or near the site. Reflective vests, flares, traffic cones (or equivalent), and flashlights may be used for traffic control on-site.

7.5 COLD AND HEAT RELATED EMERGENCIES

7.5.1 Frostbite

Frostbite occurs when temperatures drop below freezing. Tissue is damaged in two ways: (1) actual tissue freezing, which results in the formation of ice crystals between the tissue cells, and (2) the obstruction of blood supply to the tissues.

Signs and Symptoms

Superficial:

- Skin color is white or grayish yellow.
- Pain may occur early and later subside.
- Affected part may feel only very cold and numb. There may be a tingling, stinging, or aching sensation.
- Skin surface will feel hard or crusty and underlying tissue soft when depressed gently and firmly.

Deep:

- Affected part feels hard, solid, and cannot be depressed.
- Blisters appear in 12 to 36 hours.
- Affected part is cold with pale, waxy skin.
- A painfully cold part suddenly stops hurting.

First Aid

- Frostbite injuries follow the same first aid treatment.
- Do not attempt to rewarm if a medical facility is nearby or there is a chance that refreezing may occur.

- Remove any clothing or items that could impair blood circulation.
- Put the frostbitten part(s) in warm (not hot) water (102-106 ^{o}F).
- Do not use water greater than 106 ^{o}F.
- Do not break any blisters.
- Do not rub the part.
- Do not walk on frostbitten toes, especially after rewarming.
- Do not allow the thawed part to refreeze.
- Do not rewarm with anything other than water, otherwise you can not control the temperature and may burn the victim.

7.5.2 Heat Cramps

Heat cramps are painful muscle spasms in the arms or legs. They may occur when an excessive amount of body fluid is lost through sweating.

Signs and Symptoms

- Severe cramping, usually affecting arms or legs.
- Abdominal cramping.
- Skin: normal temperature, but heavy perspiration.

First Aid

- Move victim to a cool place.
- Rest the cramping muscle.
- Give the victim a lot of cold water or sports drink.
- Do not massage the muscle.

7.5.3 Heat Exhaustion

Heat exhaustion results from either excessive perspiration or the inadequate replacement of water lost by sweating.

Signs and Symptoms

- Heavy sweating.
- Weakness.
- Fast pulse.
- Normal body temperature.

- Moist clammy skin.
- Headache, dizziness, vomiting, and nausea.

First Aid

- Move victim to a cool place.
- Elevate legs 8 - 12 inches.
- Cool the victim with cold packs or wet towels.
- Give the victim cold water if they are conscious.
- If no improvement in 30 minutes, seek medical attention.

7.5.4 Heat Stroke

Heat stroke happens when the body is subjected to more heat than it can handle.

Signs and Symptoms

- Dry or wet hot (>104 ^{o}F) skin.
- Confused, lethargy, or unconsciousness.
- Rapid breathing and pulse.

First Aid

- Check the A, B, C's (Airways open, Breathing, and Circulation).
- Move victim to a cool place, remove heavy clothing.
- Elevate head and shoulders.
- Cool the victim.
- Seek medical attention immediately.

7.5.5 Burns

First Aid

First Degree

- Apply cold water until pain stops (10-30 mins.) and dry sterile dressing.

Second Degree

- Proceed as first degree.
- Do not break blisters or remove tissue.
- Do not use antiseptic preparation or ointment.
- Seek medical attention.

Third Degree

- Check the A, B, C's (Airways open, Breathing and Circulation).
- Treat for shock.
- Elevate arms or legs to reduce swelling.
- Do not apply cold or ice, conserve heat to prevent hypothermia.
- Do not open any blisters.
- Apply sterile dressing.
- Do not remove melted/burned clothing.
- Seek medical attention immediately.

7.5.6 Chemical Burns

A chemical burn causes tissue damage and continues to cause damage until it is inactivated by the tissue, is neutralized, or is diluted with water.

First Aid

- Wash with copious amounts of water (acids, alkalis, caustic agents).
- Remove any contaminated clothing.
- Do not apply water under any type of pressure (pressure drives the chemicals deeper) apply water for up to 1 or more hours.
- Brush off dry chemicals before applying water.
- Flush eyes for ≥ 15 minutes with low pressure water.
- Do not attempt to neutralize a chemical, (it may create damaging heat).
- Seek medical attention immediately.

7.5.7 Electrical Burns

High voltage electrical currents padding through the body may disrupt the normal heart rhythm, cause cardiac arrest, burns, and other injuries. In case of an electrical burn, immediately contact emergency medical services. Then, check for multiple burn sites and cover the burns with a loose, dry, sterile dressing, and bandage. In addition, provide care for shock. Never touch a person in contact with live current unless properly protected.

First Aid

- Check the A, B, C's (Airways open, Breathing and Circulation).
- Treat for shock.
- Treat as heat burn.
- Seek medical attention immediately.

7.5.8 Shock

Shock refers to circulatory system failure, which occurs when oxygenated blood and nutrients are not provided in sufficient amounts for every body part.

Signs and Symptoms

- Rapid breathing and pulse.
- Pail or bluish skin, nails, and lips.
- Heavy sweating.
- Loss of consciousness in severe shock.
- Dilated pupils.
- Thirst.
- Cool and wet (clammy) skin.
- Nausea and vomiting.

First Aid

- Care for life threatening injuries.
- Keep victim on their back (unless stroke or head injury with no spinal injury).
- Unconscious, semiconscious and vomiting victims lie on their side.
- Elevate legs 8 - 12 inches.
- Prevent loss of body heat with blankets.
- Do not give the victim food or drink, if driving a long distance they may suck on a wet cloth or towel.
- Seek medical attention.

7.6 RECORD OF INJURIES INCURRED ON-SITE

7.6.1 Occupational Injuries and Illnesses Form (OSHA 300)

Occupational injuries and illnesses that are required to be recorded under the Occupational Safety and Health Act (OSHA) will be registered on OSHA Form 300 (Attachment D). Occupational injuries and illnesses will be recorded by the Site Safety Supervisor within 48 hours of occurrence as required by statute.

7.6.2 Employer's First Report of Injury

An "Employer's First Report of Injury" form (Attachment E) will be completed by the Site Safety Supervisor for each accident involving a worker injured at the site. Follow-up procedures will include investigation of each accident or potential accident by the Site Safety Supervisor to assure that no similar accidents occur.

7.7 EMERGENCY SITE EVACUATION PROCEDURES

In order to mobilize the manpower resources and equipment necessary to cope with a fire or other emergency, a clear chain of authority has been established. The Site Safety Supervisor will take charge of emergency response activities and dictate the procedures that will be followed for the duration of the emergency. The Site Safety Supervisor will report immediately to the scene of the emergency, assess the seriousness of the situation, and direct whatever efforts are necessary until the emergency response units arrive. At his direction, the Site Safety Supervisor also may order the closure of the site for an indefinite period.

Project personnel will be instructed on proper emergency response procedures and locations of emergency telephone numbers during the initial site safety meeting. If an emergency occurs, including but not limited to, fire, explosion, or significant release of toxic gas into the atmosphere, an air horn (or vehicle horn) will be sounded on the site by any of the field team members. The horn will be sounded continuously for approximately 15 seconds, signaling that immediate evacuation of all personnel is necessary due to some immediate or impending danger. Heavy equipment will be shut down and personnel will evacuate the work areas and assemble at the site entrance, where the Site Safety Supervisor will give further instructions on what to do during the emergency. The field team member, who has been designated as the emergency communications officer at the site safety briefing, will attend the site telephone from the time the alarm sounds until the emergency has ended, as determined by the Site Safety Supervisor.

If a fire or toxic-gas release occurs, the Site Safety Supervisor will determine whether it is upwind of the site office/command post and whether fire/smoke or the gas poses a danger to the health and safety of those assembling at the site vehicle. If so, those assembled at the site vehicle will immediately report to a predetermined alternative meeting location. Incoming visitors will not be allowed to enter the site after the alarm has been sounded. Visitors and observers present in the emergency area will be instructed to leave immediately. A project team member (visitor evacuation officer) will be responsible for guiding visitors from the site.

After sounding the alarm and initiating emergency response procedures, the Site Safety Supervisor will check and verify that access roads are unobstructed. If traffic control is necessary, a field team member designated at the site safety meeting will take over these duties until local police and fire fighters arrive. Appropriate reflective warning vests will be worn by personnel involved with traffic control. The Site Safety Supervisor will remain at the site to provide any assistance requested by emergency-response squads as they arrive to deal with the situation.

The Site Safety Supervisor will have the authority to restrict access to the site or area until he/she deems it safe. He/she will authorize any changes in the site safety practices necessary to deal with the existing emergency or to prevent further emergencies. Field team members have been assigned safety responsibilities as follows:

Table 7-2
Field Team Member Responsibilities

Title	**Field Team Member**	**Responsibilities**
Site Safety Supervisor	Lara Gray	Overall responsibility for site safety and emergency response
Emergency Communications Officer	Lara Gray or designee	Attend site telephone
Visitor Evacuation Officer	Lara Gray or designee	Guide visitors to/from work site Access and security control

8
SIGNATURES OF FIELD TEAM MEMBERS AND OBSERVERS

All field team members and site visitors will sign the form below verifying that they have completely read the HASP and agree to adhere to its guidelines. Failure to comply with this HASP may lead to dismissal from the site.

Name	**Signature**

A
MATERIAL SAFETY DATA SHEETS

Genium Publishing Corporation
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Material Safety Data Sheets Collection:

Sheet No. 757
Coal Tar Creosote

Issued: 7/91

Section 1. Material Identification

34

Coal Tar Creosote (molecular formula varies with purity) Description: Three main derivations: by distillation of coal tar produced by high-temperature carbonization of bituminous coal; by mixing strained naphthalene oil, wash oil, and strained or light anthracene oil; as a by-product of conventional coal coking. It typically contains up to 160 chemicals, mainly aromatic compounds such as phenol, pyrol and pyridine. Used mainly as a wood preservative for railroad ties, poles, fence posts, marine pilings, and other lumber for outdoor use; as a water-proofing agent, fuel oil constituent, frothing agent for mineral separation, hop defoliant, and lubricant for die molds; in manufacturing chemicals; and in medicine as an antiseptic, disinfectant, antipyretic, astringent, germicide, and styptic.
Other Designations: CAS No. 8001-58-9, Awpa,® brick oil, Caswell No. 225,® coal tar oil, creosote, creosote oil, creosotum, cresylic creosote, heavy oil, liquid pitch oil, naphthalene oil, Preserv-o-sote,® Sakresote,® tar oil, wash oil.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*[73] for a suppliers list.
Cautions: Flammable, liquid coal tar creosote is toxic by inhalation, ingestion, and skin contact. The IARC and NTP classify it as *a human carcinogen*.

R 1
I 4
S 4*
K 2
* Skin absorption

NFPA
2
2 0
-

HMIS
H 2
F 2
R 0
PPG†
† Sec. 8

* Skin absorption can occur with phenol, a major component of coal tar creosote.

Section 2. Ingredients and Occupational Exposure Limits

Coal tar creosote, ca 100%

1990 OSHA PEL
8-hr TWA: 0.2 mg/m³*

1990-91 ACGIH TLV
TWA: 0.2 mg/m³*

1987 IDLH Level
700 mg/m³

1990 NIOSH REL
0.1 mg/m³ (cyclohexane extractable portion)

1985-86 Toxicity Data†
Rat, oral, LD_{50}: 725 mg/kg; toxic effects not yet reviewed
Dog, oral, LD_{Lo}: 600 mg/kg; toxic effects not yet reviewed
Rat, TD_{Lo}: 52,416 mg/kg administered during 91 days prior to mating produces reproductive effects on fallopian tubes and ovaries
Mouse, skin, TD_{Lo}: 99 g/kg produces tumors in skin and appendages

* As coal tar pitch volatiles.
† See NIOSH, *RTECS* (GF8615000), for additional mutation, reproductive, tumorigenic, and other toxicity data.

Section 3. Physical Data

Boiling Point: 381 to 752 °F (194 to 400 °C)
Distillation Range: 446 to 554 °F (230 to 290 °C)
Heat of Combustion: -12,500 Btu/lb
Heat of Vaporization: 107 Btu/lb
Molecular Weight: Varies with purity
Density/Specific Gravity: 1.07 to 1.08 at 68 °F (20 °C)
Water Solubility: Slightly soluble

Appearance and Odor: Pure coal tar creosote is colorless, but the industrial product is a yellow to black oily liquid with an aromatic smoky smell and a burning caustic taste.

Section 4. Fire and Explosion Data

Flash Point: 165.2 °F (74 °C), CC	**Autoignition Temperature:** 637 °F (336 °C)	**LEL:** None reported	**UEL:** None reported

Extinguishing Media: For small fires, use dry chemical, carbon dioxide (CO_2), or regular foam. For large fires, use fog or regular foam. Since water is least effective, use it as an extinguishing agent only when the preferred measures are unavailable. However, use water spray to cool fire-exposed containers.
Unusual Fire or Explosion Hazards: Vapors may travel to an ignition source and flash back. Containers may explode in heat of fire. Coal tar creosote presents a vapor explosion hazard indoors, outdoors, and in sewers.
Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Also, wear full protective clothing. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from area and let fire burn. Immediately leave area if you hear a rising sound from venting safety device or notice any fire-caused tank discoloration. Isolate area for 1/2 mile in all directions if fire involves tank, rail car or tank truck. Be aware of runoff from fire control methods. Do not release to sewers or waterways. Fully decontaminate or properly dispose of personal protective clothing.

Section 5. Reactivity Data

Stability/Polymerization: Coal tar creosote is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Creosote oil mixed with chlorosulfonic acid in a closed container causes an increase in temperature and pressure.
Conditions to Avoid: Avoid excessive heat and contact with chlorosulfonic acid.
Hazardous Products of Decomposition: Thermal oxidative decomposition of coal tar creosote can produce oxides of carbon and thick, black, acrid smoke.

Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, the IARC, NTP, and OSHA list coal tar creosote as a carcinogen.
Summary of Risks: Coal tar creosote is toxic by inhalation, ingestion, and skin contact. It contains a variety of hydrocarbons such as phenol and polycyclic aromatic hydrocarbons such as benzo[a]pyrene, benzanthracene, and phenol derivatives. The range of toxicity depends on the exposure concentration, amount, and duration. Effects may include irritation, burns, and several forms of cancer.
Medical Conditions Aggravated by Long-Term Exposure: Chronic respiratory or skin diseases.
Target Organs: Eyes, skin, bladder, kidneys, and respiratory system.
Primary Entry Routes: Inhalation, ingestion, and skin contact.
Acute Effects: Skin contact may cause irritation, burning, itching, redness, pigment changes, dermatitis (a rash of redness and small bumps), or burns. Photosensitization (worsening of rash with exposure to sunlight) may occur. Inhalation may be irritating to the respiratory tract. Eye contact may cause conjunctivitis (inflammation of the eye's lining), keratitis (corneal inflammation), or corneal burns with scarring. Ingestion may result in nausea, vomiting, abdominal pain, rapid pulse, respiratory distress, and shock. Systemic absorption by any route (including skin absorption) may cause trouble breathing, thready (continuous or drawn out) pulse, dizziness, headache, nausea, vomiting, salivation, and convulsions. Exposure to large doses (particularly by ingestion) may be fatal.
Chronic Effects: Dermatitis, skin cancer, and lung cancer.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. *Do not* let victim rub eyes or keep them tightly closed. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Wash affected area with soap and flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that *conscious* person drink 1 to 2 glasses of milk or water. *Do not induce vomiting!*
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Cresol may be detected in urine.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel. Isolate hazard area, deny entry, and stay upwind of spills. Shut off all ignition sources–no flares, smoking, or flames in hazard area. Cleanup personnel should protect against vapor inhalation and skin or eye contact. If possible with no risk, stop leak. Water spray may be used to reduce vapor but it may not prevent ignition in closed spaces. For small spills, take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers for later disposal. For large spills, dike far ahead of liquid spill for later disposal. Follow applicable OSHA regulations (29 CFR 1910.120).
Environmental Degradation: Coal tar creosote is fouling to shoreline. Ecotoxicity values are: TL_{50}, goldfish (*Carassius auratus*), 3.51 ppm/24 hr (60:40) mixture of creosote and coal tar; LD_{50}, bob white quail (*Colinus virginianus*), 1,260 ppm/8 days (60:40) mixture of creosote and coal tar.
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33), Hazardous Material No. U051
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [* per RCRA, Sec. 3001]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Listed (as coal tar pitch volatiles) as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since contact lens use in industry is controversial, establish your own policy.
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent all skin contact. Applying a layer of petroleum jelly or lanolin castor oil ointment to the face reduces vapor contact and penetration through skin. Frequent change of protective garments is an additional protective measure.
Ventilation: Provide general and local exhaust ventilation systems equipped with high-efficiency particulate filters to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.(103)
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Take particular care to avoid any contamination of drains or ventilation ducts. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Avoid physical damage to containers. Store in a cool, dry, well-ventilated area. Store coal tar creosote as close to area of use as possible to minimize transporting distance.
Engineering Controls: Use engineering controls to keep airborne concentrations below the OSHA PEL. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Always perform synthesis and purification procedures under a vertical ventilation hood and make regular operational safety checks. Label doors to rooms where coal tar creosote is produced, used, or stored as containing a carcinogen. Locate emergency equipment at well-marked and clearly identified stations in case emergency escape is necessary.
Other Precautions: Preplacement and periodic medical examinations of exposed workers emphasizing respiratory, skin, liver, and kidney disorders, including comprehensive work and medical history, physical examination, CXR, PFTs, urinalysis, LFT, and sputum cytology as the attending physician considers appropriate. Educate workers about coal tar creosote's carcinogenicity and proper handling procedures to avoid exposure.
Other Comments: Caution is in order when handling or sawing old creosote-treated lumber since it retains a considerable portion of creosote for up to 25 to 30 years.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Creosote
DOT Hazard Class: Flammable liquid
ID No.: UN1136
DOT Label: Flammable liquid

MSDS Collection **References:** 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138, 139, 140, 142, 143, 146, 148, 153, 159
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** Mark Upfal, MD, MPH; **Edited by:** JR Stuart, MS

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Material Safety Data Sheets Collection:

Sheet No. 491
Coal Dust, Bituminous

Issued: 5/82 **Revision: A, 8/90**

Section 1. Material Identification

32

Bituminous Coal Dust Description: Formed naturally from fossilized plants, coal consists of amorphous carbon with various organic and some inorganic compounds. These compounds form conjugated polyaromatic, polyunsaturated, and polysaturated ring structures with heterocycles containing oxygen, nitrogen, and sulfur. $C_{102}H_{78}O_{10}N_2$ has been suggested as a coal molecule. The chief members of the coal family are anthracite (the hardest), bituminous, and lignite (the softest). Bituminous coal includes coal between lignites and anthracites with fixed carbon (<86%), volatile matter (>14%), calorific value (>10,500 Btu/lb). Dust or particulate matter <75 µm (through 200-mesh screen) and dispersable in air is of primary interest. The source of bituminous coal is through mining, handling, and pulverizing processes with coal. Used in producing coke, coal gas, water gas, and coal tar compounds; and in manufacturing fertilizers, synthetic rubber, food dyes, insecticides, and disinfectants.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*[73] for a suppliers list.

Cautions: Excessive inhalation of bituminous coal dust can cause coalworkers' pneumoconiosis (CWP or "black lung"). This material is flammable when exposed to heat or flame.

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Genium
2
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-

HMIS
H 2
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PPG*
* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Bituminous coal

Approximate analyses of some air-dried bituminous coals:*

Source	% Moisture	% Volatiles	% Fixed Carbon	% Ash:
West Virginia	1.8	20.4	72.4	5.4
Pennsylvania	1.2	34.5	58.4	5.9
Illinois	8.4	35.0	48.2	8.4
Wyoming	11.0	38.6	40.2	10.2

1989 OSHA PELs
8-hr TWA: 2 mg/m³ (respirable qu[illegible] fraction with <5% SiO_2)
8-[illegible]A: 0.1 mg/m³ (respirable quartz fraction with >5% SiO_2)

1989-90 ACGIH TLV
TLV-TWA: 2 mg/m³ (respirable dust fraction with >5% SiO_2)

1988 NIOSH REL
None established

1985-86 Toxicity Data†
Rat, inhalation, TC_{Lo}: 6600 µg/m³ administered in intermittent 6-hr doses for 86 weeks proved an equivocal tumorigenic agent affecting the blood (lymphoma including Hodgkin's disease)

* Bituminous coals also contain trace metals, sulfur (0.4 to 3.5%), and nitrogen (0.9 to 1.5%), depending on source and type.

† See NIOSH, *RTECS* (GF8281000), for additional tumorigenic data.

Section 3. Physical Data

Specific Gravity: 1.3 to 1.6
Vapor Pressure at 25 °C: Negligible
Volatiles at 25 °C: Negligible
Water Solubility: Negligible

Appearance and Odor: Black powder; little or no odor.

Section 4. Fire and Explosion Data

Flash Point: None reported	**Autoignition Temperature:*** >1114 °F (601.6 °C) (cloud) >392 °F (200 °C) (layer)	**LEL:** >0.05 oz./ft³†	**UEL:** None reported

Extinguishing Media: Nitrogen, carbon dioxide, steam, water, or ammonium biphosphate powder. A water spray can be used to cautiously wet down coal dust to help prevent ignition.

Unusual Fire or Explosion Hazards: It is a fire hazard when exposed to heat or flame. Airborne coal dust is an explosion hazard.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective gear. Avoid creating dusty conditions.

* A pile of 2- to 7-µm Pittsburgh coal dust heated in air at 336 °F (169 °C) can reach autoignition temperature in one hour.

† The smallest 20% of particulate determines ignition characteristics. Approximately 1 oz./ft³ (1000 mg/liter) gives maximum flame energy and is the most destructive concentration. A 10- to 50-mJ spark is needed at 0 to 5% moisture, respectively, to initiate combustion in <200-mesh dust.

Section 5. Reactivity Data

Sta[illegible]ty/Polymerization: Coal dust is fairly stable at 25 °C, but can react slowly with oxygen at room temperature. Heat accelerates the process. Pi[illegible] coal dust may retain heat and a slow heat buildup could lead to spontaneous ignition. Humid air accelerates this ignition of dry coal.

Chemical Incompatibilities: This material is incompatible with strong oxidizing agents, especially when heated.

Conditions to Avoid: Heating coal releases combustibles by devolatization and pyrolysis.

Hazardous Products of Decomposition: Thermal oxidative decomposition of coal dust can include oxides of carbon, nitrogen and sulfur, partially oxidized hydrocarbons, soot, and fly ash.

Section 6. Health Hazard Data

Carcinogenicity: The NTP, IARC, and OSHA do not list bituminous coal dust as a carcinogen.
Summary of Risks: Coalworkers' pneumoconiosis is the occupational disease caused by prolonged retention of abnormal amounts of dusts in the lungs. It can occur after years of excessive exposure to respirable coal dust in coal mining, handling, and processing. Since anthracite and hard coal dusts in the respirable size range have greater mass, the risk of developing pneumoconiosis diminishes as one proceeds from anthracite (hard coal) to lignite (soft coal). Respirable quartz particulate can be simultaneously present with the coal, especially in the mine. The amount of free silica in the dust produced in coal-getting operations seldom exceeds 10% by weight and is usually less than 5%. In general, coal dust is deposited in the lungs like quartz, but requires over 10 times as much for adverse effects. There are two forms of coalworkers' pneumoconiosis: simple and complicated (progressive massive fibrosis). Simple pneumoconiosis results from inhalation and retention of excessive airborne dust. Reticulin fibers form, but little collagen is generated. Complicated pneumoconiosis develops in lungs already affected by simple pneumoconiosis. Masses of fibrous tissue appear and gradually enlarge in the lung, and may eventually distort pulmonary architecture. In advanced cases, blood vessel obliteration in lungs may cause heart failure. In many cases, coalworkers' pneumoconiosis does not progress beyond the simple stage.
Medical Conditions Aggravated by Long-Term Exposure: Any individual with a chronic pulmonary disorder should protect against exposure to bituminous coal dust. Pulmonary function could ultimately be diminished.
Target Organs: Lungs.
Primary Entry Routes: Inhalation.
Acute Effects: Symptoms of inhalation of excessive amounts of coal dust include coughing, wheezing, and shortness of breath.
Chronic Effects: Chronic bronchitis and emphysema are reported to result from excessive coal dust inhalation. Individuals having rheumatoid arthritis in conjunction with simple coalworkers' pneumoconiosis may have rapidly developing lung damage (Caplan's Syndrome).

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing with artificial respiration.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that *conscious* person drink 1 to 2 glasses of water, then induce repeated vomiting.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: There is no specific treatment for coal workers' pneumoconiosis. Medical surveillance is essential to prevention.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel and remove all heat and ignition sources. Cleanup personnel should protect against dust inhalation and eye contact. Clean up coal dust in a manner that avoids dispersing particulates into the air or environment. A water spray may be used to cautiously wet down coal dust to avoid raising dust. Using nonsparking tools, collect dust in a covered metal container for reclamation or for disposal. Follow
applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-3)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the ACGIH TLV and OSHA PEL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.(10)
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Keep sources of heat and ignition, flammable materials, and strong oxidizing agents away from areas where coal dust may collect. Prevent static sparks. Inerting media such as powdered $CaCO_3$, rock dust laid down over coal dust on mine floor, or a nitrogen-enriched atmosphere in a coal-pulverizing machine may be desirable.
Engineering Controls: Avoid coal dust inhalation. Restrict the time that miners work in hazardous conditions. Monitor airborne dust. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Avoid creating dusty conditions. Practice good personal hygiene and housekeeping procedures. Collect dust from settling areas and surfaces in a manner that avoids generating airborne dust. Design dust suppression measures into processes. Meet explosion-proof code requirements for electrical services where coal dust may be present.
Other Precautions: Perform regular chest x-ray examinations for individuals at risk. Simple pneumoconiosis is detectable by x-ray as round, irregular, 1- to 5-mm diameter "coal macules." Remove individuals diagnosed with simple pneumoconiosis from dusty environments.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Coal, ground bituminous, sea coal, *or* coal facings
DOT Hazard Class: Flammable solid
ID No.: NA1361
DOT Label: Flammable solid
DOT Packaging Exceptions: 173.165
DOT Packaging Requirements: 173.165

MSDS Collection References: 2-4, 14, 38, 43, 47, 73, 89, 103, 126, 127, 134, 138, 139, 143
Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Hardies, MD; **Edited by:** JR Stuart, MS

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Material Safety Data Sheets Collection:

Sheet No. 354
Methyl Alcohol

Issued: 11/77 **Revision: D, 11/91**

Section 1. Material Identification

36

Methyl alcohol (CH_3OH) Description: Derived from destructive distillation of wood, oxidation of hydrocarbons, or high-pressure catalytic synthesis from hydrogen and carbon dioxide or carbon monoxide. Used as a solvent in manufacturing industrial chemicals and chemical pharmaceuticals, a raw material for making formaldehyde and methyl esters, a softening agent for pyroxylin plastics, a dehydrator for natural gas, a feedstock for manufacturing synthetic proteins by continuous fermentation, an octane booster in gasoline, an extractant for animal and vegetable oils; in antifreeze for automotive radiators, air brakes, gasoline, and diesel oil; and in denaturing ethanol.
Other Designations: CAS No. 67-56-1, carbinol, Columbian spirits, methanol, methyl hydroxide, methylol, monohydroxymethane, pyroxylic spirit, wood alcohol, wood naphtha, wood spirit.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*$^{(73)}$ for a suppliers list.

Cautions: Methyl alcohol is moderately toxic by ingestion and mildly toxic by inhalation and skin absorption. It is flammable, volatile, and a dangerous fire hazard.

R 1
I 2
S 1*
K 4
* Skin absorption

NFPA
3
1 0
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HMIS
H 2
F 3
R 0
PPG†
† Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Methyl alcohol, ca 100%

1990 OSHA PELs (Skin)
8-hr TWA: 200 ppm (260 mg/m³)
15-min STEL: 250 ppm (310 mg/m³)

1990 IDLH Level
25,000 ppm

1991-92 ACGIH TLVs (Skin)
TWA: 200 ppm (262 mg/m³)
STEL: 250 ppm (328 mg/m³)

1990 DFG (Germany) MAK
200 ppm (260 mg/m³)

1990 NIOSH RELs (Skin)
TWA: 200 ppm (260 mg/m³)
Ceiling: 250 ppm (325 mg/m³)

1985-86 Toxicity Data*
Human, inhalation, TC_{Lo}: 300 ppm caused eye (visual field change), CNS (headache), and pulmonary effects
Human, oral, LD_{Lo}: 428 mg/kg causes CNS (headache) and pulmonary (respiratory change) effects
Rat, oral, TD_{Lo}: 7500 mg/kg administered continuously to the female during the 17th to 19th day of gestation produced behavioral effects on newborns
Rat, inhalation, TC_{Lo}: 20,000 ppm/7 hr administered continuously to the female during the 1st to 22nd day of gestation produced specific developmental abnormalities

* See NIOSH, *RTECS* (PC1400000), for additional toxicity data.

Section 3. Physical Data

Boiling Point: 148 °F (64.5 °C)
Freezing Point: -144.04 °F (-97.8 °C)
Vapor Pressure: 29 mm Hg at 68 °F (20 °C)
Vapor Density (air = 1): 1.11
Viscosity: 0.00593 P at 68 °F (20 °C)
Molecular Weight: 32.05
Density: 0.7924 at 68 °F (20 °C)
Water Solubility: Soluble
Other Solubilities: Soluble in ethanol, ether, benzene, ketones, and most organic solvents

Appearance and Odor: Clear, colorless, volatile liquid with a slight alcohol odor when pure, a disagreeably pungent odor when crude, and a low 10-ppm odor threshold.

Section 4. Fire and Explosion Data

Flash Point: 54 °F (12 °C), CC	Autoignition Temperature: 878 °F (470 °C)	LEL: 6% v/v	UEL: 36.5% v/v

Extinguishing Media: For small fires, use dry chemical, carbon dioxide (CO_2), water spray, or alcohol-resistant foam. For large fires, use water spray, fog, or alcohol-resistant foam. Do not scatter material with any more water than needed to extinguish fire.
Unusual Fire or Explosion Hazards: Methyl alcohol is a dangerous fire hazard when exposed to heat, flame, or oxidizers. It is explosive in its vapor form when exposed to heat or flame. Vapors may travel to an ignition source and flash back.
Special Fire-fighting Procedures: Since fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Also, wear full protective clothing. Structural firefighters' protective clothing is *ineffective* for fires involving methyl alcohol. If possible without risk, remove container from fire area. Apply cooling water to sides of fire-exposed container until fire is well out. Stay away from ends of tanks. Leave area immediately if you hear a rising sound from venting safety device or see any tank discoloration due to fire. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Methyl alcohol is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Methyl alcohol is incompatible with beryllium dihydride, metals (such as potassium or magnesium), oxidants (such as barium perchlorate, bromine, chlorine, hydrogen peroxide, and sodium hypochlorite), potassium tertbutoxide, carbon tetrachloride + metals; reacts explosively with chloroform + heat, and diethyl zinc; and reacts violently with alkyl aluminum salts, acetyl bromide, chloroform + sodium hydroxide, cyanuric chloride, and nitric acid.
Conditions to Avoid: Avoid vapor inhalation and contact with oxidizers and other incompatibles.
Hazardous Products of Decomposition: Thermal oxidative decomposition of methyl alcohol can produce carbon oxides (CO and CO_2), possible formaldehyde (HCHO) and acrid smoke, and irritating fumes.

Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, the IARC, NTP, and OSHA do not list methyl alcohol as a carcinogen.
Summary of Risks: Methyl alcohol is toxic mainly to the nervous system, particularly optic nerves, where damage can progress to permanent blindness. Poisoning may also result in metabolic acidosis. Methyl alcohol oxidizes in the body to form formaldehyde and formic acid. These derivatives are believed responsible for many of methyl alcohol's poisonous and toxic effects. Since it is eliminated slowly from the body, methyl alcohol is considered a cumulative poison. The fatal ingestion dose is 100 to 250 ml, although death is reported from less than 33 ml.
Medical Conditions Aggravated by Long-Term Exposure: None reported
Target Organs: Eyes, central nervous system, skin, and digestive tract.
Primary Entry Routes: Inhalation, ingestion, skin absorption.
Acute effects: Inhalation can cause irritation of eyes and nose, headache, fatigue, nausea, visual impairment (optic nerve neuropathy or visual field changes) or complete and possibly permanent blindness, acidosis, convulsions, circulatory collapse, respiratory failure, and death. Ingestion can cause gastrointestinal (GI) irritation followed by the symptoms described for inhalation and possible kidney impairment. Skin contact results in a feeling of coldness, dryness, and cracking possibly leading to dermatitis. Methyl alcohol can absorb through skin and may cause headache, fatigue, and visual disturbances. Eye contact causes irritation and watering of eyes, inflamed lids, and painful sensitization to light.
Chronic Effects: Chronic inhalation or skin absorption may produce visual impairment or complete blindness.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Do not let victim rub or keep eyes tightly shut. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Since methyl alcohol is volatile and flammable, carefully dispose of contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Consider administering 10% ethanol in D5W intravenously to maintain ethyl alcohol blood level at 100 mg/dl. Check formic acid in urine and measure blood pH and plasma bicarbonate. After ingestion, there is typically an 18- to 48-hr latency period before clinical toxicity

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate area, deny entry, and stay upwind. Shut off all ignition sources—no flares, smoking, or flames in hazard area. Cleanup personnel should wear fully encapsulating, vapor-protective clothing for spills or leaks with no fire. Water spray may reduce vapor, but not prevent ignition in closed spaces. For small spills, use nonsparking tools to take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers for later disposal. For large spills, dike far ahead of spill and await disposal. Follow applicable OSHA regulations (29 CFR 1910.120).
Environmental Degradation: Aquatic toxicity rating: TLm 96, over 1000 ppm.
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33): Hazardous Waste No. U154
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since contact lens use in industry is controversial, establish your own policy.
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. Select the respirator based on its suitability to provide adequate worker protection for the given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent all skin contact.
Ventilation: Provide general and local explosion-proof exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.(103)
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder contaminated work clothing before wearing. Remove this material from your shoes and clean personal protective equipment.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Avoid physical damage to containers. Store in cool, dry, well-ventilated flammables storage area, away from strong oxidizers and other incompatibles. To prevent static sparks, electrically ground all equipment used in methyl alcohol storage, manufacture, and transportation. Use nonsparking tools.
Engineering Controls: To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control hazardous airborne contaminants and to maintain concentrations at the lowest practical level.
Other Precautions: Consider preplacement and periodic medical examinations of exposed workers emphasizing neurological, kidney, liver, and visual function. Practice good personal hygiene and housekeeping procedures. If respirators are used, institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Methyl alcohol
DOT Hazard Class: Flammable liquid
ID No.: UN1230
DOT Label: Flammable liquid
DOT Packaging Exceptions: 173.118
DOT Packaging Requirements: 173.119

IMO Shipping Name: Methanol
IMO Hazard Class: 3.2
ID No.: UN1230
IMO Label: Flammable Liquid, Poison
IMDG Packaging Group: II

MSDS Collection **References:** 26, 38, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 140, 143, 146, 148, 149, 153, 159, 163
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Material Safety Data Sheets Collection:

Sheet No. 467
Automotive Gasoline, Lead-free

Issued: 10/81 Revision: A, 9/91

Section 1. Material Identification

Automotive Gasoline, Lead-free, Description: A mixture of volatile hydrocarbons composed mainly of branched-chain paraffins, cycloparaffins, olefins, naphthenes, and aromatics. In general, gasoline is produced from petroleum, shale oil, Athabasca tar sands, and coal. Motor gasolines are made chiefly by cracking processes, which convert heavier petroleum fractions into more volatile fractions by thermal or catalytic decomposition. Widely used as fuel in internal combustion engines of the spark-ignited, reciprocating type. Automotive gasoline has an octane number of approximately 90. A high content of aromatic hydrocarbons and a consequent high toxicity are also associated with a high octane rating. Some gasolines sold in the US contain a minor proportion of tetraethyllead, which is added in concentrations not exceeding 3 ml per gallon to prevent engine "knock." However, methyl-tert-butyl ether (MTBE) has almost completely replaced tetraethyllead.

Other Designations: CAS No. 8006-61-9, benzin, gasoline, gasolene, motor spirits, natural gasoline, petrol.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*[73] for a suppliers list.

R 1
I 2
S 2*
K 4
* Skin absorption

NFPA
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HMIS
H 2
F 3
R 1
PPG†
† Sec. 8

Cautions: Inhalation of automotive gasoline vapors can cause intense burning in throat and lungs, central nervous system (CNS) depression, and possible fatal pulmonary edema. Gasoline is a dangerous fire and explosion hazard when exposed to heat and flames.

Section 2. Ingredients and Occupational Exposure Limits

Automotive gasoline, lead-free*

1990 OSHA PELs
8-hr TWA: 300 ppm, 900 mg/m^3
15-min STEL: 500 ppm, 1500 mg/m^3

1990-91 ACGIH TLVs
TWA: 300 ppm, 890 mg/m^3
STEL: 500 ppm, 1480 mg/m^3

1990 NIOSH REL
None established

1985-86 Toxicity Data†
Man, inhalation, TC_{Lo}: 900 ppm/1 hr; toxic effects include sense organs and special senses (conjunctiva irritation), behavioral (hallucinations, distorted perceptions), lungs, thorax, or respiration (cough)
Human, eye: 140 ppm/8 hr; toxic effects include mild irritation
Rat, inhalation, LC_{50}: 300 g/m^3/5 min

* A typical modern gasoline composition is 80% paraffins, 14% aromatics, and 6% olefins. The mean benzene content is approximately 1%. Other additives include sulfur, phosphorus, and MTBE.
† See NIOSH, *RTECS* (LX3300000), for additional toxicity data.

Section 3. Physical Data

Boiling Point: Initially, 102 °F (39 °C); after 10% distilled, 140 °F (60 °C); after 50% distilled, 230 °F (110 °C); after 90% distilled, 338 °F (170 °C); final boiling point, 399 °F (204 °C)

Vapor Density (air = 1): 3.0 to 4.0

Density/Specific Gravity: 0.72 to 0.76 at 60 °F (15.6 °C)

Water Solubility: Insoluble

Appearance and Odor: A clear (gasoline may be colored with dye), mobile liquid with a characteristic odor recognizable at about 10 ppm in air.

Section 4. Fire and Explosion Data

Flash Point: -45 °F (-43 °C)	**Autoignition Temperature:** 536 to 853 °F (280 to 456 °C)	**LEL:** 1.3% v/v	**UEL:** 6.0% v/v

Extinguishing Media: Use dry chemical, carbon dioxide, or alcohol foam as extinguishing media. Use of water may be ineffective to extinguish fire, but use water spray to knock down vapors and to cool fire-exposed drums and tanks to prevent pressure rupture. Do not use a solid stream of water since it may spread the fuel.

Unusual Fire or Explosion Hazards: Automobile gasoline is an OSHA Class IB flammable liquid and a dangerous fire and explosion hazard when exposed to heat and flames. Vapors can flow to an ignition source and flash back. Automobile gasoline can also react violently with oxidizing agents.

Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode, and full protective clothing. When the fire is extinguished, use nonsparking tools for cleanup. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Automotive gasoline is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Automotive gasoline can react with oxidizing materials such as peroxides, nitric acid, and perchlorates.

Conditions to Avoid: Avoid heat and ignition sources.

Hazardous Products of Decomposition: Thermal oxidative decomposition of automotive gasoline can produce oxides of carbon and partially oxidized hydrocarbons.

Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, the IARC list gasoline as a possible human carcinogen (Group 2B). Although the IARC has assigned an overall evaluation to gasoline, it has not assigned an overall evaluation to specific substances within this group (inadequate human evidence).
Summary of Risks: Gasoline vapors are considered moderately poisonous. Vapor inhalation can cause central nervous system (CNS) depression and mucous membrane and respiratory tract irritation. Brief inhalations of high concentrations can cause a fatal pulmonary edema. Reported responses to gasoline vapor concentrations are: 160 to 270 ppm causes eye and throat irritation in several hours; 500 to 900 ppm causes eye, nose, and throat irritation, and dizziness in 1 hr; and 2000 ppm produces mild anesthesia in 30 min. Higher concentrations are intoxicating in 4 to 10 minutes. If large areas of skin are exposed to gasoline, toxic amounts may be absorbed. Repeated or prolonged skin exposure causes dermatitis. Certain individuals may develop hypersensitivity. Ingestion can cause CNS depression. Pulmonary aspiration after ingestion can cause severe pneumonitis. In adults, ingestion of 20 to 50 g gasoline may produce severe symptoms of poisoning.
Medical Conditions Aggravated by Long-Term Exposure: None reported.
Target Organs: Skin, eye, respiratory and central nervous systems.
Primary Entry Routes: Inhalation, ingestion, skin contact.
Acute Effects: Acute inhalation produces intense nose, throat, and lung irritation; headaches; blurred vision; conjunctivitis; flushing of the face; mental confusion; staggering gait; slurred speech; and unconsciousness, sometimes with convulsions. Ingestion causes inebriation (drunkenness), vomiting, dizziness, fever, drowsiness, confusion, and cyanosis (a blue to dark purplish coloration of skin and mucous membrane caused by lack of oxygen). Aspiration causes choking, cough, shortness of breath, increased rate of respiration, excessively rapid heartbeat, fever, bronchitis, and pneumonitis. Other symptoms following acute exposure include acute hemorrhage of the pancreas, fatty degeneration of the liver and kidneys, and passive congestion of spleen.
Chronic Effects: Chronic inhalation results in appetite loss, nausea, weight loss, insomnia, and unusual sensitivity (hyperesthesia) of the distal extremities followed by motor weakness, muscular degeneration, and diminished tendon reflexes and coordination. Repeated skin exposure can cause blistering, drying, and lesions.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* due to aspiration hazard. Give conscious victim a mixture of 2 tablespoons of activated charcoal mixed in 8 oz of water to drink. Consult a physician immediately.
After first aid, get appropriate in-plant, paramedic, or community medical support.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and liquid contact. Use nonsparking tools. Take up small spills with sand or other noncombustible adsorbent. Dike storage areas to control leaks and spills. Follow applicable OSHA regulations (29 CFR 1910.120).
Aquatic Toxicity: Bluegill, freshwater, LC_{50}, 8 ppm/96 hr.
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations
RCRA Hazardous Waste (40 CFR 261.21): Characteristic of ignitability
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since contact lens use in industry is controversial, establish your own policy.
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. There are no specific NIOSH recommendations. However, for vapor concentrations not immediately dangerous to life or health, use chemical cartridge respirator equipped with organic vapor cartridge(s), or a supplied-air respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Materials such as neoprene or polyvinyl alcohol provide excellent/good resistance for protective clothing. **Note:** Resistance of specific materials can vary from product to product.
Ventilation: Provide general and local explosion-proof exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.(103)
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed containers in a cool, dry, well-ventilated area away from heat and ignition sources and strong oxidizing agents. Protect containers from physical damage. Avoid direct sunlight. Storage must meet requirements of OSHA Class IB liquid. Outside or detached storage preferred.
Engineering Controls: Avoid vapor inhalation and skin or eye contact. Consider a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Indoor use of this material requires explosion-proof exhaust ventilation to remove vapors. Only use gasoline as a fuel source due to its volatility and flammable/explosive nature. Practice good personal hygiene and housekeeping procedures. Wear clean work clothing daily.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Gasoline (*including casing-head and natural*)
DOT Hazard Class: Flammable liquid
ID No.: UN1203
DOT Label: Flammable liquid
DOT Packaging Exceptions: 173.118
DOT Packaging Requirements: 173.119

IMO Shipping Name: Gasoline
IMO Hazard Class: 3.1
ID No.: UN1203
IMO Label: Flammable liquid
IMDG Packaging Group: II

MSDS Collection References: 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 138, 140, 143, 146, 153, 159
Prepared by: M Allison, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: W Silverman, MD; Edited by: JR Stuart, MS

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Material Safety Data Sheets Collection:

Sheet No. 468
Fuel Oil No. 1

Issued: 3/82 **Revision: A, 11/90**

Section 1. Material Identification

Fuel Oil No. 1 Description: A kerosine-like mixture of petroleum hydrocarbons; a distillate of controlled sulfur content. Fuel oil no. 1 is available for home heating use.
Other Designations: Coal oil, heating fuel, kerosene, kerosine, range oil.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*[73] for a suppliers list.

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Cautions: Fuel oil No. 1 is a skin, eye, and mucous membrane irritant and central nervous system (CNS) depressant. Ingestion may lead to *aspiration pneumonitis*. It is *flammable* when exposed to heat or flame.

Section 2. Ingredients and Occupational Exposure Limits

Fuel oil No. 1, ca 100%

1989 OSHA PEL	1990-91 ACGIH TLV	1988 NIOSH REL	1985-86 Toxicity Data*
None established	None established	None established	Rat, oral, LD_{50}: 9 g/kg; produces gastrointestinal effects (hypermotility, diarrhea)

* Monitor NIOSH, *RTECS* (HZ1800000), for future toxicity data.

Section 3. Physical Data

Boiling Range: 302 to 554 °F (150 to 290 °C)
Freezing Point: -40 °F (-40 °C)
Vapor Pressure, 100 °F (38 °C): ca 5
Viscosity: 160 centistoke at 99.5 °F (37.5 °C)
Specific Gravity: 0.8251 at 59 °F (15 °C)
Water Solubility: Insoluble
%Volatile by Volume: >99
Appearance and Odor: Light amber liquid with a mild petroleum odor.

Section 4. Fire and Explosion Data

Flash Point: 100 to 162 °F (43 to 72 °C)	**Autoignition Temperature:** 410 °F (210 °C)	**LEL:** 0.7% v/v	**UEL:** 5% v/v

Extinguishing Media: Use dry chemcial, carbon dioxide, foam, water fog or spray. Do not use a forced water spray directly on burning oil since this scatters the fire. Use a smothering technique to extinguish fire.
Unusual Fire or Explosion Hazards: *Caution!* Vapors may spread to an ignition or heat source and burn with explosive violence.
Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode and full protective clothing. Be aware of runoff from fire control methods. Do not release to sewers or waterways due to health and fire or explosion hazard.

Section 5. Reactivity Data

Stability/Polymerization: Fuel oil no. 1 is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Fuel oil no. 1 is incompatible with strong oxidizing agents; heating greatly increases fire hazard.
Conditions to Avoid: Avoid heat and ignition sources.
Hazardous Products of Decomposition: Thermal oxidative decomposition of fuel oil no. 1 can produce carbon dioxide; incomplete combustion can produce carbon monoxide.

Section 6. Health Hazard Data

Carcinogenicity: Although the IARC has not assigned an overall evaluation, it has evaluated occupational exposures in petroleum refining as IARC probable human carcinogens (Group 2A).
Summary of Risks: Fuel oil No. 1 is insufficiently volatile to constitute an acute inhalation hazard. Excessive inhalation of *aerosol* or *mist* can cause respiratory tract irritation, headache, dizziness, nausea, stupor, convulsions, or unconsciousness, depending on concentration and exposure time. When removed from exposure area, affected persons usually experience complete recovery. Death may occur by asphyxiation due to

Continue on next page

Section 6. Health Hazard Data, *continued*

pulmonary edema and consolidation. Late lung changes are noted in survivors. The characteristic lung lesion is an acute, fulminant, hemorrhagic bronchopneumonia. Other systemic effects include heart (potentially fatal rhythm disturbances), liver, kidney, bone marrow and spleen changes. The mean oral lethal dose is ~4 to 6 oz, with death occurring within 2 to 24 hr. Hemorrhaging and pulmonary edema, progressing to renal involvement and chemical pneumonitis, may result if vomiting occurs after ingestion, and oil is aspirated into the lungs. Death may result from as little as 1/2 oz, while survival is noted up to 12 oz ingested. Ingestion's systemic effect is primarily central nervous system (CNS) depression which may lead to coma and respiratory depression. Gastrointestinal (GI) lining irritation may cause burning of mouth, esophagus, and stomach, as well as vomiting, intestinal cramping, and blood-tinged diarrhea. Fuel oil No. 1 is irritating to skin and mucous membranes. Percutaneous absorption may be significant. Prolonged contact may cause significant skin damage (epidermal necrolysis, or scalded skin appearance). Kidney damage appears to occur at higher frequency after prolonged skin exposure. Eye contact with liquid or vapor may cause irritation.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Target Organs: Central nervous system, skin, and mucous membranes.

Primary Entry Routes: Inhalation, ingestion.

Acute Effects: Systemic effects from ingestion include GI irritation, vomiting, diarrhea, and, in severe cases, CNS depression, progressing to coma and death. Inhalation of aerosol or mists may result in increased respiration, tachycardia (excessively rapid heart beat), and cyanosis (dark purplish coloration of skin and mucous membranes caused by deficient blood oxygenation).

Chronic Effects: Repeated skin contact causes dermatitis.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. If large areas of the body are exposed or if irritation persists, get medical help immediately. Wash affected area with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* due to aspiration hazard. Contact a physician immediately.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Gastric lavage is contraindicated due to aspiration hazard. Preferred antidotes are charcoal and milk. In cases of severe aspiration pneumonitis, consider monitoring arterial blood gases to ensure adequate ventilation. Observe the patient for 6 hr. If vital signs become abnormal or symptoms develop, obtain a chest x-ray.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate area for large spills, remove all heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and liquid contact. Clean up spills promptly to reduce fire or vapor hazards. Use a noncombustible absorbent material to pick up small spills or residues. For large spills, dike far ahead to contain. Pick up liquid for reclamation or disposal. Do not release to sewers or waterways due to health and fire and/or explosion hazard. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.21): Ignitable waste
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations

Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, use a NIOSH-approved respirator with mist filter and organic vapor cartridge. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact. Nitrile or polyvinyl alcohol gloves are recommended.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations that promote worker safety and productivity. Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.(10)

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Use and storage conditions should be suitable for an OSHA Class II combustible liquid. Store in closed containers in a well-ventilated area away from heat and ignition sources and strong oxidizing agents. Protect containers from physical damage. To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations. Use nonsparking tools and explosion-proof electrical equipment. No smoking in areas of storage or use.

Engineering Controls: Avoid prolonged skin contact and vapor or mist inhalation. Use only in a well-ventilated area and with personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures. Do not wear oil contaminated clothing. Do not put oily rags in pockets. When working with this material, wear gloves or use barrier cream.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Fuel oil
DOT Hazard Class: Combustible liquid
ID No.: NA1993
DOT Label: None
DOT Packaging Exceptions: 173.118a
DOT Packaging Requirements: None

***MSDS Collection* References:** 1, 6, 7, 12, 73, 84, 103, 126, 131, 132, 133, 136, 143
Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** W Silverman, MD; **Edited by:** JR Stuart, MS

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Material Safety Data Sheets Collection:

Sheet No. 469
Fuel Oil No. 2

Issued: 10/81 Revision: A, 11/90

Section 1. Material Identification

33

Fuel Oil No. 2 Description: A mixture of petroleum hydrocarbons; a distillate of low sulfur content. Fuel oil no. 2 resembles kerosine. Used as a general-purpose domestic or commercial fuel in atomizing-type burners; as a fuel for trucks, ships and other automotive engines; as mosquito control (coating on breeding waters); and for drilling muds.
Other Designations: CAS No. 68476-30-2, diesel oil.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(73) for a suppliers list.

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Cautions: Fuel oil No. 2 is a skin irritant and central nervous system depressant with high mist concentrations. It is an environmental hazard and a dangerous fire hazard when exposed to heat, flame, or oxidizers.

Section 2. Ingredients and Occupational Exposure Limits

Fuel oil No. 2*

1989 OSHA PEL	1990-91 ACGIH TLV	1988 NIOSH REL	1985-86 Toxicity Data†
None established	None established	None established	Rat, oral, LD_{50}: 9 g/kg; produces gastrointestinal effects (hypermotility, diarrhea)

* A complex mixture (<95%) of paraffinic, olefinic, naphthenic, and aromatic hydrocarbons; sulfur content (<0.5%); and benzene (<100 ppm). [A low benzene level reduces carcinogenic risk. Fuel oils can be exempted under the benzene standard (29 CFR 1910.1028)].
† Monitor NIOSH, *RTECS* (HZ1800000), for future toxicity data.

Section 3. Physical Data

Boiling Point Range: 363 to 634 °F (184 to 334 °C)
Viscosity: 268 centistoke at 100 °F (37.8 °C)
Specific Gravity: 0.8654 at 59 °F (15 °C)
Water Solubility: Insoluble
Pour Point:* <21 °F (-6 °C)

Appearance and Odor: Brown, slightly viscous liquid.

*Pour point is the lowest temperature at which a liquid flows from an inverted test container.

Section 4. Fire and Explosion Data

Flash Point: 100 °F (38 °C) min.	Autoignition Temperature: 494 °F (257 °C)	LEL: 0.6% v/v	UEL: 7.5% v/v

Extinguishing Media: Use dry chemical, carbon dioxide, foam, water fog or spray. Do not use a forced water spray directly on burning oil since this scatters the fire. Use a smothering technique to extinguish fire.
Unusual Fire or Explosion Hazards: Vapors may travel to an ignition source and flash back. This fuel oil's volatility is similar to gasoline's.
Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode and full protective clothing. If feasible, remove containers from fire. Be aware of runoff from fire control methods. Do not release to sewers or waterways due to health and fire or explosion hazard.

Section 5. Reactivity Data

Stability/Polymerization: Fuel oil no. 2 is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Incompatible with strong oxidizing agents; heating greatly increases fire hazard.
Conditions to Avoid: Avoid heat and ignition sources.
Hazardous Products of Decomposition: Thermal oxidative decomposition of fuel oil no. 2 yields various hydrocarbons and hydrocarbon derivatives and partial oxidation products including carbon dioxide, carbon monoxide, and sulfur dioxide.

Section 6. Health Hazard Data

Carcinogenicity: Although it has not assigned an overall evaluation to fuel oil No. 2, the IARC has evaluated distillate (light) fuel oils as not classifiable as human carcinogen (Group 3; animal evidence limited).

Summary of Risks: Excessive inhalation of aerosol or mist can cause respiratory tract irritation, headache, dizziness, nausea, stupor, convulsions, or unconsciousness, depending on concentration and time of exposure. Since intestinal absorption of longer chain hydrocarbons is lower than absorption from lighter fuels, a lesser degree of systemic effects and more diarrhea may result. When removed from exposed area, affected persons usually experience complete recovery. Hemorrhaging and pulmonary edema, progressing to renal involvement and chemical pneumonitis, may result if oil is aspirated into the lungs. These results are more likely when vomiting after ingestion rather than upon ingestion, as is often the case with lower viscosity fuels. A comparative ratio of oral-to-aspirated lethal doses may be 1 pt vs, 5 ml. Prolonged or repeated skin contact may cause irritation of the hair follicles and may block the sebaceous glands, producing a rash of acne pimples and spots, usually on arms and legs.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Target Organs: Central nervous system (CNS), skin, and mucous membranes.

Primary Entry Routes: Inhalation, ingestion.

Acute Effects: Systemic effects from ingestion include gastrointestinal (GI) irritation, vomiting, diarrhea, and, in severe cases, CNS depression, progressing to coma and death. Inhalation of aerosol or mists may result in increased rate of respiration, tachycardia (excessively rapid heart beat), and cyanosis (dark purplish coloration of the skin and mucous membranes caused by deficient blood oxygenation).

Chronic Effects: Repeated contact with the skin causes dermatitis.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.

Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. If large areas of the body are exposed or if irritation persists, get medical help immediately. Wash affected area with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* due to aspiration hazard. Contact a physician immediately.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Gastric lavage is contraindicated due to aspiration hazard. Preferred antidotes are charcoal and milk. In cases of severe aspiration pneumonitis, consider monitoring arterial blood gases to ensure adequate ventilation. Observe the patient for 6 hr. If vital signs become abnormal or symptoms develop, obtain a chest x-ray.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate area for large spills, remove all heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and liquid contact. Clean up spills promptly to reduce fire or vapor hazards. Use noncombustible absorbent material to pick up small spills or residues. For large spills, dike far ahead to contain. Pick up liquid for reclamation or disposal. Do not release to sewers or waterways due to health and fire and/or explosion hazard. Follow applicable OSHA regulations (29 CFR 1910.120). Fuel oil no. 2 is an environmental hazard. Report large spills.

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.21): Ignitable waste
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations

Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, use a NIOSH-approved respirator with mist filter and organic vapor cartridge. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations that promote worker safety and productivity. Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.(103)

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Use and storage conditions should be suitable for an OSHA Class II combustible liquid. Store in closed containers in a well-ventilated area away from heat and ignition sources and strong oxidizing agents. Protect containers from physical damage. To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations. Use nonsparking tools and explosion-proof electrical equipment. No smoking in areas of storage or use.

Engineering Controls: Avoid prolonged skin contact and vapor or mist inhalation. Use only in a well-ventilated area with personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures. Do not wear oil contaminated clothing. Do not put oily rags in pockets. When working with this material, wear gloves or use barrier cream.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Fuel oil
DOT Hazard Class: Combustible liquid
ID No.: NA1993
DOT Label: None
DOT Packaging Exceptions: 173.118a
DOT Packaging Requirements: None

MSDS Collection **References:** 1, 6, 7, 12, 73, 84, 103, 126, 127, 132, 133, 136, 143

Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** W Silverman, MD; **Edited by:** JR Stuart, MS

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Material Safety Data Sheets Collection:

Sheet No. 470
Diesel Fuel Oil No. 2-D

Issued: 10/81 **Revision: A, 11/90**

Section 1. Material Identification

Diesel Fuel Oil No. 2-D Description: Diesel fuel is obtained from the middle distillate in petroleum separation; a distillate oil of low sulfur content. It is composed chiefly of unbranched paraffins. Diesel fuel is available in various grades, one of which is synonymous with fuel oil No. 2-D. This diesel fuel oil requires a minimum Cetane No. (efficiency rating for diesel fuel comparable to octane number ratings for gasoline) of 40 (ASTM D613). Used as a fuel for trucks, ships, and other automotive engines; as mosquito control (coating on breeding waters); and for drilling muds.

Other Designations: CAS No. 68334-30-5, diesel fuel.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*[73] for a suppliers list.

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Cautions: Diesel fuel oil No. 2-D is a skin irritant and central nervous depressant with high mist concentrations. It is an environmental hazard and moderate fire risk.

Section 2. Ingredients and Occupational Exposure Limits

Diesel fuel oil No. 2-D*

1989 OSHA PEL	1990-91 ACGIH TLV	1988 NIOSH REL	1985-86 Toxicity Data‡
None established	Mineral Oil Mist TWA: 5 mg/m³† STEL: 10 mg/m³	None established	Rat, oral, LD_{50}: 9 g/kg produces gastrointestinal (hypermotility, diarrhea) effects

* Diesel fuel No. 2-D tends to be low in aromatics and high in paraffinics. This fuel oil is complex mixture of: 1) >95% paraffinic, olefinic, naphthenic, and aromatic hydrocarbons, 2) sulfur (<0.5%), and 3) benzene (<100 ppm). [A low benzene level reduces carcinogenic risk. Fuel oils can be exempted under the benzene standard (29 CFR 1910.1028)]. Although low in the fuel itself, benzene concentrations are likely to be much higher in processing areas.

† As sampled by nonvapor-collecting method.

‡ Monitor NIOSH, *RTECS* (HZ1800000), for future toxicity data.

Section 3. Physical Data

Boiling Point Range: 340 to 675 °F (171 to 358 °C)
Specific Gravity: <0.86
Viscosity: 1.9 to 4.1 centistoke at 104 °F (40 °C)
Water Solubility: Insoluble

Appearance and Odor: Brown, slightly viscous liquid.

Section 4. Fire and Explosion Data

Flash Point: 125 °F (52 °C) min.	**Autoignition Temperature:** >500 °F (932 °C)	**LEL:** 0.6% v/v	**UEL:** 7.5% v/v

Extinguishing Media: Use dry chemical, carbon dioxide, or foam to fight fire. Use a water spray to cool fire exposed containers. Do not use a forced water spray directly on burning oil since this will scatter the fire. Use a smothering technique for extinguishing fire.

Unusual Fire or Explosion Hazards: Diesel fuel oil No. 2-D is a OSHA Class II combustible liquid. Its volatility is similar to that of gas oil. Vapors may travel to a source of ignition and flash back.

Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective clothing. If feasible, remove containers from fire. Be aware of runoff from fire control methods. Do not release to sewers or waterways due to pollution and fire or explosion hazard.

Section 5. Reactivity Data

Stability/Polymerization: Diesel fuel oil No. 2-D is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: It is incompatible with strong oxidizing agents; heating greatly increases the fire hazard.

Conditions to Avoid: Avoid heat and ignition sources.

Hazardous Products of Decomposition: Thermal oxidative decomposition of diesel fuel oil No. 2-D can produce various hydrocarbons and hydrocarbon derivatives, and other partial oxidation products such as carbon dioxide, carbon monoxide, and sulfur dioxide.

Section 6. Health Hazard Data

Carcinogenicity: Although the IARC has not assigned an overall evaluation to diesel fuels as a group, it has evaluated occupational exposures in petroleum refining as an IARC probable human carcinogen (Group 2A). It has evaluated distillate (light) diesel oils as not classifiable as human carcinogens (Group 3).
Summary of Risks: Although diesel fuel's toxicologic effects should resemble kerosine's, they are somewhat more pronounced due to additives such as sulfurized esters. Excessive inhalation of aerosol or mist can cause respiratory tract irritation, headache, dizziness, nausea, vomiting, and loss of coordination, depending on concentration and exposure time. When removed from exposure area, affected persons usually recover completely. If vomiting occurs after ingestion and if oil is aspirated into the lungs, hemorrhaging and pulmonary edema, progressing to renal involvement and chemical pneumonitis, may result. A comparative ratio of oral to aspirated lethal doses may be 1 pt vs. 5 ml. Aspiration may also result in transient CNS depression or excitement. Secondary effects may include hypoxia (insufficient oxygen in body cells), infection, pneumatocele formation, and chronic lung dysfunction. Inhalation may result in euphoria, cardiac dysrhythmias, respiratory arrest, and CNS toxicity. Prolonged or repeated skin contact may irritate hair follicles and block sebaceous glands, producing a rash of acne pimples and spots, usually on arms and legs.
Medical Conditions Aggravated by Long-Term Exposure: None reported.
Target Organs: Central nervous system, skin, and mucous membranes.
Primary Entry Routes: Inhalation, ingestion.
Acute Effects: Systemic effects from ingestion include gastrointestinal irritation, vomiting, diarrhea, and in severe cases central nervous system depression, progressing to coma or death. Inhalation of aerosols or mists may result in increased rate of respiration, tachycardia (excessively rapid heart beat), and cyanosis (dark purplish discoloration of the skin and mucous membranes caused by deficient blood oxygenation).
Chronic Effects: Repeated contact with the skin causes dermatitis.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. If large areas of the body have been exposed or if irritation persists, get medical help immediately. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* due to aspiration hazard. Contact a physician immediately. Position to avoid aspiration.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Gastric lavage is contraindicated due to aspiration hazard. Preferred antidotes are charcoal and milk. In cases of severe aspiration pneumonitis, consider monitoring arterial blood gases to ensure adequate ventilation. Observe the patient for 6 hr. If vital signs become abnormal or symptoms develop, obtain a chest x-ray.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate area for large spills, remove all heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and liquid contact. Clean up spills promptly to reduce fire or vapor hazards. Use a noncombustible absorbent material to pick up small spills or residues. For large spills, dike far ahead to contain. Pick up liquid for reclamation or disposal. Do not release to sewers or waterways due to health and fire and/or explosion hazard. Follow applicable OSHA regulations (29 CFR 1910.120). Diesel fuel oil No. 2-D spills may be environmental hazards. Report large spills.
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

RCRA Hazardous Waste (40 CFR 261.21): Ignitable waste
CERCLA Hazardous Substance (40 CFR 302.4): Not listed
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations

Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, use a NIOSH-approved respirator with a mist filter and organic vapor cartridge. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations that promote worker safety and productivity. Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.(103)
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Use and storage conditions should be suitable for a OSHA Class II combustible liquid. Store in closed containers in a well-ventilated area away from heat and ignition sources and strong oxidizing agents. Protect containers from physical damage. To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations. Use nonsparking tools and explosion-proof electrical equipment. No smoking in storage or use areas.
Engineering Controls: Avoid vapor or mist inhalation and prolonged skin contact. Wear protective rubber gloves and chemical safety glasses where contact with liquid or high mist concentration may occur. Additional suitable protective clothing may be required depending on working conditions. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures. Do not wear oil contaminated clothing. At least weekly laundering of work clothes is recommended. Do not put oily rags in pockets. When working with this material, wear gloves or use barrier cream.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Fuel oil
DOT Hazard Class: Combustible liquid
ID No.: NA1993
DOT Label: None
DOT Packaging Exceptions: 173.118a
DOT Packaging Requirements: None

MSDS Collection References: 1, 6, 7, 12, 73, 84, 101, 103, 126, 127, 132, 133, 136, 143, 146

Prepared by: MJ Allison, BS; Industrial Hygiene Review: DJ Wilson, CIH; Medical Review: AC Darlington, MD; Edited by: JR Stuart, MS

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Material Safety Data Sheets Collection:

Sheet No. 316
Benzene

Issued: 11/78 **Revision: E, 8/90**

Section 1. Material Identification

Benzene (C_6H_6) Description: Derived by fractional distillation of coal tar, hydrodealkylation of toluene or pyrolysis of gasoline, catalytic reforming of petroleum, and transalkylation of toluene by disproportionation reaction. Used as a fuel; a chemical reagent; a solvent for a large number of materials such as paints, plastics, rubber, inks, oils, and fats; in manufacturing phenol, ethylbenzene (for styrene monomer), nitrobenzene (for aniline), dodecylbenzene (for detergents), cyclohexane (for nylon), chlorobenzene, diphenyl, benzene hexachloride, maleic anhydride, benzene-sulfonic acid, artificial leather, linoleum, oil cloth, varnishes, and lacquers; for printing and lithography; in dry cleaning; in adhesives and coatings; for extraction and rectification; as a degreasing agent; in the tire industry; and in shoe factories. Benzene has been banned as an ingredient in products intended for household use and is no longer used in pesticides.
Other Designations: CAS No. 0071-43-2, benzol, carbon oil, coal naphtha, cyclohexatriene, mineral naphtha, nitration benzene, phene, phenyl hydride, pyrobenzol.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*[73] for a suppliers list.

Cautions: Benzene is a confirmed *human carcinogen* by the IARC. *Chronic low-level exposure may cause cancer (leukemia) and bone marrow damage, with injury to blood-forming tissue.* It is also a dangerous fire hazard when exposed to heat or flame.

R 1
I 4
S 2*
K 4
*Skin absorption

NFPA
3
2 0
-

HMIS
H 3
F 3
R 0
PPG†
† Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Benzene, ca 100%*

1989 OSHA PELs
(29 CFR 1910.1000, Table Z-1-A)
8-hr TWA: 1 ppm, 3 mg/m^3
15-min STEL: 5 ppm, 15 mg/m^3

(29 CFR 1910.1000, Table Z-2)
8-hr TWA: 10 ppm
Acceptable Ceiling Concentration: 25 ppm
Acceptable Maximum Peak: 50 ppm (10 min)†

1989-90 ACGIH
TLV-TWA: 10 ppm, 32 mg/m^3

1988 NIOSH RELs
TWA: 0.1 ppm, 0.3 mg/m^3
Ceiling: 1 ppm, 3 mg/m^3

1985-86 Toxicity Data‡
Man, oral, LD_{Lo}: 50 mg/kg; no toxic effect noted
Man, inhalation, TC_{Lo}: 150 ppm inhaled intermittently over 1 yr in a number of discrete, separate doses affects the blood (other changes) and nutritional and gross metabolism (body temperature increase)
Rabbit, eye: 2 mg administered over 24 hr produces severe irritation

* OSHA 29 CFR 1910.1000, Subpart Z, states that the final benzene standard in 29 CFR 1910.1028 applies to all occupational exposures to benzene except in some subsegments of industry where exposures are consistently under the action level (i.e., distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures); for the excepted subsegments, the benzene limits in Table Z-2 apply.
† Acceptable maximum peak above the acceptable ceiling concentration for an 8-hr shift.
‡ See NIOSH, *RTECS* (CY1400000), for additional irritative, mutative, reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data

Boiling Point: 176 °F (80 °C)
Melting Point: 42 °F (5.5 °C)
Vapor Pressure: 100 mm Hg at 79 °F (26.1 °C)
Vapor Density (Air = 1): 2.7
Evaporation Rate (Ether = 1): 2.8
Molecular Weight: 78.11
Specific Gravity (15 °C/4 °C): 0.8787
Water Solubility: Slightly (0.180 g/100 g of H_2O at 25 °C)
% Volatile by Volume: 100
Viscosity: 0.6468 mPa at 20 °C

Appearance and Odor: A colorless liquid with a characteristic sweet, aromatic odor. The odor recognition threshold (100% of panel) is approximately 5 ppm (unfatigued) in air. Odor *is not* an adequate warning of hazard.

Section 4. Fire and Explosion Data

Flash Point: 12 °F (-11.1 °C), CC
Autoignition Temperature: 928 °F (498 °C)
LEL: 1.3% v/v
UEL: 7.1% v/v

Extinguishing Media: Use dry chemical, foam, or carbon dioxide to extinguish benzene fires. Water may be ineffective as an extinguishing agent since it can scatter and spread the fire. Use water spray to cool fire-exposed containers, flush spills away from exposures, disperse benzene vapor, and protect personnel attempting to stop an unignited benzene leak.
Unusual Fire or Explosion Hazards: Benzene is a Class 1B flammable liquid. A concentration exceeding 3250 ppm is considered a potential fire explosion hazard. Benzene vapor is heavier than air and can collect in low lying areas or travel to an ignition source and flash back. Explosive and flammable benzene vapor-air mixtures can easily form at room temperature. Eliminate all ignition sources where benzene is used, handled, or stored.
Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and full protective equipment. Structural firefighter's protective clothing provides limited protection. Stay out of low areas. Be aware of runoff from fire control methods. Do not release to sewers or waterways. Runoff to sewer can create pollution, fire, and explosion hazard.

Section 5. Reactivity Data

Stability/Polymerization: Benzene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Benzene explodes on contact with diborane, permanganic acid, bromine pentafluoride, peroxodisulfuric acid, and peroxomonosulfuric acid. It ignites on contact with dioxygen difluoride, dioxygenyl tetrafluoroborate, iodine heptafluoride, and sodium peroxide + water. Benzene forms sensitive, explosive mixture with iodine pentafluoride, ozone, liquid oxygen, silver perchlorate, nitryl perchlorate, nitric acid, and arsenic pentafluoride + potassium methoxide (explodes above 30 °C). A vigorous or incandescent reaction occurs with bromine trifluoride, uranium hexafluoride, and hydrogen + Raney nickel [above 410 °F (210 °C)]. Benzene is incompatible with oxidizing materials.
Conditions to Avoid: Avoid heat and ignition sources.
Hazardous Products of Decomposition: Thermal oxidative decomposition of benzene can produce toxic gases and vapors such as carbon monoxide.

Section 6. Health Hazard Data

Carcinogenicity: The ACGIH, OSHA, and IARC list benzene as, respectively, a supected human carcinogen, a cancer hazard, and, based on sufficient human and animal evidence, a human carcinogen (Group 1).
Summary of Risks: Prolonged skin contact or excessive inhalation of benzene vapor may cause headache, weakness, appetite loss, and fatigue. The most important health hazards are cancer (leukemia) and bone marrow damage with injury to blood-forming tissue from chronic low-level exposure. Higher level exposures may irritate the respiratory tract and cause central nervous system (CNS) depression.
Medical Conditions Aggravated by Long-Term Exposure: Exposure may worsen ailments of the heart, lungs, liver, kidneys, blood, and CNS.
Target Organs: Blood, central nervous system, bone marrow, eyes, upper respiratory tract, and skin.
Primary Entry Routes: Inhalation, skin contact.
Acute Effects: Symptoms of acute overexposure include irritation of the eyes, nose, and respiratory tract, breathlessness, euphoria, nausea, drowsiness, headache, dizziness, and intoxication. Severe exposure may lead to convulsions and unconsciousness. Skin contact may cause a drying rash (dermatitis).
Chronic Effects: Long-term chronic exposure may result in many blood disorders ranging from aplastic anemia (an inability to form blood cells) to leukemia.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Immediately rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air. Emergency personnel should protect against inhalation exposure. Provide CPR to support breathing or circulation as necessary. Keep awake and transport to a medical facility.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, *do not induce vomiting* since aspiration may be fatal. Call a physician immediately.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: Evaluate chronic exposure with a CBC, peripheral smear, and reticulocyte count for signs of myelotoxicity. Follow up any early indicators of leukemia with a bone marrow biopsy. Urinary phenol conjugates may be used for biological monitoring of recent exposure. Acute management is primarily supportive for CNS depression.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: *Design and practice a benzene spill control and countermeasure plan (SCCP).* Notify safety personnel, evacuate all unnecessary personnel, eliminate all heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against vapor inhalation, eye contact, and skin absorption. Absorb as much benzene as possible with an inert, noncombustible material. For large spills, dike far ahead of spill and contain liquid. Use nonsparking tools to place waste liquid or absorbent into closable containers for disposal. Keep waste out of confined spaces such as sewers, watersheds, and waterways because of explosion danger. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

Listed as a RCRA Hazardous Waste (40 CFR 261.33), Hazardous Waste No. U019
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1000 lb (454 kg) [* per Clean Water Act, Sec. 307 (a), 311 (b)(4), 112; and per RCRA, Sec. 3001]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Tables Z-1-A and Z-2)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations at least below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.(103)
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a cool, dry, well-ventilated area away from all heat and ignition sources and incompatible materials. *Caution! Benzene vapor may form explosive mixtures in air.* To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas. When opening or closing benzene containers, use nonsparking tools. Keep fire extinguishers readily available.
Engineering Controls: Because OSHA specifically regulates benzene (29 CFR 1910.1028), educate workers about its potential hazards and dangers. Minimize all possible exposures to carcinogens. If possible, substitute less toxic solvents for benzene; use this material with extreme caution and only if absolutely essential. Avoid vapor inhalation and skin and eye contact. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Designate regulated areas of benzene use (see legend in the box below) and label benzene containers with "DANGER, CONTAINS BENZENE, CANCER HAZARD."
Other Precautions: Provide preplacement and periodic medical examinations with emphasis on a history of blood disease or previous exposure.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Benzene (*benzol*)
DOT Hazard Class: Flammable liquid
ID No.: UN1114
DOT Label: Flammable liquid
DOT Packaging Exceptions: 173.118
DOT Packaging Requirements: 173.119

IMO Shipping Name: Benzene
IMO Hazard Class: 3.2
ID No.: UN1114
IMO Label: Flammable liquid
IMDG Packaging Group: II

DANGER
BENZENE
CANCER HAZARD
FLAMMABLE–NO SMOKING
AUTHORIZED PERSONNEL ONLY
RESPIRATOR REQUIRED

MSDS Collection **References:** 1, 2, 12, 26, 73, 84-94, 100, 101, 103, 109, 124, 126, 127, 132, 134, 136, 138, 139, 143

Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Upfal, MD, MPH; **Edited by:** JR Stuart, MS

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Material Safety Data Sheets Collection:

Sheet No. 366
Chlorobenzene

Issued: 11/82 **Revision: B, 11/90**

Section 1. Material Identification

Chlorobenzene (C_6H_5Cl) Description: Produced by chlorinating benzene in the presence of a catalyst. Used in dry cleaning; as a solvent in manufacturing paints, adhesives, polishes, waxes, diisocyanates, natural rubber, and pharmaceuticals; a chemical intermediate for phenol, *o*-, and *p*-chloronitrobenzene, DDT, and aniline; and an intermediate in manufacturing dyestuffs.

Other Designations: CAS No. 0108-90-7, benzene chloride; chlorobenzol; MCB; monochlorobenzene; phenyl chloride.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(73) for a suppliers list.

Cautions: Chlorobenzene is a skin and mucous membrane irritant, a fairly strong narcotic, and a central nervous system (CNS) depressant. Chronic inhalation may cause *lung, liver, and kidney damage*. This material is a dangerous fire hazard when exposed to heat or flame.

R 1
I 3
S 2
K 3

NFPA
3
2 0
-

HMIS
H 2
F 3
R 0
PPG*
* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Chlorobenzene, ca 100%

1989 OSHA PEL	1990-91 ACGIH TLV*	1988 NIOSH REL	1985-86 Toxicity Data†
8-hr TWA: 75 ppm, 350 mg/m^3	TWA: 75 ppm, 345 mg/m^3	None established	Rat, oral, LD_{50}: 2910 mg/kg; toxic effects not yet reviewed Rat, inhalation, TC_{Lo}: 210 ppm administered for 6 hr to a 6- to 15-day pregnant female produces specific developmental abnormalities
1987 IDLH Level 2400 ppm			

* In its "Notice of Intended Changes (for 1990-91)," the ACGIH lists a proposed lower level TWA for chlorobenzene: 10 ppm, 46 mg/m^3.(134)

†See NIOSH, *RTECS* (CZ0175000), for additional mutative, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 270 °F (132 °C) at 760 mm Hg
Melting Point: -50.1 °F (-45.6 °C)
Vapor Pressure: 11.8 mm Hg at 77 °F (25 °C)
Vapor Density (Air = 1): 3.88
Viscosity: 0.790 centipoise at 70 °F (21 °C)
Molecular Weight: 112.56
Specific Gravity (20 °C/4 °C): 1.1058
Water Solubility: Insoluble

Appearance and Odor: A clear, colorless, volatile liquid with a faint, almond-like odor. Threshold odor concentration: 100% recognition, 0.21 ppm.

Section 4. Fire and Explosion Data

Flash Point: 85 °F (29.5 °C), CC	**Autoignition Temperature:** 1180 °F (638 °C) **LEL:** 1.8% v/v	**UEL:** 9.6% v/v

Extinguishing Media: Use carbon dioxide, dry chemical, halon, water spray, or standard foam to extinguish fires involving chlorobenzene. Use water in flooding quantities as fog since solid streams of water may spread fire. Apply water spray from as far as possible to cool fire-exposed containers.

Unusual Fire or Explosion Hazards: Chlorobenzene is dangerous when exposed to heat or flame. Vapor may travel to an ignition source and flash back.

Special Fire-fighting Procedures: Isolate hazard area and deny entry. Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Do not extinguish fire unless flow can be stopped. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Chlorobenzene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: Chlorobenzene is incompatible with strong oxidizers; contact may cause fires and explosions. It reacts violently with dimethyl sulfoxide. Silver perchlorate forms a solvated, shock-sensitive salt with chlorobenzene (explosion). Chlorobenzene is potentially explosive with powdered sodium or phosphorus trichloride + sodium.

Conditions to Avoid: Avoid all heat and ignition sources and incompatible materials.

Hazardous Products of Decomposition: Thermal oxidative decomposition products of chlorobenzene can include soot, hydrogen chloride, phosgene, and carbon monoxide.

Section 6. Health Hazard Data

Carcinogenicity: The NTP, IARC, and OSHA do not list chlorobenzene as a carcinogen.
Summary of Risks: Chlorobenzene is a fairly strong narcotic and can cause central nervous system (CNS) depression. Overexposure is irritating to the eyes, nasal passages, and upper respiratory tract. It is moderately toxic by inhalation or ingestion and can be absorbed slowly through the skin. Short exposures to liquid may cause skin irritation and defatting, while prolonged or repeated skin contact may result in dermatitis or skin burns. Following absorption of toxic doses, liver and kidney degeneration are also observed. Chlorobenzene may also cause hemolysis.
Medical Conditions Aggravated by Long-Term Exposure: Individuals with skin, liver, kidney, or chronic respiratory disease may be at increased risk from exposure.
Target Organs: Respiratory system, eyes, skin, central nervous system, and liver.
Primary Entry Routes: Inhalation, ingestion, eye and skin contact.
Acute Effects: Symptoms to be expected from acute exposure are headache, eye and upper respiratory tract irritation, dizziness, drowsiness, cyanosis, spastic contractions of extremities, and loss of consciousness, depending on the exposure's concentration and duration. Symptoms of ingestion include pallor, cyanosis, and coma, followed by complete recovery.
Chronic Effects: Frequently repeated contact with chlorobenzene may result in skin burns, eye and upper respiratory tract irritation, headaches, dizziness, somnolence, and dyspeptic disorders (indigestion). Chronic inhalation may result in lung, liver, and kidney damage.

FIRST AID

Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. For reddened or blistered skin, consult a physician. Wash affected area with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that *conscious* person drink 1 to 2 glasses of water. Consult a physician immediately. If vomiting occurs, administer more water.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: In a *conscious* patient, attempt to induce vomiting with Syrup of Ipecac. Consider activated charcoal cathartic. Administer charcoal slurry with saline, water, or sorbitol. In an *unconscious* patient, do gastric lavage with suction.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: *Design and practice a chlorobenzene spill control and counter measure plan (SCCP).* Notify safety personnel, evacuate all unnecessary personnel, eliminate all heat and ignition sources, and provide maximum explosion-proof ventilation. Cleanup personnel should protect against vapor inhalation and contact with liquid. Take up spilled material with a noncombustible absorbent material and place into containers for disposal. For large spills, dike far ahead of spill to contain. Do not release runoff to sewers or waterways since chlorobenzene is harmful to aquatic life in very low concentrations. Aquatic toxicity: A 20-ppm concentration of chlorobenzene administered to bluegill in fresh water during a 96-hr test period is the median tolerance limit (TLm) at which 50% of the aquatic organisms survive. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33), Hazardous Waste No. U037
CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 100 lb (45.4 kg) [* per Clean Water Act, Sec. 311(b)(4), Sec. 307(a), and per RCRA, Sec. 3001]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. Use an organic vapor-acid gas respirator where appropriate. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets (polyvinyl alcohol is recommended) to prevent prolonged or repeated skin contact.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PEL and ACGIH TLV (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.(103)
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in tightly closed containers in a well-ventilated, fire-resistant area away from heat and ignition sources and oxidizing agents. Outside or detached storage is preferred. Storage and handling must be suitable for an OSHA Class IC flammable liquid. To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas. Protect containers from physical damage.
Engineering Controls: Avoid vapor inhalation and contact with liquid. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures.
Other Precautions: Provide a preplacement questionnaire that emphasizes detecting a history of skin, liver, kidney, or chronic respiratory disease.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Chlorobenzene
DOT Hazard Class: Flammable liquid
ID No.: UN1134
DOT Label: Flammable liquid
DOT Packaging Exceptions: 173.118
DOT Packaging Requirements: 173.119

IMO Shipping Name: Chlorobenzene
IMO Hazard Class: 3.3
ID No.: UN1134
IMO Label: Flammable liquid
IMDG Packaging Group: II

MSDS Collection **References:** 38, 73, 84, 85, 89, 100, 101, 103, 124, 126, 131, 132, 133, 136, 138, 139, 140, 143, 146, 148
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Material Safety Data Sheets Collection:

Sheet No. 385
Ethylbenzene

Issued: 8/78 **Revision: B, 9/92**

Section 1. Material Identification

Ethylbenzene ($C_6H_5C_2H_5$) Description: Derived by heating benzene and ethylene in presence of aluminum chloride with subsequent distillation, by fractionation directly from the mixed xylene stream in petroleum refining, or dehydrogenation of naphthenes. Used as a solvent, an antiknock agent in gasoline; and as an intermediate in production of synthetic rubber, styrene, cellulose acetate, diethylbenzene, acetophenone, ethyl anthraquinone, propyl oxide, and α-methylbenzol alcohol.
Other Designations: CAS No. 100-41-4, ethylbenzol, EB, phenylethane, NCI-C56393.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

Cautions: Ethylbenzene is a skin and mucous membrane irritant considered the most irritating of the benzene series. Inhalation causes acute and chronic central nervous system (CNS) effects. It is highly flammable and forms explosive mixtures with air.

R 1
I 3
S 2*
K 4
* Skin absorption

NFPA

HMIS
H 2†
F 3
R 0
PPE - Sec. 8
† Chronic effects

Section 2. Ingredients and Occupational Exposure Limits

Ethylbenzene, ca >99.0%. Impurities include ~ 0.1% *meta & para* xylene, ~ 0.1% cumene, and ~ 0.1% toluene.

1991 OSHA PELs
8-hr TWA: 100 ppm (435 mg/m^3)
15-min STEL: 125 ppm (545 mg/m^3)
Action Level: 50 ppm (217 mg/m^3)

1990 IDLH Level
2000 ppm

1990 NIOSH REL
TWA: 100 ppm (435 mg/m^3)
STEL: 125 ppm (545 mg/m^3)

1992-93 ACGIH TLVs
TWA: 100 ppm (434 mg/m^3)
STEL: 125 ppm (545 mg/m^3)

1990 DFG (Germany) MAK
TWA: 100 ppm (440 mg/m^3)
Category 1: local irritants
Peak Exposure Limit: 200 ppm, 5 min momentary value, max of 8/shift
Danger of cutaneous absorption

1985-86 Toxicity Data*
Human, inhalation, TC_{Lo}: 100 ppm/8 hr caused eye effects, sleep, and respiratory changes.
Human, lymphocyte: 1 mmol/L induced sister chromatid exchange.
Rat, oral, LD_{50}: 3500 mg/kg; toxic effects not yet reviewed
Rat (female), inhalation, TC_{Lo}: 1000 ppm/7 hr/day, 5 days/wk, for 3 wk prior to mating and daily for 19 days of gestation produced pups with high incidence of extra ribs.(179)

* See NIOSH, *RTECS* (DA0700000), for additional irritation, mutation, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 277 °F (136 °C)
Melting Point: -139 °F (-95 °C)
Surface Tension: 31.5 dyne/cm
Ionization Potential: 8.76 eV
Viscosity: 0.64 cP at 77 °F (25 °C)
Refraction Index: 1.4959 at 68 °F (20 °C)
Relative Evaporation Rate (ether = 1): 0.0106
Bulk Density: 7.21 lb/Gal at 77 °F (25 °C)
Critical Temperature: 651 °F (343.9 °C)
Critical Pressure: 35.6 atm

Molecular Weight: 106.16
Density: 0.863 at 77 °F (25 °C)
Water Solubility: Slightly, 14 mg/100 mL at 59 °F (15 °C)
Other Solubilities: Miscible in alcohol, ether; soluble in carbon tetrachloride, benzene, sulfur dioxide, and many organic solvents; insoluble in ammonia
Odor Threshold: 2.3 ppm
Vapor Pressure: 7.1 mm Hg at 68 °F (20 °C); 10 mmHg at 78.62 °F (25.9 °C); 100 mm Hg 165.38 °F (74.1 °C)
Saturated Vapor Density (Air = 0.075 lb/ft^3 or 1.2 kg/m^3): 0,0768 lb/ft^3 or 1.2298 kg/m^3

Appearance and Odor: Colorless, flammable liquid with a pungent odor.

Section 4. Fire and Explosion Data

Flash Point: 64 °F (18 °C) CC	**Autoignition Temperature:** 810 °F (432 °C)	**LEL:** 1.0% v/v	**UEL:** 6.7% v/v

Extinguishing Media: Class 1B Flammable liquid. For small fires, use dry chemical, carbon dioxide, or 'alcohol-resistant' foam. For large fires, use fog or 'alcohol-resistant' foam. Use water only if other agents are unavailable; EB floats on water and may travel to an ignition source and spread fire. **Unusual Fire or Explosion Hazards:** Burning rate = 5.8 mm/min. Vapors may travel to an ignition source and flash back. Container may explode in heat of fire. EB poses a vapor explosion hazard indoors, outdoors, and in sewers. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Cool container sides with water until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from area and let fire burn. Withdraw immediately if you hear rising sound from venting safety device or notice any tank discoloration due to fire. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Ethylbenzene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Reacts vigorously with oxidizers.
Conditions to Avoid: Exposure to heat and oxidizers.
Hazardous Products of Decomposition: Thermal oxidative decomposition of EB can produce acrid smoke and irritating fumes.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,(164) NTP,(169) and OSHA(164) do not list EB as a carcinogen. **Summary of Risks:** Occupational exposure to EB alone is rare since it is usually present together with other solvents. EB is irritating to the eyes, skin, and respiratory tract. Vapor inhalation produces varying degrees of CNS effects depending on concentration. The liquid is absorbed through the skin but vapors are not. 56 to 64% of inhaled ethylbenzene is retained and metabolized. Urinary metabolites following exposure to 23 to 85 ppm for 8 hr are mandelic acid (64%), phenylglyoxylic acid (25%), and methylphenylcarbinol/1-phenyl ethanol (5%). Concurrent exposure to xylene and ethylbenzene causes slower excretion of EB metabolites. Based on the rat LD_{50}, one manufacturer gives 3 to 4 oz. as the lethal dose for a 100 lb person.

Continue on next page

Section 6. Health Hazard Data

Medical Conditions Aggravated by Long-Term Exposure: Skin and CNS diseases and impaired pulmonary function (especially obstructive airway disease). **Target Organs:** Eyes, respiratory system, skin, CNS, blood. **Primary Entry Routes:** Inhalation, skin and eye contact. **Acute Effects:** Vapor inhalation of 200 ppm caused transient eye irritation; 1000 ppm caused eye irritation with profuse watering (tolerance developed rapidly); 2000 ppm caused severe and immediate eye irritation and watering, nasal irritation, chest constriction, and vertigo; 5000 ppm was intolerable and caused eye and nose irritation. Inhalation of high concentrations may cause narcosis, cramps, and death due to respiratory paralysis. Skin exposed to pure ethylbenzene for 10 to 15 min absorbed 22 to 33 $mg/cm^2/hr$. Immersion of hand in solutions of 112 & 156 mg/L for 1 hr absorbed 118 & 215.7 $\mu g/cm^2/hr$, respectively. **Chronic Effects:** Repeated skin contact may cause dryness, scaling, and fissuring. Workers chronically exposed to > 100 ppm complained of fatigue, sleepiness, headache, and mild irritation of the eyes and respiratory tract. Repeated vapor inhalation may result in blood disorders, particularly leukopenia (abnormally low level of white blood cells) and lymphocytosis.

FIRST AID

Eyes: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, have that *conscious and alert* person drink 1 to 2 glasses of water to dilute. *Do not* induce vomiting! Aspiration of even a small amount of EB in vomitus can cause severe damage since its low viscosity and surface tension will cause it to spread over a large area of the lung tissue.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: BEI = mandelic acid in urine (1.5 g/g of creatinine), sample at end of shift at workweeks end. Since this test is not specific, test for EB in expired air for confirmation.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel. Isolate and ventilate area, deny entry and stay upwind. Shut off all ignition sources. Cleanup personnel should protect against vapor inhalation and skin/eye contact. Take up small spills with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable container. Dike far ahead of large spill for later reclamation or disposal. Report any release >1000 lb. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** If released to soil, EB partially evaporates into the atmosphere, with a half-life of hrs to wks, and some leaches into groundwater, especially in soil with low organic carbon content. Biodegradation occurs with a half-life of 2 days. Some EB may absorb to sediment or bioconcentrate in fish. Evidence points to slow biodegradation in groundwater. In air, it reacts with photochemically produced hydroxyl radicals with a half-life of hrs to 2 days. Additional amounts may be removed by rain. **Ecotoxicity Values:** Shrimp (*Mysidopsis bahia*), LC_{50} = 87.6 mg/L/96 hr; sheepshead minnow (*Cyprinodon variegatus*) LC_{50} = 275 mg/L/96 hr; fathead minnow (*Pimephales promelas*) LC_{50} = 42.3 mg/L/96 hr in hard water & 48.5 mg/L/96 hr in softwater. **Disposal:** A candidate for rotary kiln incineration at 1508 to 2912°F (820 to 1600°C), liquid injection incineration at 1202 to 2912°F (650 to 1600°C), and fluidized bed incineration at 842 to 1796°F (450 to 980°C). Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.21): No. D001
Listed as a SARA Toxic Chemical (40 CFR 372.65)
SARA Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per CWA, Sec. 311 (b)(4) & CWA, Sec. 307 (a)]

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 1000 ppm, use a powered air-purifying respirator with an appropriate organic vapor cartridge, a supplied-air respirator (SAR), SCBA, or chemical cartridge respirator with appropriate organic vapor cartridge. For < 2000 ppm, use a SAR or SCBA with a full facepiece. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets made of Viton or polyvinylchloride to prevent skin contact. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.[103] **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Remove this material from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in a cool, dry, well-ventilated area away from ignition sources and oxidizers. Outside or detatched storage is preferred. If inside, store in a standard flammable liquids cabinet. Containers should have flame-arrester or pressure-vacuum venting. To prevent static sparks, electrically ground and bond all equipment used with ethylbenzene. Install Class 1, Group D electrical equipment. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain levels as low as possible. Purge and ventilate reaction vessels before workers are allowed to enter for maintenance or cleanup. **Administrative Controls:** Consider preplacement and periodic medical exams of exposed workers that emphasize the CNS, skin, blood, and respiratory system.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Ethylbenzene
DOT Hazard Class: 3
ID No.: UN1175
DOT Packing Group: II
DOT Label: Flammable liquid
Special Provisions (172.102): T1

Packaging Authorizations
a) Exceptions: 173.150
b) Non-bulk Packaging: 173.202
c) Bulk Packaging: 173.242

Quantity Limitations
a) Passenger Aircraft or Railcar: 5L
b) Cargo Aircraft Only: 60 L
Vessel Stowage Requirements
a) Vessel Stowage: B
b) Other: —

MSDS Collection **References:** 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 153, 159, 162, 163, 164, 167, 168, 171, 176, 179
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** D Wilson, CIH; **Medical Review:** W Silverman, MD

Material Safety Data Sheet
from Genium's Reference Collection

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GENIUM PUBLISHING CORP.

No. 439

NITROBENZENE

(Revision A)
Issued: July 1980
Revised: April 1989

SECTION 1. MATERIAL IDENTIFICATION

Material: NITROBENZENE

Description (Origin/Uses): Prepared by treating benzene with a mixture of nitric acid (HNO_3) and sulfuric acid (H_2SO_4). Used as an intermediate in the manufacture of aniline and benzidine; also used in some shoe and metal polishes.

Other Designations: Nitrobenzol; Essence of Mirbane; Oil of Mirbane; $C_6H_5NO_2$; CAS No. 0098-95-3

Manufacturer: Contact your supplier or distributor. Consult the latest edition of *Chemicalweek Buyers' Guide* (Genium ref. 73) for a list of suppliers.

Comments: Simultaneous exposure to ethanol aggravates the poisonous effects of exposure to nitrobenzene. Workers must not drink alcoholic beverages before or after their shifts.

2
3 0

NFPA

HMIS			
H	3	R	1
F	2	I	4
R	0	S	2†
PPG*		K	2

*See sect. 8
†Absorption risk is high

SECTION 2. INGREDIENTS AND OCCUPATIONAL EXPOSURE LIMITS

Nitrobenzene, ca 100%

OSHA PEL (Skin*)	ACGIH TLV (Skin*), 1988-89	Toxicity Data†
8-hr TWA: 1 ppm, 5 mg/m^3	TLV-TWA: 1 ppm, 5 mg/m^3	Woman, Oral, TD_{Lo}: 200 mg/kg
		Rat, Oral, LD_{50}: 640 mg/kg

*This material can be absorbed through intact skin, which contributes to overall exposure.
†See NIOSH, *RTECS* (DA6475000), for additional data with references to irritative, reproductive, and mutagenic effects.

SECTION 3. PHYSICAL DATA

Boiling Point: 410 °F (210 °C)
Melting Point: 42.8 °F (6 °C)
Vapor Density (Air = 1): 4.25
Vapor Pressure: <1 Torr
Molecular Weight: 123 g/mol
Solubility in Water (%): Slight
Specific Gravity (H_2O = 1): 1.205 at 59 °F (15 °C)

Appearance and Odor: A colorless to pale yellow oily liquid or bright yellow solid crystals; a distinctive odor of volatile almond oil. Its identification threshold is 4.7 parts per billion (ppb).

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point: 190 °F (88 °C) CC	Autoignition Temperature: 900 °F (482 °C)	LEL: 1.8% v/v	UEL: Not Found

Extinguishing Media: Use dry chemical, "alcohol" foam, carbon dioxide (CO_2), or a water spray to put out fires involving nitrobenzene. Water spray can be used to disperse vapor, to cool fire-exposed containers, and to flush nonignited spills or vapor away from sensitive exposures such as incompatible chemicals or sources of ignition. **Unusual Fire or Explosion Hazards:** Nitrobenzene vapor is more than 4 times heavier than air (see sect. 3); it can flow along surfaces, collect in low-lying, confined areas, reach a distant source of ignition, and flash back to its source. This vapor can easily form an explosive mixture with air, especially if the nitrobenzene is heated (heating will cause more nitrobenzene vapor to be given off). **Special Fire-fighting Procedures:** Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Stability/Polymerization: Nitrobenzene is stable in closed containers during routine operations at room temperature. Hazardous polymerization cannot occur. **Chemical Incompatibilities:** Nitrobenzene is an oxidizing agent that can react dangerously with reducing agents such as nitric acid (HNO_3); phenol (C_6H_5OH) and aluminum chloride ($AlCl_3$); aniline and glycerine; silver perchlorate ($AgClO_4$); dinitrogen tetroxide (N_2O_4); caustics; and reactive metals such as tin or zinc. **Conditions to Avoid:** Prevent exposure to sources of heat and ignition or to incompatible chemicals. **Hazardous Products of Decomposition:** Thermal oxidative degradation of nitrobenzene can produce toxic gases such as carbon monoxide (CO) and oxides of nitrogen (NO_x).

SECTION 6. HEALTH HAZARD INFORMATION

Carcinogenicity: Nitrobenzene is not listed as a carcinogen by the NTP, IARC, or OSHA.
Summary of Risks: Nitrobenzene is a deadly poison that can be rapidly absorbed through intact skin. It reacts with hemoglobin in the blood to form methemoglobin, which seriously depletes the blood's oxygen-carrying capacity. The onset of even potentially fatal methemoglobinemia is insidious; severe symptoms can be delayed for up to 4 hours. The exposed person may feel well and have no complaints; he or she may exhibit signs of cyanosis such as blue lips, nose, and ears, which are noticeable but not uncomfortable; headache is commonly the first symptom of intoxication and may become more intense as the condition progresses. Workers can be exposed to dangerous levels of this poison without immediately discernible health effects. Cyanosis, anemia, and deleterious effects on the central nervous system (CNS) and the cardiovascular system (CVS) can develop following significant occupational exposure to nitrobenzene. **Medical Conditions Aggravated by Long-Term Exposure:** Disorders of the heart, liver, and blood. **Target Organs:** Skin, eyes, blood, liver, kidneys, testicles, and CVS. **Primary Entry:** Inhalation, skin contact/absorption. **Acute Effects:** Symptoms of occupational exposure to nitrobenzene include headache, vertigo, vomiting, nausea, dizziness, anemia, atoxia, shortness of breath, rapid pulse, and irritation of the skin and eyes. Coma and death may ensue. **Chronic Effects:** Chronic exposure produces a reversible anemia. *(cont'd.)*

SECTION 6. HEALTH HAZARD INFORMATION, continued

FIRST AID: Eyes. Immediately flush eyes, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 minutes. **Skin.** Completely remove nitrobenzene from the exposed person's body. Immediately remove all clothing and wash the entire body from head to foot with soap and water. Pay special attention to the ear canals, fingernails, toenails, hair, and scalp because they are sources of continuing absorption of this poison. **Inhalation.** Remove the exposed person to fresh air; restore and/or support his or her breathing as needed. Have qualified medical personnel administer oxygen to alleviate the headache and general sense of weakness that characterize nitrobenzene intoxication. Keep exposed person warm and at rest until medical help is available. **Ingestion.** Unlikely. If accidental ingestion should occur, have the exposed person drink 1 to 2 glasses of water, then induce vomiting. **Comments:** Do not expose workers with existing heart, liver, or blood disorders to nitrobenzene. Screen prospective employees by testing them for hypersensitivity to hemolytic chemicals such as nitrobenzene. Alcohol ingestion and a heated environment may increase susceptibility. Instruct employees on methemoglobinemia signs and symptoms. **Get in-plant, paramedic, or community medical help for all exposures.** Seek prompt medical assistance for further treatment and support after first aid. **Physician's Note:** Determine the methemoglobin concentration in the blood; repeat this test hourly for at least 24 hr until a definite decline is noted. Repeat thorough skin cleaning if the methemoglobin level rises after 3 or 4 hr. Patients usually return to normal within 24 to 48 hr if all absorption sources are eliminated. Administer oxygen, using intermittent positive-pressure breathing (IPPB) if its available.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: *Treat accidental bulk releases of nitrobenzene as emergencies.* Prior planning and designing of emergency response routines are necessary. Notify safety personnel, evacuate nonessential personnel, eliminate sources of heat and ignition, and provide adequate explosion-proof ventilation, particularly at floor level (see sect. 4). Cleanup personnel must wear a complete set of personal protective equipment (see sect. 8) to protect the skin and eyes against any contact with this liquid poison or inhalation of its vapor. Shovel, scoop, or vacuum the released nitrobenzene and place it into appropriate containers for disposal. **Waste Disposal:** Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000 Subpart Z)

EPA Designations

Listed as RCRA Hazardous Waste No. U169 (40 CFR 261.33)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1000 lb (454 kg) [*per CWA, §311(b)(4) and 307(a); and RCRA, §3001]

Listed as a SARA Extremely Hazardous Substance (40 CFR 355), Threshold Planning Quantity (TPQ): 10000 lb

Listed as a SARA Toxic Chemical* (40 CFR 372.65) [*EPA Form R may apply to your facility; see 40 CFR 372.85 for instructions]

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Where splashing of nitrobenzene is possible, wear a full face shield. Follow OSHA eye- and face-protection regulations (29 CFR 1910.133). **Respirator:** Wear a NIOSH-approved respirator per Genium reference 88 for the maximum-use concentrations and/or exposure limits cited in section 2. Follow OSHA respirator regulations (29 CFR 1910.134). For emergency or nonroutine operations (leaks or cleaning reactor vessels and storage tanks), wear an SCBA. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Other:** Wear impervious gloves, boots, aprons, and gauntlets to prevent any contact of nitrobenzene with your skin. **Ventilation:** Install and operate general and local maximum-explosion-proof ventilation systems powerful enough to maintain airborne concentrations of this material below the OSHA PEL standard cited in section 2. Local exhaust ventilation is preferred because it prevents dispersion of the contaminant into the general work area by eliminating it at its source. Consult the latest edition of Genium reference 103 for detailed recommendations. **Safety Stations:** Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work areas. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove contaminated clothing and launder it before wearing it again; clean this material from your shoes and equipment. **Comments:** The health effects of nitrobenzene are so dangerous that persons exposed to it should be periodically instructed in safe-handling procedures and in recognizing the symptoms of developing cyanosis (see sect. 6). Practice good personal hygiene; always wash thoroughly after using this material and before eating, drinking, smoking, using the toilet, or applying cosmetics. Keep it off your clothing and equipment. Avoid transferring it from your hands to your mouth while eating, drinking, or smoking. Do *not* eat, drink, or smoke in work areas. Avoid all skin contact with this liquid and inhalation of its vapor.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage/Segregation: Store nitrobenzene in closed containers in a cool, dry, well-ventilated, low fire-risk area away from incompatible chemicals (see sect. 5) and sources of heat or ignition. Protect these containers from physical damage; shield them from direct sunlight. **Engineering Controls:** Electrically ground and bond all containers and equipment used in shipping, receiving, or sampling operations in production or storage areas to prevent static sparks.

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: Nitrobenzene, Liquid
DOT Hazard Class: Poison B
DOT ID No.: UN1662
DOT Label: Poison
DOT Packaging Requirements: 49 CFR 173.346
DOT Packaging Exceptions: 49 CFR 173.345

IMO Shipping Name: Nitrobenzene
IMO Hazard Class: 6.1
IMO Label: Poison
IMDG Packaging Group: II

References: 1, 6, 26, 38, 84-94, 100, 116, 118, 119, 122

Prepared by: PJ Igoe, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** W Silverman, MD

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Material Safety Data Sheets Collection:

Sheet No. 317
Toluene

Issued: 8/79 Revision: E, 9/92

Section 1. Material Identification

Toluene ($C_6H_5CH_3$) Description: Derived from petroleum i.e., dehydrogenation of cycloparaffin fractions followed by the aromatization of saturated aromatic hydrocarbons or by fractional distillation of coal-tar light oil and purified by rectification. Used widely as a solvent (replacing benzene in many cases) for oils, resins, adhesives, natural rubber, coal tar, asphalt, pitch, acetyl celluloses, cellulose paints and varnishes; a diluent for photogravure inks, raw material for organic synthesis (benzoyl & benzilidene chlorides, saccharine, TNT, toluene diisocyanate, and many dyestuffs), in aviation and high octane automobile gasoline, as a nonclinical thermometer liquid and suspension solution for navigational instruments.

Other Designations: CAS No. 108-88-3, Methacide, methylbenzene, methylbenzol, phenylmethane, toluol, Tolu-sol.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*[73] for a suppliers list.

Cautions: Toluene is an eye, skin, and respiratory tract irritant becoming narcotic at high centrations. Liver and kidney damage has occurred. Pregnant women chronically exposed to toluene have shown teratogenic effects. Toluene is highly flammable.

R 1
I 3
S 2*
K 3
* Skin absorption

NFPA

HMIS
H 2 - Chronic effects
F 3
R 0
PPE-Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Toluene, < 100%; may contain a small amount of benzene (~ 1%), xylene, and nonaromatic hydrocarbons.

1991 OSHA PELs
8-hr TWA: 100 ppm (375 mg/m³)
15-min STEL: 150 ppm (560 mg/m³)

1990 IDLH Level
2000 ppm

1990 NIOSH RELs
TWA: 100 ppm (375 mg/m³)
STEL: 150 ppm (560 mg/m³)

1992-93 ACGIH TLV (Skin)
TWA: 50 ppm (188 mg/m³)

1990 DFG (Germany) MAK*
TWA: 100 ppm (380 mg/m³)
Half-life: 2 hr to end of shift
Category II: Substances with systemic effects
Peak Exposure Limit: 500 ppm, 30 min average value, 2/shift

1985-86 Toxicity Data†
Man, inhalation, TC_{Lo}: 100 ppm caused hallucinations, and changes in motor activity and changes in psychophysiological tests.
Human, oral, LD_{Lo}: 50 mg/kg; toxic effects not yet reviewed
Human, eye: 300 ppm caused irritation.
Rat, oral, LD_{50}: 5000 mg/kg
Rat, liver: 30 µmol/L caused DNA damage.

* Available information suggests damage to the developing fetus is probable.
†See NIOSH, *RTECS* (XS5250000), for additional irritation, mutation, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 232 °F (110.6 °C)
Melting Point: -139 °F (-95 °C)
Molecular Weight: 92.15
Density: 0.866 at 68 °F (20/4 °C)
Surface Tension: 29 dyne/cm at 68 °F (20 °C)
Viscosity: 0.59 cP at 68 °F (20 °C)
Refraction Index: 1.4967 at 20 °C/D
Water Solubility: Very slightly soluble, 0.6 mg/L at 68 °F (20 °C)
Other Solubilities: Soluble in acetone, alcohol, ether, benzene, chloroform, glacial acetic acid, petroleum ether, and carbon disulfide.
Vapor Pressure: 22 mm Hg at 68 °F (20 °C); 36.7 mm Hg at 86 °F (30 °C)
Saturated Vapor Density (Air = 0.075 lb/ft³ or 1.2 kg/m³): 0.0797 lb/ft³ or 1.2755 kg/m³
Odor Threshold (range of all referenced values): 0.021 to 69 ppm

Appearance and Odor: Colorless liquid with a sickly sweet odor.

Section 4. Fire and Explosion Data

Flash Point: 40 °F (4.4 °C) CC	**Autoignition Temperature:** 896 °F (480 °C)	**LEL:** 1.27% v/v	**UEL:** 7.0% v/v

Extinguishing Media: Toluene is a Class 1B flammable liquid. To fight fire, use dry chemical carbon dioxide, or 'alcohol-resistant' foam. Water spray may be ineffective as toluene floats on water and may actually spread fire. **Unusual Fire or Explosion Hazards:** Concentrated vapors are heavier than air and may travel to an ignition source and flash back. Container may explode in heat of fire. Toluenes' burning rate = 5.7 mm/min and its flame speed = 37 cm/sec. Vapor poses an explosion hazard indoors, outdoors, and in sewers. May accumulate static electricity. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighter's protective clothing provides only limited protection. Apply cooling water to sides of tanks until well after fire is out. Stay away from ends of tanks. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if impossible, withdraw from fire and let burn. Withdraw immediately if you hear a rising sound from venting safety device or notice any tank discoloration due to fire because a BLEVE (boiling liquid expanding vapor explosion) may be imminent. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Toluene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization can't occur. **Chemical Incompatibilities:** Strong oxidizers, concentrated nitric acid, nitric acid + sulfuric acid, dinitrogen tetroxide, silver perchlorate, bromine trifluoride, tetranitromethane, and 1,3-dichloro-5,5-dimethyl-2,4-imidazolididione. **Conditions to Avoid:** Contact with heat, ignition sources, or incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of toluene can produce carbon dioxide, and acrid, irritating smoke.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,[164] NTP,[169] and OSHA[164] do not list toluene as a carcinogen. **Summary of Risks:** Toluene is irritating to the eyes, nose, and respiratory tract. Inhalation of high concentrations produces a narcotic effect sometimes leading to coma as well as liver and kidney damage. 93% of inhaled toluene is retained in the body of which 80% is metabolized to benzoic acid, then to hippuric acid and excreted in urine. The remainder is metabolized to *o*-cresol and excreted or exhaled unchanged. Toluene metabolism is inhibited by alcohol ingestion and is synergistic with benzene, asphalt fumes, or chlorinated hydrocarbons (i.e. perchloroethylene). Toluene is readily absorbed through the skin at 14 to 23 mg/cm²/hr. Toluene is absorbed quicker during exercise than at rest and appears to be retained longer in obese versus thin victims; presumably due to its lipid solubility. There is inconsistent data on toluene's ability to damage bone marrow; chronic poisoning has resulted in anemia and leucopenia with biopsy showing bone marrow hypo-plasia. These reports are few and some authorities argue that the effects may have been due to benzene contaminants. Chronic inhalation during pregnancy has been associated with teratogenic effects on the fetus including microcephaly, CNS dysfunction, attentional deficits, developmental delay + language impairment, growth retardation, and physical defects including a small midface, short palpebral fissures, with deep-set eyes, low-set ears, flat nasal bridge with a small nose, micrognathia, and blunt fingertips. There is some evidence that toluene causes an autoimmune illness in which the body produces antibodies that cause inflammation of its own kidney.

Continue on next page

Section 6. Health Hazard Data

Medical Conditions Aggravated by Long-Term Exposure: Alcoholism and CNS, kidney, skin, or liver disease. **Target Organs:** CNS, liver, kidney, skin. **Primary Entry Routes:** Inhalation, skin contact/absorption. **Acute Effects:** Vapor inhalation causes respiratory tract irritation, fatigue, weakness, confusion, dizziness, headache, dilated pupils, watering eyes, nervousness, insomnia, parasthesis, and vertigo progressing to narcotic coma. Death may result from cardiac arrest due to ventricular fibrillation with catecholamines loss. Liquid splashed in the eye causes conjunctival irritation, transient corneal damage and possible burns. Prolonged skin contact leads to drying and fissured dermatitis. Ingestion causes GI tract irritation and symptoms associated with inhalation. **Chronic Effects:** Symptoms include mucous membrane irritation, headache, vertigo, nausea, appetite loss and alcohol intolerance. Repeated heavy exposure may result in encephalopathies (cerebellar ataxia and cognitive dysfunction), liver enlargement, and kidney dystrophy (wasting away). Symptoms usually appear at workdays end, worsen at weeks end and decrease or disappear over the weekend.

FIRST AID **Eyes:** *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult an ophthalmologist immediately. **Skin:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, have that *conscious and alert* person drink 1 to 2 glasses of water to dilute. *Do not* induce vomiting because of danger of aspiration into the lungs. Gastric lavage may be indicated if large amounts are swallowed; potential toxicity needs to be weighed against aspiration risk when deciding for or against gastric lavage. **Note to Physicians:** Monitor cardiac function. If indicated, use epinephrine and other catecholamines carefully, because of the possibility of a lowered myocardial threshold to the arrhythmogenic effects of such substances. Obtain CBC, electrolytes, and urinalysis. Monitor arterial blood gases. If toluene has > 0.02% (200 ppm) benzene, evaluate for potential benzene toxicity. BEI: hippuric acid in urine, sample at shift end (2.5 g/g creatinine); Toluene in venous blood, sample at shift end (1.0 mg/L).

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Cleanup personnel protect against inhalation and skin/eye contact. Use water spray to cool and disperse vapors but it may not prevent ignition in closed spaces. Cellosolve, hycar absorbent materials, and fluorocarbon water can also be used for vapor suppression/containment. Take up small spill with earth, sand, vermiculite, or other absorbent, noncombustible material. Dike far ahead of large spills for later reclamation or disposal. For water spills, (10 ppm or greater) apply activated carbon at 10X the spilled amount and remove trapped material with suction hoses or use mechanical dredges/lifts to remove immobilized masses of pollutants and precipitates. Toluene can undergo fluidized bed incineration at 842 to 1796 °F (450 to 980 °C), rotary kiln incineration at 1508 to 2912 °F (820 to 1600 °C), or liquid injection incineration at 1202 to 2912 °F (650 to 1600 °C). Follow applicable OSHA regulations (29 CFR 1910.120). **Ecotoxicity Values:** Blue gill, LC_{50} = 17 mg/L/24 hr; shrimp (*Crangonfracis coron*), LC_{50} = 4.3 ppm/96 hr; fathead minnow (*Pimephales promelas*), LC_{50} = 36.2 mg/L/96 hr. **Environmental Degradation:** If released to land, toluene evaporates and undergoes microbial degradation. In water, toluene volatilizes and biodegrades with a half-life of days to several weeks. In air, toluene degrades by reaction with photochemically produced hydroxyl radicals. **Disposal:** Treat contaminated water by gravity separation of solids, followed by skimming of surface. Pass through dual media filtration and carbon absorption units (carbon ratio 1 kg to 10 kg soluble material). Return waste water from backwash to gravity separator. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. U220
SARA Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg)
[* per RCRA, Sec. 3001; CWA, Sec. 311 (b)(4); CWA, Sec. 307 (a)]
Listed as a SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses with shatter-resistant glass and side-shields or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For < 100 ppm, use any chemical cartridge respirator with appropriate organic vapor cartridges, any supplied-air respirator (SAR), or SCBA. For < 200 ppm, use any SAR operated in continuous-flow mode, any SAR or SCBA with a full facepiece, or any air-purifying respirator with a full facepiece having a chin-style, front or back mounted organic vapor canister. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas. **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Polyvinyl alcohol with a breakthrough time of > 8 hr, Teflon and Viton are recommended as suitable materials for PPE. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.(103) **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes and launder before reuse. Remove toluene from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from ignition sources and incompatibles. Outside or detached storage is preferred. If stored inside, use a standard flammable liquids warehouse, room, or cabinet. To prevent static sparks, electrically ground and bond all equipment used with toluene. Do not use open lights in toluene areas. Install Class 1, Group D electrical equipment. Check that toluene is free of or contains < 1% benzene before use. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. **Administrative Controls:** Adopt controls for confined spaces (29 CFR 1910.146) if entering areas of unknown toluene levels (holes, wells, storage tanks). Consider preplacement and periodic medical exams of exposed workers that emphasize the CNS, liver, kidney, and skin. Include hemocytometric and thrombocyte count in cases where benzene is a contaminant of toluene. Monitor air at regular intervals to ensure effective ventilation.

Transportation Data (49 CFR 172.101)

	Packaging Authorizations	**Quantity Limitations**	**Vessel Stowage Requirements**
DOT Shipping Name: Toluene	**a) Exceptions:** 150	**a) Passenger Aircraft or Railcar:** 5L	**Vessel Stowage:** B
DOT Hazard Class: 3	**b) Non-bulk Packaging:** 202	**b) Cargo Aircraft Only:** 60L	**Other:** --
ID No.: UN1294	**c) Bulk Packaging:** 242		
DOT Packing Group: II			
DOT Label: Flammable Liquid			
Special Provisions (172.102): T1			

MSDS Collection **References:** 26, 73, 100, 101, 103, 124, 126, 127, 132, 140, 148, 153, 159, 163, 164, 167, 169, 171, 174, 175, 176, 180.
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** PA Roy, CIH, MPH; **Medical Review:** AC Darlington, MD, MPH

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Material Safety Data Sheets Collection:

Sheet No. 318
Xylene *(Mixed Isomers)*

Issued: 11/80 Revision: E, 9/92 Errata: 12/94

Section 1. Material Identification

Xylene (Mixed Isomers) (C_8H_{10}) Description: The commercial product is a blend of the three isomers [*ortho*-(*o*-), *meta*-(*m*-), *para*-(*p*-)] with the largest proportion being *m*- xylene. Xylene is obtained from coal tar, toluene by transalkylation, and pseudocumene. Used in the manufacture of dyes, resins, paints, varnishes, and other organics; as a general solvent for adhesives, a cleaning agent in microscope technique; as a solvent for Canada balsam microscopy; as a fuel component; in aviation gasoline, protective coatings, sterilizing catgut, hydrogen peroxide, perfumes, insect repellants, pharmaceuticals, and the leather industry; in the production of phthalic anhydride, isophthalic, and terephthalic acids and their dimethyl esters which are used in the manufacture of polyester fibers; and as an indirect food additive as a component of adhesives. Around the home, xylene is found as vehicles in paints, paint removers, degreasing cleaners, lacquers, glues and cements and as solvent/vehicles for pesticides.

Other Designations: CAS No. 1330-20-7 [95-47-6; 108-38-3; 106-42-3 (*o*-, *m*-, *p*-isomers)], dimethylbenzene, methyltoluene, NCI-C55232, Violet 3, xylol.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

Cautions: Xylene is an eye, skin, and mucous membrane irritant and may be narcotic in high concentrations. It is a dangerous fire hazard.

R 1
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S 2
K 3

NFPA
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HMIS
H 2†
F 3
R 0
PPE ‡
† Chronic Effects
‡ Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Xylene (mixed isomers): the commercial product generally contains ~ 40% *m*-xylene; 20% each of *o*-xylene, *p*-xylene, and ethylbenzene; and small quantities of toluene. Unpurified xylene may contain pseudocumene.

1991 OSHA PELs
8-hr TWA: 100 ppm (435 mg/m^3)
15-min STEL: 150 ppm (655 mg/m^3)

1990 IDLH Level
1000 ppm

1990 NIOSH RELs
TWA: 100 ppm (435 mg/m^3)
STEL: 150 ppm (655 mg/m^3)

1992-93 ACGIH TLVs
TWA: 100 ppm (434 mg/m^3)
STEL: 150 ppm (651 mg/m^3)
BEI (Biological Exposure Index): Methylhippuric acids in urine at end of shift: 1.5 g/g creatinine

1990 DFG (Germany) MAK
TWA: 100 ppm (440 mg/m^3)
Category II: Substances with systemic effects
Half-life: < 2 hr
Peak Exposure: 200 ppm, 30 min, average value, 4 peaks per shift

1985-86 Toxicity Data*
Human, inhalation, TC_{Lo}: 200 ppm produced olfaction effects, conjunctiva irritation, and other changes involving the lungs, thorax, or respiration.
Man, inhalation, LC_{Lo}: 10000 ppm/6 hr; toxic effects not yet reviewed.
Human, oral, LD_{Lo}: 50 mg/kg; no toxic effect noted.
Rat, oral, LD_{50}: 4300 mg/kg; toxic effect not yet reviewed.
Rat, inhalation, LC_{50}: 5000 ppm/4 hr; toxic effects not yet reviewed.

* See NIOSH, *RTECS* (XE2100000), for additional toxicity data.

Section 3. Physical Data

Boiling Point Range: 279 to 284 °F (137 to 140 °C)*
Boiling Point: *ortho:* 291 °F (144 °C); *meta:* 281.8 °F (138.8 °C); *para:* 281.3 °F (138.5 °C)
Freezing Point/Melting Point: *ortho:* -13 °F (-25 °C); *meta:* -53.3 °F (- 47.4 °C); *para:* 55 to 57 °F (13 to 14 °C)
Vapor Pressure: 6.72 mm Hg at 70 °F (21 °C)
Saturated Vapor Density (Air = 1.2 kg/m^3): 1.23 kg/m^3, 0.077 lbs/ft^3

Appearance and Odor: Clear, sweet-smelling liquid.

* Materials with wider and narrower boiling ranges are commercially available.

Molecular Weight: 106.16
Specific Gravity: 0.864 at 20 °C/4 °C
Water Solubility: Practically insoluble
Other Solubilities: Miscible with absolute alcohol, ether, and many other organic liquids.
Octanol/Water Partition Coefficient: logKow = 3.12-3.20
Odor Threshold: 1 ppm
Viscosity: <32.6 SUS

Section 4. Fire and Explosion Data

Flash Point: 63 to 77 °F (17 to 25 °C) CC	**Autoignition Temperature:** 982 °F (527 °C) (*m*-)	**LEL:** 1.1 (*m*-, *p*-); 0.9 (*o*-)	**UEL:** 7.0 (*m*-, *p*-); 6.7 (*o*-)

Extinguishing Media: For small fires, use dry chemical, carbon dioxide (CO_2), water spray or regular foam. For large fires, use water spray, fog or regular foam. Water may be ineffective. Use water spray to cool fire-exposed containers. **Unusual Fire or Explosion Hazards:** Xylene vapors or liquid (which floats on water) may travel to an ignition source and flash back. The heat of fire may cause containers to explode and/or produce irritating or poisonous decomposition products. Xylene may present a vapor explosion hazard indoors, outdoors, or in sewers. Accumulated static electricity may occur from vapor or liquid flow sufficient to cause ignition. **Special Fire-fighting Procedures:** Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighter's protective clothing will provide limited protection. If feasible and without risk, move containers from fire area. Otherwise, cool fire-exposed containers until well after fire is extinguished. Stay clear of tank ends. Use unmanned hose holder or monitor nozzles for massive cargo fires. If impossible, withdraw from area and let fire burn. Withdraw immediately in case of any tank discoloration or rising sound from venting safety device. Do not release runoff from fire control methods to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Xylene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Xylene is easily chlorinated, sulfonated, or nitrated. **Chemical Incompatibilities:** Incompatibilities include strong acids and oxidizers and 1,3-dichloro-5,5-dimethyl-2,4-imidazolidindione (dichlorohydrantoin). Xylene attacks some forms of plastics, rubber, and coatings. **Conditions to Avoid:** Avoid heat and ignition sources and incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of xylene can produce carbon dioxide, carbon monoxide, and various hydrocarbon products.

Section 6. Health Hazard Data

Carcinogenicity: The IARC,(164) NTP,(169) and OSHA(164) do not list xylene as a carcinogen. **Summary of Risks:** Xylene is an eye, mucous membrane, and respiratory tract irritant. Irritation starts at 200 ppm; severe breathing difficulties which may be delayed in onset can occur at high concentrations. It is a central nervous system (CNS) depressant and at high concentrations can cause coma. Kidney and liver damage can occur with xylene exposure. With prolonged or repeated cutaneous exposure, xylene produces a defatting dermatitis. Chronic toxicity is not well defined, but it is less toxic than benzene. Prior to the 1950s, benzene was often found as a contaminant of xylene and the effects attributed to xylene such as blood dyscrasias are questionable. Since the late 1950s, xylenes have been virtually benzene-free and blood dyscrasias have not been associated with xylenes. Chronic exposure to high concentrations of xylene in animal studies have demonstrated mild reversible decrease in red and white cell counts as well as increases in platelet counts.

Continue on next page

Section 6. Health Hazard Data, *continued*

Menstrual irregularity was reported in association with workplace exposure to xylene perhaps due to effects on liver metabolism. Xylene crosses the human placenta, but does not appear to be teratogenic under conditions tested to date. **Medical Conditions Aggravated by Long-Term Exposure:** CNS, respiratory, eye, skin, gastrointestinal (GI), liver and kidney disorders. **Target Organs:** CNS, eyes, GI tract, liver, kidneys, and skin. **Primary Entry Routes:** Inhalation, skin absorption (slight), eye contact, ingestion. **Acute Effects:** Inhalation of high xylene concentrations may cause dizziness; nausea, vomiting, and abdominal pain; eye, nose, and throat irritation; respiratory tract irritation leading to pulmonary edema (fluid in lung); drowsiness; and unconsciousness. Direct eye contact can result in conjunctivitis and corneal burns. Ingestion may cause a burning sensation in the oropharynx and stomach and transient CNS depression. **Chronic Effects:** Repeated or prolonged skin contact may cause drying and defatting of the skin leading to dermatitis. Repeated eye exposure to high vapor concentrations may cause reversible eye damage, peripheral and central neuropathy, and liver damage. Other symptoms of chronic exposure include headache, fatigue, irritability, chronic bronchitis, and GI disturbances such as nausea, loss of appetite, and gas.

FIRST AID *Emergency personnel should protect against exposure.* **Eyes:** *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately. **Skin:** *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician. Carefully dispose of contaminated clothing as it may pose a fire hazard. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. Monitor exposed person for respiratory distress. **Ingestion:** Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center and unless otherwise advised, *do not induce vomiting!* If spontaneous vomiting should occur, keep exposed person's head below the hips to prevent aspiration (breathing liquid xylene into the lungs). *Aspiration of a few millimeters of xylene can cause chemical pneumonitis, pulmonary edema, and hemorrhage.* **Note to Physicians:** Hippuric acid or the ether glucuronide of *ortho*-toluic acid may be useful in diagnosis of *meta-*, *para-* and *ortho*-xylene exposure, respectively. Consider gastric lavage if a large quantity of xylene was ingested. Proceed gastric lavage with protection of the airway from aspiration; consider endotracheal intubation with inflated cuff.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, remove all heat and ignition sources, and ventilate spill area. Cleanup personnel should protect against vapor inhalation and skin or eye contact. If feasible and without undue risk, stop leak. Use appropriate foam to blanket release and suppress vapors. Water spray may reduce vapor, but does not prevent ignition in closed spaces. For small spills, absorb on paper and evaporate in appropriate exhaust hood or absorb with sand or some non-combustible absorbent and place in containers for later disposal. For large spills dike far ahead of liquid to contain. Do not allow xylene to enter a confined space such as sewers or drains. On land, dike to contain or divert to impermeable holding area. Apply water spray to control flammable vapor and remove material with pumps or vacuum equipment. On water, contain material with natural barriers, booms, or weirs; apply universal gelling agent; and use suction hoses to remove spilled material. Report any release in excess of 1000 lb. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** Little bioconcentration is expected. Biological oxygen demand 5 (after 5 days at 20 °C): 0.64 (no stated isomer). **Ecotoxicity values:** LD_{50}, Goldfish, 13 mg/L/24 hr, conditions of bioassay not specified, no specific isomer. **Environmental Degradation:** In the atmosphere, xylenes degrade by reacting with photochemically produced hydroxyl radicals with a half-life ranging from 1-1.7 hr. in the summer to 10-18 hr in winter or a typical loss of 67-86% per day. Xylenes are resistant to hydrolysis. **Soil Absorption/Mobility:** Xylenes have low to moderate adsorption to soil and when spilled on land, will volatilize and leach into groundwater. **Disposal:** As a hydrocarbon, xylene is a good candidate for controlled incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
Listed as a RCRA Hazardous Waste (40 CFR 261.33): No. U239, F003 (spent solvent)
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1000 lb (454 kg) [* per Clean Water Act, Sec. 311(b)(4); per RCRA, Sec. 3001]

OSHA Designations

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy. **Respirator:** Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For concentrations >1000 ppm, use any chemical cartridge respirator with organic vapor cartridges; any powered, air-purifying respirator with organic vapor cartridges; any supplied-air respirator; or any self-contained breathing apparatus. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* **Other:** Wear chemically protective gloves, boots, aprons, and gauntlets to prevent all skin contact. With breakthrough times > 8 hr, consider polyvinyl alcohol and fluorocarbon rubber (Viton) as materials for PPE. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.(103) **Safety Stations:** Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities. **Contaminated Equipment:** Separate contaminated work clothes from street clothes. Launder contaminated work clothing before wearing. Remove this material from your shoes and clean PPE. **Comments:** Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in clearly labelled, tightly closed, containers in a cool, well-ventilated place, away from strong oxidizing materials and heat and ignition sources. During transferring operations, electrically ground and bond metal containers. **Engineering Controls:** To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control airborne contaminants and to maintain concentrations at the lowest practical level. Use hermetically sealed equipment, transfer xylene in enclosed systems, avoid processes associated with open evaporating surfaces, and provide sources of gas release with enclosures and local exhaust ventilation. Use Class I, Group D electrical equipment. **Administrative Controls:** Establish air and biological monitoring programs and evaluate regularly. Consider preplacement and periodic medical examinations including a complete blood count, a routine urinalysis, and liver function tests. Consider hematologic studies if there is any significant contamination of the solvent with benzene. If feasible, consider the replacement of xylene by less toxic solvents such as petrol (motor fuel) or white spirit. Before carrying out maintenance and repair work, steam and flush all equipment to remove any xylene residues.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Xylenes
DOT Hazard Class: 3
ID No.: UN1307
DOT Packing Group: II
DOT Label: Flammable Liquid
Special Provisions (172.102): T1

Packaging Authorizations
a) Exceptions: 173.150
b) Nonbulk Packaging : 173.202
c) Bulk Packaging: 173.242

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 5L
b) Cargo Aircraft Only: 60L

Vessel Stowage Requirements
a) Vessel Stowage: B
b) Other: –

MSDS Collection **References:** 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 139, 140, 148, 149, 153, 159, 163, 164, 167, 171, 174, 176, 180.
Prepared by: MJ Wurth, BS; **Industrial Hygiene Review:** PA Roy, MPH, CIH; **Medical Review:** W Silverman, MD

Material Safety Data Sheet

From Genium's Reference Collection
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GENIUM PUBLISHING CORP.

No. 636

MESITYLENE

Issued: November 1987

SECTION 1. MATERIAL IDENTIFICATION

24

Material Name: MESITYLENE

Description (Origin/Uses): Used as a raw material in chemical synthesis and as an ultraviolet stabilizer.

Other Designations: 1,3,5-Trimethylbenzene; 1,3,5-Trimethyl Benzol; TMB; *sym*-Trimethylbenzene; C_9H_{12}; NIOSH *RTECS* No. DC3220000; CAS No. 0108-67-8

Manufacturer/Supplier: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyers' Guide* (Genium. ref. 73) for a list of suppliers.

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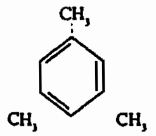
HMIS
H 1
F 2
R 0
PPG*
*See sect. 8

R 1
I 3
S 2
K 2

SECTION 2. INGREDIENTS AND HAZARDS

SECTION 2. INGREDIENTS AND HAZARDS	%	EXPOSURE LIMITS
Mesitylene, CAS No. 0108-67-8	ca 100	**ACGIH TLV, 1987-88** **TLV-TWA: 25 ppm, 125 mg/m³** **Toxicity Data*** **Human, Inhalation, TC_{Lo}: 10 ppm**



*See NIOSH, *RTECS*, for additional data.

SECTION 3. PHYSICAL DATA

Boiling Point: 328.3°F (164.6°C)
Vapor Pressure at 20°C, mm Hg: 1.86
Water Solubility: Negligible
Vapor Density (Air = 1): 4.15
Evaporation Rate: Not Found

Specific Gravity (H_2O = 1): 0.8652
Melting Point: -48.6°F (-44.8°C)
% Volatile by Volume: ca 100
Molecular Weight: 120.19 Grams/Mole

Appearance and odor: A clear, colorless liquid; peculiar aromatic odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
112°F (44°C) TCC	970°F (521°C)	% by Volume (Calculated)	1.47%	Not Found

Extinguishing Media: Use dry chemical, foam, carbon dioxide, or water fog. Do not use a solid stream of water because the stream will scatter the fire and spread it. Use water spray to cool fire-exposed tanks/containers and to disperse vapors.

Unusual Fire/Explosion Hazards: This OSHA class II combustible liquid is a moderate fire hazard when exposed to heat, sparks, or open flame. It can react vigorously with oxidizing materials. **Warning:** When mesitylene is heated, its vapors may form explosive mixtures with air.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Mesitylene is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.

Chemical Incompatibilities: Mesitylene is incompatible with strong oxidizing agents.

Conditions to Avoid: Prevent contact with heat, sparks, and open flame.

Hazardous Products of Decomposition: Thermal decomposition or burning may produce carbon dioxide and/or carbon monoxide.

SECTION 6. HEALTH HAZARD INFORMATION

Mesitylene is not listed as a carcinogen by the NTP, IARC, or OSHA.

Summary of Risks: Mesitylene vapor is somewhat unpleasant and may cause irritation of the eyes, nose, and throat. Overexposure to high concentrations of vapor may cause narcosis and central nervous system depression. The liquid is irritating to the eyes and may cause irritation of the skin, especially if contact is repeated or prolonged. **Warning:** Aspiration of liquid into lungs can cause chemical pneumonitis.
Medical Conditions Aggravated by Long-Term Exposure: None reported. **Target Organs:** Central nervous system.
Primary Entry: Inhalation, skin and eye contact. **Acute Effects:** Central nervous system depression, skin and eye irritation.
Chronic Effects: None reported.

FIRST AID: Eye Contact. Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. **Skin Contact.** Immediately wash the affected area with soap and water. **Inhalation.** Remove victim to fresh air; restore and/or support his breathing as needed.
Ingestion. Call a poison control center. Never give anything by mouth to someone who is unconscious or convulsing. If the victim is responsive, give him one or two glasses of milk or water to drink. Do not induce vomiting because of possible aspiration hazards.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel of large mesitylene spills or leaks. Remove all sources of heat and ignition. Provide maximum explosion-proof ventilation. Evacuate the spill area and limit access to necessary personnel only. Remove leaking containers to a safe place, if feasible. Those involved in cleanup need protection against contact with liquid and inhalation of vapor (see sect. 8). Absorb small spills with paper toweling or vermiculite. Contain large spills and collect them, if feasible, or absorb them with an inert material such as sand, earth, or vermiculite. Place waste liquid or absorbent into closable containers for reclamation or disposal, using nonsparking tools. Water spray may be used to flush spills away from sensitive exposures. Keep waste out of sewers, watersheds, or waterways.

Waste Disposal: Consider reclamation, recycling, or destruction rather than disposal in a landfill. Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. **Gloves:** Wear impervious gloves.
Respirator: Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* for the maximum-use concentrations and/or the exposure limits cited in section 2. Follow the respirator guidelines in 29 CFR 1910.134. IDLH or unknown concentrations require an SCBA, full facepiece, and pressure-demand/positive-pressure modes. **Warning:** Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres. **Ventilation:** Install and operate ventilation systems of sufficient power to maintain airborne levels of mesitylene below the cited exposure limit set by the ACGIH in section 2.
Safety Stations: Make eyewash stations, washing facilities, and safety showers available in areas of use and handling.
Contaminated Equipment: Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Remove and launder contaminated clothing before wearing it again; clean material from shoes and equipment.
Comments: Practice good personal hygiene. Keep material off of your clothing and equipment. Avoid transferring material from hands to mouth while eating, drinking, or smoking.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage Segregation: Store mesitylene in closed containers in a cool, dry, well-ventilated area away from oxidizing agents, heat, sparks, and open flame.
Special Handling/Storage: Storage area must meet OSHA requirements for class II combustible liquids. Protect containers from physical damage.
Engineering Controls in the Workplace: All bulk storage facilities must have an explosion-proof design. Ground and bond metal containers and equipment when transferring them to prevent static sparks.
Other Precautions: Do not smoke in areas where this material is handled or stored. Emptied containers retain product residues; handle them accordingly!

Transportation Data (49 CFR 172.101-2)

DOT Shipping Name: 1,3,5-Trimethylbenzene	**DOT ID No.** UN2325
DOT Hazard Class: Flammable Liquid	**IMO Label:** Flammable Liquid
IMO Class: 3.3	**DOT Label:** Flammable Liquid

References: 1, 2, 5, 7, 9, 12, 37, 59, 73, 81, 82, 84-94, 103. CR/PJI

Approvals

Indust. Hygiene/Safety DJW

Medical Review

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Material Safety Data Sheets Collection:

Sheet No. 358
o-Dichlorobenzene

Issued: 11/77 **Revision: C, 8/90**

Section 1. Material Identification

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o-Dichlorobenzene ($C_6H_4Cl_2$) Description: Prepared by the chlorination of benzene or monochlorobenzene in the presence of a catalyst. Used as a solvent for waxes, gums, tars, resins, oils, and asphalts; an insecticide for locust borers and termites; a degreasing agent for metals, leather, and wool; an intermediate in manufacturing dyes; an ingredient of metal polishes; an industrial odor control; a heat transfer medium; and in removing sulfur from illuminating gas.

Other Designations: CAS No. 0095-50-1, DCB, 1,2-dichlorobenzene, orthodichlorobenzene.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(73) for a suppliers list.

R	1
I	3
S	2*
K	2

* Skin absorption

NFPA

HMIS

H	2
F	2
R	0
PPG*	

* Sec. 8

Caution: o-Dichlorobenzene is a local irritant, a strong central nervous system (CNS) depressant, and a liver and kidney poison.

Section 2. Ingredients and Occupational Exposure Limits

o-Dichlorobenzene*

1989 OSHA PEL
15-min STEL (ceiling): 50 ppm, 300 mg/m³

1987 IDLH Level
1700 ppm

1989-90 ACGIH
TLV-STEL (ceiling): 50 ppm, 301 mg/m³

1988 NIOSH REL
None established

1985-86 Toxicity Data†
Rat, inhalation, LC_{Lo}: 821 ppm inhaled over 7 hr produces changes in behavior (general anesthetic), liver (hepatitis: hepatocellular necrosis, zonal) and sense organs, and special senses (tearing)
Rat, oral, LD_{50}: 500 mg/kg; toxic effects not yet reviewed
Rabbit, eye: 100 mg/30-s rinse produces mild irritation

* This material may contain some impurities. It is at least 85% o-dichlorobenzene, but may contain varying percentages of *para-* and *meta-*dichlorobenzene.
† See NIOSH, *RTECS* (CZ4500000), for additional irritative, mutative, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 356.9 °F (180.5 °C) at 760 mm Hg
Melting Point: 1.4 °F (-17 °C)
Vapor Pressure: 1.47 mm Hg at 25 °C
Vapor Density (Air = 1): 5.05
Molecular Weight: 147.01
Specific Gravity 20°C/4°C: 1.3059
Water Solubility: Practically insoluble (137 mg/liter at 25°C)
%Volatile by Volume: ca 100
Evaporation Rate (BuAc = 1): <1

Appearance and Odor: A colorless liquid with a disagreeable, aromatic odor. The high and low odor thresholds are 300 and 12 mg/m³; o-dichlorobenzene is irritating at 150 mg/m³. The odor is perceptible at 2 to 4 ppm.

Section 4. Fire and Explosion Data

Flash Point: 151°F (66 °C), CC	Autoignition Temperature: 1198 °F (648 °C)	LEL: 2.2% v/v	UEL: 9.2% v/v

Extinguishing Media: Extinguish fires involving this combustible material with water spray, dry chemical, foam, or carbon dioxide.

Unusual Fire or Explosion Hazards: Under normal working conditions, o-dichlorobenzene should not pose a fire hazard because of its high flash point. However, explosive mixtures may form if this material is heated or in a fire situation.

Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode and a fully encapsulating suit. Use water to cool fire-exposed containers, to flush spills away from exposures, and to protect workers attempting to stop a leak. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: o-Dichlorobenzene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.

Chemical Incompatibilities: This material can react vigorously with oxidizing materials. If o-dichlorobenzene is stored in sealed aluminum containers, a slow reaction with the aluminum could lead to an explosion.

Conditions to Avoid: Avoid heat and hot surfaces.

Hazardous Products of Decomposition: Thermal oxidative decomposition of o-dichlorobenzene can emit toxic fumes of chlorine (Cl^-).

Section 6. Health Hazard Data

Carcinogenicity: The IARC does not list *o*-dichlorobenzene as a carcinogen because of inadequate human and animal evidence. However, other sources identify *o*-dichlorobenzene as a suspected carcinogen.(126) Experimental studies show *o*-dichlorobenzene has teratogenic, mutagenic, and reproductive effects in laboratory animals.
Summary of Risks: This material is a skin, eye, and mucous membrane irritant. Noticeable eye irritation at 25 to 30 ppm is reported after a few minutes' exposure; at 60- to 100-ppm exposure levels eye irritation becomes painful. Voluntary overexposure is unlikely due to good warning properties (odor, eye, and respiratory irritation). Excessive vapor inhalation can cause drunkenness, anesthetic effect, and central nervous system (CNS) depression.
Medical Conditions Aggravated by Long-Term Exposure: Toxic effects can include hematological (blood) disorders and liver and kidney damage. Leukemia has been reported, but with no definite link to *o*-dichlorobenzene.
Target Organs: Liver, kidneys, skin, eyes.
Primary Entry Routes: Inhalation, skin absorption.
Acute Effects: Inhalation causes nose, eye, and throat irritation. Liquid contact with skin causes irritation. Prolonged or repeated contact may cause blister formation. Ingestion of *o*-dichlorobenzene causes burning pain in the stomach, nausea, vomiting, and diarrhea.
Chronic Effects: Symptoms include headache, anorexia, nausea, vomiting, weight loss, jaundice, and cirrhosis.
FIRST AID
Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.
Skin: *Quickly* remove contaminated clothing. After rinsing affected skin with flooding amounts of water, wash it with soap and water.
Inhalation: Remove exposed person to fresh air and support breathing as needed.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have that *conscious* person drink 2 to 3 glasses of water or milk to dilute. Spontaneous vomiting may occur. Position to prevent aspiration and observe for signs of breathing difficulty and change in consciousness. Contact a physician immediately.
Physician's Note: There is a chemical aspiration hazard if vomiting is induced; treat symptomatically. Serum hydrocarbon levels are not clinically useful since they reflect cumulative, rather than acute, exposure and may be misleading. The National Pesticide Telecommunications Network (800-858-7378) provides 24-hr consultation to health professionals.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, remove all heat and ignition sources, provide adequate ventilation, and evacuate all unnecessary personnel. Cleanup personnel should protect against vapor inhalation and contact with skin or eyes. Contain spills by diking. Collect liquid if feasible. Absorb small spills and residues on sand or vermiculite and place in a closed metal drum for disposal or reclamation. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33), No. U070
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 100 lb (45.4 kg) [* per Clean Water Act, Sec. 311(b)(4) and Sec. 307(a); per RCRA, Sec. 3001]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. A chemical cartridge respirator with an organic vapor cartridge and full facepiece can be used below 1000 ppm. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact. Neoprene or vinyl gloves are recommended.
Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PEL and ACGIH TLV (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.(103)
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed containers in a cool, dry, well-ventilated area away from oxidizing agents and heat and ignition sources. Outside or detached storage is preferred. Protect containers from physical damage. To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas.
Engineering Controls: Avoid vapor inhalation and contact with eyes and skin. Use only with personal protective gear. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Practice good personal hygiene and housekeeping procedures.
Other Precautions: Provide a preplacement questionnaire with emphasis on detecting a history of skin, liver, or kidney disease. Such individuals may be at an increased risk from exposure. Individuals may develop tolerance to high levels of exposure.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Dichlorobenzene, ortho, liquid
DOT Hazard Class: ORM-A
ID No.: UN1591
DOT Label: None
DOT Packaging Requirements: 173.510
DOT Packaging Exceptions: 173.505

IMO Shipping Name: *o*-Dichlorobenzene
IMO Hazard Class: 6.1
IMO Label: St. Andrews Cross
IMDG Packaging Group: III
ID No.: UN1591

MSDS Collection **References:** 38, 73, 84, 85, 88, 89, 100, 101, 103, 109, 124-127, 129, 132, 133-136, 138
Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Hardies, MD; **Edited by:** JR Stuart, MS

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Material Safety Data Sheet Collection

Anthracene **MSDS No. 917**

Date of Preparation: 6/94

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: Anthracene
Chemical Formula: $(C_6H_4CH)_2$
CAS No.: 120-12-7
Synonyms: anthracin, green oil, paranaphthalene, Tetra Olive N2G

Derivation: Occurs naturally in smoke (gasoline, coal, cigarette, etc.), charbroiled foods, and coal tar pitch volatiles. Obtained by distilling crude anthracene oil with alkali carbonate in iron retorts (phenanthrene is removed via carbon disulfide) *or* by salting out from crude anthracene oil and draining; the crude salts are then purified by pressing and the use of various solvents (phen-anthrene and carbazole are removed).

General Use: Used in chemical manufacture (phenanthrene, carbazole, anthraquinone), in calico printing; as a component of dyes, scintillation fluid, smoke screens; and in organic semi-conductor research.

Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Anthracene, ca 90 to 95 %wt (commercial grade); 90 to 98 %wt (technical grade)
Trace Impurities: Include phenanthrene, carbazole, chrysene, pyridine (0.2%), iron (0.03%)

OSHA PEL*	**NIOSH REL†**	**DFG (Germany) MAK**
8-hr TWA: 0.2 mg/m^3	10-hr TWA: 0.1 mg/m^3	None established
ACGIH TLV*	**IDLH Level**	
TWA: 0.2 mg/m^3	Ca, 700 mg/m^3	

*Coal tar pitch volatiles (benzene soluble). OSHA defines *coal tar pitch volatiles* as the fused polycyclic hydrocarbons that volatilize from the distillation residues of coal, petroleum, wood, and other organic matter, and *includes anthracene.*
†Coal tar products (cyclohexane extractable fraction), including anthracene.

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Anthracene is a polyaromatic hydrocarbon present in coal tar pitch volatiles. It exists as colorless crystals with a violet fluorescence when pure and as yellow crystals with a green fluorescence. Anthracene is irritating to the eyes, skin, and respiratory tract. Exposure to the sun can aggravate skin irritation and cause dermatitis. It is combustible.

Wilson Risk Scale

R	1
I	3
S	2*
K	1

*Skin absorption

HMIS

H	1†
F	1
R	0

† Chronic Effects
PPE‡
‡ Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, skin/eye contact
Target Organs: Eyes, skin, respiratory and digestive tracts.
Acute Effects
Inhalation: Symptoms include irritation of the respiratory tract, headache, nausea and vomiting, loss of appetite, slowed reactions, and adynamia (lack or loss of strength due to disease or other outside agent).
Eye: Irritation of the conjunctiva with burning, itching and watering.
Skin: Irritation with burning, itching, and edema (fluid build-up). Volunteers with a 2% crude tar solution applied to the skin showed anthracene absorption via blood tests.
Ingestion: Gastrointestinal tract irritation.
Carcinogenicity: *Coal tar pitch volatiles* (in general) are considered to be carcinogens by the NTP, IARC, DFG, NIOSH, and ACGIH. However, *anthracene* has been specifically evaluated by IARC and designated as Class 3 (*unclassifiable* as to carcinogenicity with no human evidence and limited animal evidence).
Medical Conditions Aggravated by Long-Term Exposure: Dermatitis.
Chronic Effects: Repeated skin contact can cause pigmentation of the skin with cornification of surface layers and telangioectasis (an abnormal dilatation of capillary vessels that often form small, raised, red, wart-like spots). Sensitization (including photo-sensitization) may also occur.
Other: Acute symptoms disappear within several days of last exposure. Anthracene appears to concentrate in the fat and liver.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.
Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult an ophthalmologist if pain and irritation persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water to dilute. Vomiting may be spontaneous.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treatment is symptomatic and supportive.

Section 5 - Fire-Fighting Measures

Flash Point: 250 °F (121 °C)

Flash Point Method: CC

Autoignition Temperature: 1004 °F (540 °C)

LEL: 0.6% v/v

UEL: Not reported.

Flammability Classification: Combustible

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

Unusual Fire or Explosion Hazards: May explode in air.

Hazardous Combustion Products: Include carbon oxide(s) and irritating, acrid smoke.

Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Spill /Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Cleanup personnel should protect against inhalation and skin/eye contact.

Small Spills: Carefully scoop up or vacuum (with appropriate filter) and place in suitable containers for disposal.

Large Spills

Containment: Use water to flush large spills to containment area for later disposal. Do not release into sewers or waterways.

Cleanup: Damp mop any residue.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: *Do not* use near heat or flame. Wear appropriate PPE.

Storage Requirements: Store in a cool, dry, well-ventilated area away from heat, ignition sources, and incompatibles (Sec. 10).

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond equipment used with and around anthracene. Enclosure of equipment and mechanization of processes will aid in exposure control.

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.(103)

Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. For any detectable concentration, use a SCBA or supplied-air respirator with a full facepiece and operated in pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Protective Clothing/Equipment: Limit work in sunlight as much as possible to prevent photosensitization. Photoprotective creams or pastes must be applied to bare skin regions. Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Polyvinyl chloride is a suitable material for PPE. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes and place in closed containers until laundered. Remove anthracene from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using anthracene, especially before eating, drinking, smoking, using the toilet, or applying cosmetics. Skin cleansers (ex. 55% kaolin, 25% neutral soap, 20% bran) are recommended.

Section 9 - Physical and Chemical Properties

Physical State: Solid
Appearance and Odor: Colorless crystals with a violet fluorescence (pure), yellow crystals with a green fluorescence (due to tetracene and naphthacene)
Vapor Pressure: 1mm Hg at 293 °F (145 °C)
Formula Weight: 178.22
Density (H_2O=1, at 4 °C): 1.25 g/cm^3 at 80.6 °F (27 °C)
Octanol/Water Partition Coefficient: log Kow = 4.45 (calc.)
Water Solubility: 1.29 mg/L at 77 °F/25 °C (*distilled water*), 0.6 mg/L at 77 °F/25 °C (*salt water*)
Other Solubilities: 1 g in 67 mL absolute alcohol, 70 mL methanol, 62 mL benzene, 85 mL chloroform, 200 mL ether, 31 mL carbon disulfide, 86 mL carbon tetrachloride, and 125 mL toluene. Also soluble in acetone.
Boiling Point: 644 °F (340 °C)
Melting Point: 423 °F (217 °C)

Section 10 - Stability and Reactivity

Stability: Anthracene darkens upon exposure to sunlight (transformed to *para*-anthracene).
Polymerization: Hazardous polymerization *does not* occur.
Chemical Incompatibilities: Include calcium hypochlorite (exothermic), fluorine (explodes), chromic acid, and calcium oxychloride.
Conditions to Avoid: Exposure to heat, ignition sources, sunlight, and incompatibles.
Hazardous Decomposition Products: Thermal oxidative decomposition of anthracene can produce carbon oxide(s) and acrid, irritating smoke.

Section 11 - Toxicological Information

Toxicity Data:*

Skin Effects:
Mouse, skin: 118 µg caused mild irritation.
Mutagenicity:
Rat, liver cell: 300 µmoL caused DNA damage.
Acute Oral Effects:
Mouse, oral, LD: > 17 g/kg caused fatty liver degeneration.
Tumorigenicity:
Rat, oral: 20 g/kg intermittently for 79 weeks caused liver tumors.

* See NIOSH, *RTECS* (CA9350000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: *Leponis macrochirus* (bluegill sunfish), LC$_{50}$ = 11.9 µg/L/96 hr; *Rana pipiens* (leopard frog), LC$_{50}$ = 0.065 ppm/30 min & 0.025 ppm/5 hr. BCF (bioconcentration factor): goldfish (162), rainbow trout (4400-9200). Bioconcentration occurs most heavily in organisms which lack the enzyme microsomal oxidase. Anthracene can become concentrated on the waxy surface of some plant leaves and fruits.
Environmental Degradation: If released to soil, anthracene is expected to absorb strongly and not leach to groundwater. It will not hydrolyze, but may be subject to biodegradation, the rate of which depends on soil type. In water, anthracene is subject to direct photolysis near the surface and undergoes significant biodegradation. Biodegradation in water is faster with increased temperature, increased oxygen, and acclimated microbes. Evaporation may also be significant with an estimated half-life range of 4.3 to 5.9 days from a river 1 m deep, flowing 1 m/sec, with a wind velocity of 3 m/sec. In the air, photolysis and reaction with photochemically-produced hydroxyl radicals (half-life: 1.67 days). Vapor phase anthracene is expected to degrade faster than particle-sorbed anthracene.
Soil Absorption/Mobility: A Koc of 26,000 suggests anthracene is relatively immobile in soil and unlikely to leach to groundwater; it will absorb strongly to soil.

Section 13 - Disposal Considerations

Disposal: Anthracene is a waste chemical stream constituent which may be subjected to ultimate disposal by controlled incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name:
Environmentally hazardous substances, solid, n.o.s.*
Shipping Symbols: —
Hazard Class: 9
ID No.: UN3077
Packing Group: III
Label: Class 9
Special Provisions (172.102): 8, B54, N50

Packaging Authorizations
a) Exceptions: 173.155
b) Non-bulk Packaging: 173.213
c) Bulk Packaging: 173.240

Quantity Limitations
a) Passenger, Aircraft, or Railcar: None
b) Cargo Aircraft Only: None

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: —

* Classified as a hazardous substance when anthracene is in a quantity, in one package, which equals or exceeds the RQ of 5000 lb (2270 kg)

Section 15 - Regulatory Information

EPA Regulations:
RCRA Hazardous Waste (40 CFR 261.33): Not listed
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) per CWA, Sec. 311 (b)(4)
CERCLA Reportable Quantity (RQ), 5000 lb (2270 kg)
Listed as a SARA Toxic Chemical (40 CFR 372.65)
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed
OSHA Regulations:
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A)

Section 16 - Other Information

References: 73, 103, 124, 132, 136, 149, 159, 176, 184, 187, 189, 192

Prepared By .... M Gannon, BA
Industrial Hygiene Review .... DJ Wilson, CIH
Medical Review .... T Thoburn, MD, MPH

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Material Safety Data Sheets Collection

Benzo(a)pyrene **MSDS No. 164**

Date of Preparation: 2/94

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: Benzo(a)pyrene
Chemical Formula: $C_{20}H_{12}$; a polynuclear aromatic hydrocarbon
CAS No.: 50-32-8
Synonyms: BaP; 3,4-benz(a)pyrene; BP; 3,4-benzopyrene; 3,4-benzpyrene. Formerly called 1,2-benzpyrene.
Derivation: Synthesized from pyrene and succinic anhydride.
General Use: Benzo(a)pyrene is no longer used or produced commercially in the US. In its pure form, benzo(a)pyrene may be used as a research laboratory reagent. It also occurs in combustion products of coal, oil, petroleum, wood and other biological matter; in motor vehicle and other gasoline and diesel engine exhaust; in charcoal-broiled foods; in cigarette smoke and general soot and smoke of industrial, municipal, and domestic origin. It occurs naturally in crude oils, shale oils, coal tars, gases and fly ash from active volcanoes and forest fires. **Vendors:** Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Benzo(a)pyrene, ca 100 %wt; except in laboratories, benzo(a)pyrene is usually mixed with other coal tar pitch chemicals. Consider exposure limits for coal tar pitch volatiles as a guideline. However, because benzo(a)pyrene is considered a probable carcinogen to humans, it is recommended that exposures to carcinogens be limited to the lowest feasible concentration.

OSHA PELs
Coal tar pitch volatiles
8-hr TWA: 0.2 mg/m^3

ACGIH TLVs
A2: Suspected Human Carcinogen

NIOSH REL
10-hr TWA: 0.1 mg/m^3
Carcinogen; coal tar pitch volatile, cyclohexane extractable fraction.

DFG (Germany) MAK
None established

IDLH Level
700 mg/m^3
Coal tar pitch volatiles (benzene soluble fraction)

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Benzo(a)pyrene is a pale yellow, crystalline solid or powder that is irritating to the skin, eyes, and respiratory tract. It is a carcinogen and mutagen. Handle with extreme caution!

Wilson Risk Scale	
R	1
I	4
S	4
K	1

HMIS	
H	2*
F	1
R	0
* Chronic Effects	
PPE†	
†Sec. 8	

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion. **Target Organs:** Respiratory system, bladder, kidneys, skin.
Acute Effects: Inhalation: Respiratory tract irritation. **Eye:** Irritation and/or burns on contact. **Skin:** Irritation with burning sensation, rash, and redness; dermatitis on prolonged exposure. Sunlight enhances effects (photosensitization). **Ingestion:** None reported.
Carcinogenicity: IARC, NTP, NIOSH, ACGIH, EPA, and MAK list benzo(a)pyrene as: an IARC 2A (probably carcinogenic to humans: limited human evidence, sufficient evidence in experimental animals), an NTP-2 (reasonably anticipated to be a carcinogen: limited evidence from studies in humans or sufficient evidence from studies in experimental animals), a NIOSH-X (carcinogen defined with no further categorization); an ACGIH TLV-A2 (suspected human carcinogen: carcinogenic in experimental animals, but available epidemiological studies are conflicting or insufficient to confirm an increased risk of cancer in exposed humans); an EPA-B2 (sufficient evidence from animal studies, inadequate evidence or no data from epidemiological studies); and an MAK-A1 (capable of inducing malignant tumors as shown by experience with humans) carcinogen, respectively.
Medical Conditions Aggravated by Long-Term Exposure: Respiratory system, bladder, kidney, and skin disorders.
Chronic Effects: Inhalation: Cough and bronchitis. **Eye:** Photosensitivity and irritation. **Skin:** Skin changes such as thickening, darkening, pimples, loss of color, reddish areas, thinning of the skin, and warts. Sunlight enhances effects (photosensitization). **Other:** Gastrointestinal (GI) effects include leukoplakia (a pre-cancerous condition characterized by thickened white patches of epithelium on mucous membranes, especially of the mouth). Cancer of the lung, skin, kidneys, bladder, or GI tract is also possible. Smoking in combination with exposure to benzo(a)pyrene increases the chances of developing lung cancer. Persons with a high degree of inducibility of the enzyme aryl hydrocarbon hydroxylase may be a high risk population.
Comments: Pregnant women may be especially susceptible to exposure effects of benzo(a)pyrene; exposure may damage the fetus. In general, polyaromatic hydrocarbons such as benzo(a)pyrene tend to localize primarily in body fat and fatty tissues (for ex. breasts) and are excreted in breast milk. Benzo(a)pyrene may also affect the male reproductive system (testes and sperm).

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of tepid water for at least 15 min. Consult an ophthalmologist if irritation or pain persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water (less than 15 min). Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water to dilute. Inducing vomiting is not necessary since benzo(a)pyrene has a low acute toxicity and therefore, is generally an unnecessary procedure. Consider activated charcoal/cathartic.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Monitor CBC and arterial blood gases, conduct liver, renal, and pulmonary function tests (if respiratory tract irritation is present), and urinalysis. Biological monitoring techniques testing for metabolites in blood or urine, or DNA adducts in blood or tissues are useful for epidemiological studies that determine if exposure has occurred. Because neither normal nor toxic levels have been established, those techniques may not be useful for evaluating individual patients.

Special Precautions/Procedures: Emergency personnel should protect against exposure.

Section 5 - Fire-Fighting Measures

Genium

Flash Point: None reported. Benzo(a)pyrene may burn, but does *not* readily ignite.

Autoignition Temperature: None reported.

LEL: None reported.

UEL: None reported.

Extinguishing Media: For small fires, use dry chemical, sand, water spray, or foam. For large fires, use water spray, fog, or foam.

Unusual Fire or Explosion Hazards: None reported.

Hazardous Combustion Products: Carbon monoxide and carbon dioxide.

Fire-Fighting Instructions: Isolate hazard and deny entry. If feasible and without undue risk, move containers from fire hazard area. Otherwise, cool fire-exposed containers with water spray until well after fire is extinguished. Do not release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode and full protective clothing.

Section 6 - Accidental Release Measures

Spill /Leak Procedures: Notify safety personnel of large spills, remove heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against dust inhalation and skin or eye contact. Clean up spills promptly.

Small Spills: Carefully scoop up spilled material and place into appropriate containers for disposal. For liquid spills, take up with a noncombustible, inert absorbent and place into appropriate containers for disposal.

Large Spills

Containment: For large spills, dike far ahead of liquid spill or contain dry spill for later disposal. Do not release into sewers or waterways.

Cleanup: *Do not* dry sweep! Use a vacuum with a HEPA filter or a wet method to reduce dust. After cleanup is complete, thoroughly decontaminate all surfaces. *Do not* reuse contaminated cleaning materials.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Handle with extreme caution and take all necessary measures to avoid exposure to benzo(a)pyrene because it is a carcinogen and mutagen. Follow good personal hygiene procedures and thoroughly wash hands with soap and water after handling. Use safety pipettes for all pipetting.

Storage Requirements: Store in tightly closed and properly labeled containers in a cool, well-ventilated area.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use a Class I, Type B, biological safety hood when working with benzo(a)pyrene in a laboratory. Decrease the rate of air extraction, so that benzo(a)pyrene can be handled without powder being blown around the hood. Keep glove boxes under negative pressure. Use vertical laminar-flow, 100% exhaust, biological safety cabinets for containment of in vitro procedures. The exhaust air flow should be sufficient to provide an inward air flow at the face opening of the cabinet. Ensure contaminated air sheaths that are under positive pressure are leak-tight. Never use horizontal laminar-flow hoods or safety cabinets where filtered air is blown across the working area towards the operator. Test cabinets before work begins to ensure they are functioning properly.

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.(103)

Administrative Controls: Consider preplacement and periodic medical examinations with emphasis on the oral cavity, bladder, kidneys, skin, and respiratory tract. Conduct urinalysis including specific gravity, albumin, glucose, and microscopic examination of centrifuged sediment for red blood cells. Also, include 14" x 17" chest roentgenogram, FVC + FEV_1, and CBC to detect any leukemia or aplastic anemia. It is recommended that this exam be repeated on an annual basis and semi-annual basis for employees 45 yr of age or older or with 10 or more years of exposure to coal tar pitch volatiles. Train workers about the hazards of benzo(a)pyrene and the necessary protective measures to prevent exposure. Periodically inspect lab atmospheres, surfaces such as walls, floors, and benches, and interior of fume hoods and air ducts for contamination. Post appropriate signs and labels on doors leading into areas where benzo(a)pyrene is used.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following respirator recommendations are for coal tar pitch volatiles. For any unknown concentration, wear any SCBA with a full facepiece and operated in a pressure-demand or other positive pressure mode, or any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive pressure mode. For escape, wear any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister having a high-efficiency particulate filter, or any appropriate escape-type SCBA. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. In animal laboratories, wear protective suits (disposable, one-piece and close-fitting at ankles and wrists), gloves, hair covering, and overshoes. In chemical laboratories, wear gloves and gowns. Wear protective eyeglasses or chemical safety, gas-proof goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Shower and change clothes after exposure or at the end of the workshift. Separate contaminated work clothes from street clothes. Launder before reuse. Remove benzo(a)pyrene from your shoes and clean personal protective equipment. Use procedures to ensure laundry personnel are not exposed.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Solid

Appearance and Odor: Pale yellow monoclinic needles with a faint, aromatic odor.

Vapor Pressure: >1 mm Hg at 68 °F (20 °C)

Formula Weight: 252.30

Specific Gravity (H_2O=1, at 4 °C): 1.351

Water Solubility: Insoluble; 0.0038 mg (+/- 0.00031 mg) in 1 L at 77 °F (25 °C)

Other Solubilities: Ether, benzene, toluene, xylene, concentrated hydrosulfuric acid; sparingly soluble in alcohol, methanol.

Boiling Point: >680 °F (>360 °C); 540 °F (310 °C) at 10 mm Hg

Melting Point: 354 °F (179 °C)

Octanol/Water Partition Coefficient: log Kow= 6.04

Section 10 - Stability and Reactivity

Stability: Benzo(a)pyrene is stable at room temperature in closed containers under normal storage and handling conditions. It undergoes photo-oxidation when exposed to sunlight or light in organic solvents and is also oxidized by chromic acid and ozone.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: Strong oxidizers (chlorine, bromine, fluorine) and oxidizing chemicals (chlorates, perchlorates, permanganates, and nitrates).

Conditions to Avoid: Avoid heat and ignition sources and incompatibles.

Hazardous Decomposition Products: Thermal oxidative decomposition of benzo(a)pyrene can produce carbon monoxide and carbon dioxide.

Section 11- Toxicological Information

Toxicity Data:*

Tumorigenic Effects:

Rat, oral: 15 mg/kg produced gastrointestinal and musculoskeletal tumors.

Mouse, inhalation: 200 ng/m^3/6 hr administered intermittently over 13 weeks produced tumors of the lungs.

Rabbit, skin: 17 mg/kg administered intermittently over 57 weeks produced tumors of the skin and appendages.

Teratogenicity:

Rat, oral: 2 g/kg administered 28 days prior to mating and 1-22 days of pregnancy produced a stillbirth.

Rat, oral: 40 mg/kg on the 14th day of pregnancy caused changes in the extra embryonic structures.

Mouse, oral: 75 mg/kg administered to the female during the 12-14 day of pregnancy produced biochemical and metabolic effects on the newborn.

Skin Effects:
Mouse: 14 μg caused mild irritation.

Mutagenicity:
Human, liver cell: 100 nmol/L caused DNA damage.
Human, lung cell: 1 μmol/L caused DNA damage.
Human, HeLa cell: 1500 nmol/L caused DNA inhibition.

* See NIOSH, *RTECS* (DJ3675000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: Oysters, BCF (bioconcentration factor): 3000; rainbow trout, BCF: 920; *Daphnia pulex*, BCF: 13,000.

Environmental Transport: Some marine organisms such as phytoplankton, certain zooplankton, scallops (*Placopecten sp*), snails (*Litternia littorea*), and mussels (*Mytilus edulis*) lack a metabolic detoxification enzyme system to metabolize benzo(a)pyrene and therefore, tend to accumulate benzo(a)pyrene. Humic acid in solution may decrease bioconcentration.

Environmental Degradation: If released to water, benzo(a)pyrene adsorbs very strongly to particulate matter and sediments, bioconcentrates in aquatic organisms which cannot metabolize it, but does not hydrolyze. Direct photolysis at the water surface, evaporation, or biodegradation may be important, but adsorption may significantly retard these processes. Adsorption to particulates may also retard direct photolysis when benzo(a)pyrene is released to air. Benzo(a)pyrene may be removed from air by reaction with nitrogen dioxide (half-life, 7 days) or ozone (half-life, 37 min), or photochemically produced hydroxyl radicals (estimated half-life, 21.49 hr).

Soil Absorption/Mobility: It will adsorb very strongly to the soil. Although it is not expected to appreciably leach to the groundwater, groundwater samples indicate that it can be transported there. It is not expected to significantly evaporate or hydrolyze from soils and surfaces. However, it may be subject to appreciable biodegradation in soils.

Section 13 - Disposal Considerations

Disposal: Small quantities: 10 mL of a solution containing 0.3 mol/L of potassium permanganate and 3 mol/L of sulfuric acid will degrade 5 mg of benzo(a)pyrene. Also, can treat with sodium dichromate in strong sulfuric acid (1-2 days). Benzo(a)pyrene is also a good candidate for fluidized bed incineration at a temperature range of 842 to 1796 °F (450 to 980 °C) or rotary kiln incineration at 820 to 1600°C. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Environmentally hazardous substances, solid, n.o.s.*
Shipping Symbols: —
Hazard Class: 9
ID No.: UN3077
Packing Group: III
Label: Class 9
Special Provisions (172.102): 8, B54

Packaging Authorizations
a) Exceptions: 173.155
b) Non-bulk Packaging: 173.213
c) Bulk Packaging: 173.240

Quantity Limitations
a) Passenger, Aircraft, or Railcar: None
b) Cargo Aircraft Only: None

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: —

* If it is in a quantity, in one package, which equals or exceeds the reportable quantity (RQ) of 1 lb (0.454 kg)

Section 15 - Regulatory Information

EPA Regulations:
Listed as a RCRA Hazardous Waste (40 CFR 261.33)
RCRA Hazardous Waste Number: U022
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) per RCRA and CWA, Sec. 307(a)
CERCLA Reportable Quantity (RQ), 1 lb (0.454 kg)
SARA 311/312 Codes: 1,2
SARA Toxic Chemical (40 CFR 372.65): Not listed
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed
OSHA Regulations:
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1)
Listed as an OSHA Specifically Regulated Substance, Coal Tar Pitch Volatiles, (29CFR 1910.1002)

Section 16 - Other Information

References: 73, 103, 124, 127, 132, 133, 136, 139, 148, 164, 169, 174, 175, 184, 187, 189, 190

Prepared By .. MJ Wurth, BS **Industrial Hygiene Review** ....PA Roy, MPH **Medical Review**.... T Thoburn, MD, MPH

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Material Safety Data Sheet

From Genium's Reference Collection

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No. 624

NAPHTHALENE

Issued: November 1987

SECTION 1. MATERIAL IDENTIFICATION 24

Material Name: NAPHTHALENE

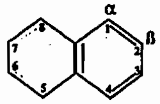
Description (Origin/Uses): Used as a moth repellant and in many industrial processes.

Other Designations: Naphthalin; Naphthene; Tar Camphor; $C_{10}H_8$;
NIOSH *RTECS* No. QJ0525000; CAS No. 0091-20-3

Manufacturer: Contact your supplier or distributor. Consult the latest edition of the *Chemicalweek Buyer's Guide* (Genium ref. 73) for a list of suppliers.

2
2 0
-

HMIS			
H	2		
F	2	R	1
R	0	I	4
PPG*		S	1
*See sect. 8		K	2

SECTION 2. INGREDIENTS AND HAZARDS	%	EXPOSURE LIMITS
Naphthalene, CAS No. 0091-20-3  *Immediately dangerous to life and health **See NIOSH *RTECS* for additional data with references to irritative, mutagenic, reproductive, and tumorigenic effects.	ca 100	IDLH* Level: 500 ppm **ACGIH TLVs, 1987-88** TLV-TWA: 10 ppm, 50 mg/m³ **OSHA PEL** 8-Hr TWA: 10 ppm, 50 mg/m³ **Toxicity Data**** Child, Oral, LD_{Lo}: 100 mg/kg Man, Unknown, LD_{Lo}: 74 mg/kg Rat, Oral, LD_{50}: 1250 mg/kg

SECTION 3. PHYSICAL DATA

Boiling Point: 424°F (218°C)
Vapor Density (Air = 1): 4.4
Vapor Pressure: 0.087 Torr at 77°F (25°C)
Water Solubility: Insoluble

Specific Gravity (H_2O = 1): 1.162 at 68°F (20°C)
Melting Point: 176°F (80°C)
Molecular Weight: 128 Grams/Mole
% Volatile by Volume: ca 100

Appearance and Odor: White crystalline flakes; strong coal tar odor.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temperature	Flammability Limits in Air	LOWER	UPPER
174°F (79°C) OC; 190°F (88°C) CC	979°F (526°C)	% by Volume	0.9	5.9

Extinguishing Media: Use water spray, dry chemical, or carbon dioxide to fight fires involving naphthalene. **Caution:** Foam or direct water spray applied to molten naphthalene may cause extensive foaming.

Unusual Fire or Explosion Hazards: Naphthalene is a volatile solid that gives off flammable vapor when heated (as in fire situations). This vapor is much denser than air and will collect in enclosed or low-lying areas like sumps. In these areas an explosive air-vapor mixture may form, and extra caution is required to prevent any ignition sources from starting an explosion or fire.

Special Fire-fighting Procedures: Wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode.

SECTION 5. REACTIVITY DATA

Naphthalene is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization.

Chemical Incompatibilities: Naphthalene is incompatible with strong oxidizing agents, chromic anhydride, and mixtures of aluminum trichloride and benzoyl chloride.

Conditions to Avoid: Ignition sources like open flame, unprotected heaters, excessive heat, lighted tobacco products, and electric sparks must not occur in work areas where naphthalene vapor may become concentrated.

Hazardous Products of Decomposition: Toxic gases like carbon monoxide are produced during fire conditions. Irritating, flammable vapor forms below the melting point because even solid naphthalene has a significant vapor pressure.

SECTION 6. HEALTH HAZARD INFORMATION

Naphthalene is not listed as a carcinogen by the NTP, IARC, or OSHA.
Summary of Risks: Renal shutdown (kidney failure), hemolytic effects (breakdown of red blood cells), hematuria (blood in the urine), oliguria (low volume of urine), jaundice, eye damage, and depression of the central nervous system (CNS) are the primary health concerns associated with exposure to naphthalene. The ACGIH TLVs in section 2 are set to prevent eye damage. These recommended exposure limits may not be low enough to prevent blood changes in genetically hypersensitive individuals.
Medical Conditions Aggravated by Long-Term Exposure: Diseases of the blood, liver, and kidneys. Administer medical exams emphasizing these organs. **Target Organs:** Eyes, skin, kidneys, liver, blood (red blood cell effects), and CNS.
Primary Entry: Inhalation, skin contact. **Acute Effects:** Inhalation of naphthalene vapor causes excitement, confusion, headache, nausea, and loss of appetite. **Chronic Effects:** Increased incidence of cataracts.

FIRST AID

Eye Contact: Immediately flush eyes, including under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes to remove particles.
Skin Contact: Immediately wash the affected area with soap and water.
Inhalation: Remove victim to fresh air; restore and/or support his breathing as needed.
Ingestion: Call a poison control center. Never give anything by mouth to someone who is unconscious or convulsing. Administer a gastric lavage followed by saline catharsis. Monitor blood and electrolytic balance. Other sources recommend giving the victim several glasses of water to drink.

GET MEDICAL HELP (IN PLANT, PARAMEDIC, COMMUNITY) FOR ALL EXPOSURES. Seek prompt medical assistance for further treatment, observation, and support after first aid.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

Spill/Leak: Notify safety personnel, provide ventilation, and eliminate all ignition sources immediately. Cleanup personnel need protection against contact and inhalation of vapor (see sect. 8). Contain large spills and collect waste. Use nonsparking tools to place naphthalene into closable containers for disposal. Keep waste out of sewers, watersheds, and waterways.
Waste Disposal: Consider reclamation, recycling, or destruction rather than disposal in a landfill. Contact your supplier or a licensed contractor for detailed recommendations. Follow Federal, state, and local regulations.

OSHA Designations
Air Contaminant (29 CFR 1910.1000, Subpart Z)
EPA Designations (40 CFR 302.4)
RCRA Hazardous Waste, No. U165
CERCLA Hazardous Substance, Reportable Quantity: 100 lbs (45.4 kg)

SECTION 8. SPECIAL PROTECTION INFORMATION

Goggles: Always wear protective eyeglasses or chemical safety goggles. Follow the eye- and face-protection guidelines of 29 CFR 1910.133. **Respirator:** Use a NIOSH-approved respirator per the *NIOSH Pocket Guide to Chemical Hazards* (Genium ref. 88) for the maximum-use concentrations and/or the exposure limits cited in section 2. Respirator usage must be in accordance with the OSHA regulations of 29 CFR 1910.134. IDLH or unknown concentrations require an SCBA with a full facepiece operated in the pressure-demand or positive-pressure mode. Warning: Air-purifying respirators will *not* protect workers in oxygen-deficient atmospheres.
Other Equipment: Wear impervious gloves, boots, aprons, gauntlets, etc., as required by the specific work environment to prevent skin contact. **Ventilation:** Install and operate general and local maximum explosion-proof ventilation systems of sufficient power to maintain airborne levels of naphthalene below the OSHA PEL standard cited in section 2. **Safety Stations:** Make eyewash stations, washing facilities, and safety showers available in areas of use and handling. **Contaminated Equipment:** Contact lenses pose a special hazard; soft lenses may absorb irritants, and all lenses concentrate them. Do *not* wear contact lenses in any work area. Remove and launder contaminated clothing before wearing it again; clean this material from shoes and equipment.
Comments: Practice good personal hygiene; always wash thoroughly after using this material. Keep this material off of your clothing and equipment. Avoid transferring this material from hands to mouth while eating, drinking, or smoking. Do *not* smoke, eat, or drink in any immediate work area. Avoid inhalation of vapor!

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

Storage Segregation: Store naphthalene in a cool, dry, well-ventilated area away from chemical incompatibles (see sect. 5).
Special Handling/Storage: Protect containers from physical damage. All bulk storage facilities must be built with an explosion-proof design. All containers used in shipping/transferring operations must be electrically grounded to prevent static sparks. Use monitoring equipment to measure the extent of vapor present in any storage facility containing naphthalene because of potential fire and explosion hazards.
Comments: All operations with naphthalene must be done carefully to prevent accidental ignition of its flammable/explosive vapor. If the weather is warm, more naphthalene vapor forms and the potential for explosion increases. Do *not* smoke in any use or storage area!

Transportation Data (49 CFR 172.101-2)
DOT Shipping Name: Naphthalene
DOT Hazard Class: ORM-A
IMO Class: 4.1
DOT ID No. UN1334
IMO Label: Flammable Solid
DOT Label: None

References: 1, 2, 12, 73, 84-94, 103. PJI

Approvals
Indust. Hygiene/Safety
Medical Review

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Material Safety Data Sheet Collection

Phenanthrene **MSDS No. 905**

Date of Preparation: 6/94

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: Phenanthrene
Chemical Formula: $(C_6H_4CH)_2$
CAS No.: 85-01-8
Synonyms: Phenantrin
Derivation: A polynuclear aromatic hydrocarbon found as a component of coal tar pitch volatiles (products of bituminous coal distillation). Produced from toluene, bibenzil, 9-methyl fluorene or stilbene by passage through red hot tubes or by diene synthesis of 1-vinyl naphthalene and maleic anhydride.
General Use: Used in the manufacture of dyestuffs and explosives; in biological research or drug synthesis.
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Phenanthrene, ca 100 % wt

OSHA PEL*
8-hr TWA: 0.2 mg/m^3

ACGIH TLV*
TWA: 0.2 mg/m^3

NIOSH REL*
10-hr TWA: 0.1 mg/m^3, *cyclohexane extractable fraction*

DFG (Germany) MAK
None established

*Coal tar pitch volatiles (benzene soluble)

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆
Phenanthrene exists as shiny crystals with a faint, aromatic odor. It can cause photosensitization of the skin. Phenanthrene is combustible and reacts dangerously with oxidizers.

Wilson Risk Scale
R 1
I 3
S 3
K 1

HMIS
H 1
F 1
R 0

PPE*
*Sec. 8

Potential Health Effects

Primary Entry Routes: Skin contact.
Target Organs: Skin.
Acute Effects
Inhalation: Effects not reported.
Eye: Effects not reported.
Skin: Can cause photosensitization of the skin.
Ingestion: Effects not reported.
Carcinogenicity: Although it has produced skin cancer in experimental animals, the results were not statistically significant and IARC has assigned phenanthrene a Class 3 (unclassifiable as to carcinogenicity) designation. The NTP and OSHA do not list phenanthrene as a carcinogen.
Medical Conditions Aggravated by Long-Term Exposure: Skin disorders.
Chronic Effects: None reported.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.
Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin Contact: *Quickly* remove contaminated clothing. Rinse exposed area with flooding amounts of water to remove loose material and then move quickly to a soap and water wash. For reddened or blistered skin, consult a physician.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Treatment is symptomatic and supportive.

Section 5 - Fire-Fighting Measures

Flash Point: 340 °F (171 °C)
Flash Point Method: OC
LEL: Not reported.
UEL: Not reported.
Flammability Classification: Class IIIB Combustible liquid
Extinguishing Media: Use dry chemical or carbon dioxide; water spray or foam may cause frothing.
Unusual Fire or Explosion Hazards: None reported
Hazardous Combustion Products: Carbon oxides (CO_x) and acrid smoke
Fire-Fighting Instructions: Do not release runoff from fire control methods to sewers or waterways.
Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Spill /Leak Procedures: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. Shut off ignition sources. Cleanup personnel should protect against skin contact.
Small Spills: To avoid dust generation, *do not* sweep! Carefully scoop up or vacuum (with appropriate filter). Damp mop residue.
Large Spills
Containment: Flush large spill to containment area for later disposal. Do not release into sewers or waterways.
Cleanup: Mop up any residue.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use nonsparking tools to open containers.
Storage Requirements: Prevent physical damage to containers. Store in a cool, dry, well-ventilated area away from heat, ignition sources, and strong oxidizers.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all equipment used with and around phenanthrene.
Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.(103)
Administrative Controls: Consider preplacement and periodic medical exams of exposed workers with emphasis on the skin.
Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following respirator recommendation is for *coal-tar pitch volatiles*: For any detectable concentration, use a SCBA or supplied-air respirator (with auxiliary SCBA) with a full facepiece and operated in pressure-demand or other positive pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.
Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.
Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.
Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Solid
Appearance and Odor: Colorless, shiny crystals with a faint, aromatic odor.
Vapor Pressure: 1 mm Hg at 244.76 °F (118.2 °C); 400 mm Hg at 586.4 (308 °C)
Formula Weight: 178.22
Density (H_2O=1, at 4 °C): 1.179 g/L at 77 °F (25 °C)
Water Solubility: 1.6 mg/L at 59 °F (15 °C)
Other Solubilities: 1 g in: 2.4 mL toluene, 2.4 mL carbon tetrachloride, 2 mL benzene, 1 mL carbon disulfide, 25 mL absolute alcohol, 60 mL cold 95% alcohol, 10 mL boiling 95% alcohol and 3.3 mL anhydrous ether. Also soluble in glacial acetic acid, chloroform, and hot pyridine.
Boiling Point: 644 °F (340 °C)
Melting Point: 213 °F (101 °C)
Refraction Index: 1.59427
Octanol/Water Partition Coefficient: log Kow = 4.57

Section 10 - Stability and Reactivity

Stability: Phenanthrene is stable at room temperature in closed containers under normal storage and handling conditions.
Polymerization: Hazardous polymerization does not occur.
Chemical Incompatibilities: Strong oxidizers.
Conditions to Avoid: Phenanthrene dust generation and exposure to heat ignition sources, or oxidizers.
Hazardous Decomposition Products: Thermal oxidative decomposition of phenanthrene can produce carbon oxide(s).

Section 11- Toxicological Information

Toxicity Data:*

Acute Oral Effects:
Mouse, oral, LD_{50}: 700 mg/kg

Carcinogenicity:
Mouse, skin: 71 mg/kg produced tumors at site of application.

Mutagenicity:
Rat, liver cell: 3 mmol/L caused DNA damage
Human, lymphocyte: 100 µmol/L caused mutation

* See NIOSH, *RTECS* (SF7175000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: *Neanhes arenaceodentata*, TLm = 0.6 ppm/96 hr, sea water at 71.6 °F (22 °C)
Environmental Degradation: If released to soil, some phenanthrene may biodegrade but the majority will bind to the soil without much leaching to groundwater. Volatilization is not expected to be significant. In water, it will adhere to particulates and sediment. Photolysis may occur near the surface producing toxic substances. Photolysis/photooxidation half-life = 8.4 hr. In the air, it will react with photochemically generated hydroxyl radicals (half-life = 1.67 days).
Soil Absorption/Mobility: Phenanthrene absorbs strongly to soil and sediment in water.

Section 13 - Disposal Considerations

Disposal: For treatment of phenanthrene contaminated water, the particulate bound portion can be removed by sedimentation, flocculation, and filtration. Chlorination is not recommended as it has been shown to produce mutagenic substances. The dissolved portion requires oxidation for partial removal. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name:
Environmentally hazardous substances, solid, n.o.s.*
Shipping Symbols: —
Hazard Class: 9
ID No.: UN3077
Packing Group: III
Label: Class 9
Special Provisions (172.102): 8, B54, N50

Packaging Authorizations
a) **Exceptions:** 173.155
b) **Non-bulk Packaging:** 173.213
c) **Bulk Packaging:** 173.240

Quantity Limitations
a) **Passenger, Aircraft, or Railcar:** None
b) **Cargo Aircraft Only:** None

Vessel Stowage Requirements
a) **Vessel Stowage:** A
b) **Other:** —

* Classified as a hazardous substance when phenanthrene is in a quantity, in one package, which equals or exceeds the RQ of 5000 lb (2270 kg)

Section 15 - Regulatory Information

EPA Regulations:
RCRA Hazardous Waste Number: Not listed
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) per CWA, Sec. 307(a)
CERCLA Reportable Quantity (RQ), 5000 lb (2270 kg)
SARA 311/312 Codes: 1
SARA Toxic Chemical (40 CFR 372.65): Not listed
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed
OSHA Regulations:
Listed (coal tar pitch volatiles) as an Air Contaminant (29 CFR 1910.1000, Table Z-1, Z-1-A)

Section 16 - Other Information

References: 23, 73, 103, 124, 132, 133, 136, 139, 159, 164, 187, 190
Prepared By .... M Gannon, BA
Industrial Hygiene Review .... PA Roy, MPH, CIH
Medical Review .... W Silverman, MD

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Material Safety Data Sheets Collection:

Sheet No. 711
Pyrene

Issued: 4/90

Section 1. Material Identification 31

Pyrene Description: A condensed ring, polyaromatic hydrocarbon compound derived from coal tar. Also synthesized from o,o'-ditolyl. Used in biochemical research and as starting material for synthesizing benzo(a)pyrene. An ingredient of smoked and broiled meat, tobacco smoke, and air pollution.
Other Designations: CAS No. 0129-00-0; $C_{16}H_{10}$; beta-pyrene; benzo(d,e,f)phenanthrene; benzo(d,e,f)phenathrene.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(73) for a suppliers list.

R 1
I 3
S 2*
K --
* Skin absorption

Genium

HMIS
H 2
F 1
R 0
PPG†
† Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Pyrene, ca 100%

OSHA PEL	ACGIH TLV, 1989-90	NIOSH REL, 1987	Toxicity Data*
8-hr TWA: 0.2 mg/m³	None established	None established	Rat, oral, LD_{50}: 2700 mg/kg ingested produces conjunctiva irritation, excitement, and muscle contraction Rat, inhalation, LC_{50}: 170 mg/m³ inhaled produces conjunctiva irritation, excitement, and muscle contraction Gene mutation in mammalian cells; human cell types: 12 µmol/l

* See NIOSH, *RTECS* (UR2450000), for additional mutative, tumorigenic, and toxicity data.

Section 3. Physical Data

Boiling Point: 759 °F/404 °C
Melting Point: 313 °F/156 °C
Vapor Pressure: 6.85 x 10^{-7} torr at 68 °F/20 °C
Molecular Weight: 202.26 g/mol
Specific Gravity (H_2O = 1 at 39 °F/4 °C): 1.271 at 73 °F/23 °C
Water Solubility: Insoluble (0.135 mg/l)

Appearance and Odor: Colorless solid or a slight blue florescent solution. Tetracene impurities give pyrene a yellow color.

Section 4. Fire and Explosion Data

Flash Point: None reported	**Autoignition Temperature:** None reported	**LEL:** None reported	**UEL:** None reported

Extinguishing Media: Use foam, dry chemical, and CO_2 to extinguish fire.
Unusual Fire or Explosion Hazards: Pyrene is a flammable and combustible material that heat and ignition sources may ignite. It burns rapidly with a flare-like effect.
Special Fire-fighting Procedures: Since fire may produce toxic fumes, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in the pressure-demand or positive-pressure mode. Avoid skin contact. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Pyrene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Hazardous Products of Decomposition: Thermal oxidative decomposition of pyrene can emit irritating fumes and acrid smoke.

Section 6. Health Hazard Data

Carcinogenicity: Neither the NTP, IARC, nor OSHA lists pyrene as a carcinogen.

Summary of Risks: Pyrene is irritating to exposed skin and eyes, moderately toxic by ingestion and intraperitoneal routes, and a poison by inhalation. Experimental studies show pyrene is a tumorigen in animals and a mutagen in humans. Workers exposed to concentrations between 3 and 5 mg/m^3 showed some unspecified teratogenic effects. In general, human exposure occurs mainly through inhalation of tobacco smoke and polluted air. Although ingesting smoked and broiled meats may expose humans to pyrene, there is little indication of serious health effects.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Target Organs: Skin, eyes, respiratory tract.

Primary Entry Routes: Inhalation, ingestion, skin contact.

Acute Effects: Vapor inhalation may irritate the nose mucosa and respiratory tract. Vapors may also cause conjunctival irritation. Pyrene is absorbed through intact skin and causes dermal irritation. Ingestion may irritate and burn the esophagus and gastrointestinal tract.

Chronic Effects: None reported.

FIRST AID

Eyes: Flush immediately, including under the eyelids, gently but thoroughly with flooding amounts of running water for at least 15 min.

Skin: *Quickly* remove contaminated clothing. After rinsing affected skin with flooding amounts of water, wash it with soap and water.

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. If ingested, have a *conscious* person drink 1 to 2 glasses of milk or water. Do not induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Physician's Note: Observe patients with dermal exposure for systemic poisoning since pyrene is absorbed through intact skin.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, and remove all heat and ignition sources. Cleanup personnel should protect against vapor inhalation and skin and eye contact. Scoop spilled material into appropriate disposal containers. Absorb liquid with inert, noncombustible material and place waste in appropriate disposal containers. Follow applicable OSHA regulations (29 CFR 1910.120).

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

EPA Designations

RCRA Hazardous Waste (40 CFR 261.33): Not listed

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 5000 lb (2270 kg) [* per Clean Water Act, Sec. 307(a)]

Listed as SARA Extremely Hazardous Substance (40 CFR 355), Reportable Quantity: 5000 lb, Threshold Planning Quantity (TPQ): 1000/10,000 lb

SARA Toxic Chemical (40 CFR 372.65): Not listed

OSHA Designations

Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133).

Respirator: Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA.

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

Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent skin contact.

Ventilation: Provide general and local explosion-proof ventilation systems to maintain airborne concentrations below the OSHA PEL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.(103)

Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.

Contaminated Equipment: Never wear contact lenses in the work area: soft lenses may absorb, and all lenses concentrate, irritants. Remove this material from your shoes and equipment. Launder contaminated clothing before wearing.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9. Special Precautions and Comments

Storage Requirements: Store in closed containers in a cool, well-ventilated area. Protect containers from physical damage.

Engineering Controls: Avoid vapor inhalation and skin contact. Practice good personal hygiene and housekeeping procedures. To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations in production and storage areas. Provide preplacement and periodic medical examinations, including comprehensive medical histories with emphasis on the oral cavity, respiratory tract, bladder, and kidneys. Examine the skin for premalignant and malignant lesions.

Transportation Data (49 CFR 172.101, .102): Not listed

MSDS Collection References: 7, 73, 87, 103, 123, 124, 126, 127, 136

Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Hardies, MD

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Material Safety Data Sheets Collection:

Sheet No. 789
Cyanide

Issued: 11/91

Section 1. Material Identification

36

R 1
I 4
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K 1

Genium
1
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HMIS
H 4
F 1
R 1
PPG*
* Sec. 8

Cyanide (CN⁻) Description: Derived by combining a carbon ion with a nitride ion. Used in rat and pest poisons, silver and metal polishes, photographic solutions, fumigating products, and electroplating solutions. Cyanide may also be liberated in burning of plastics, natural fabrics (wool or silk), polyurethane bedding or furniture, acrylic baths, nylon carpets, and melamine resin insulation.
Other Designations: CAS No. 57-12-5, carbon nitride ion, cyanide anion, isocyanide.
Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*[73] for a suppliers list.

Cautions: Cyanide is severely toxic by all routes of entry and its lethal dose is an estimated 1 µg/ml. Take necessary precautions to avoid all possible exposure to this material.

Section 2. Ingredients and Occupational Exposure Limits

Cyanide, ca 100%

1990 OSHA PEL (Skin)
STEL: 4.7 ppm, 5 mg/m³, as hydrogen cyanide (gas)

1990 IDLH Level
50 mg/m³

1991-92 ACGIH TLV (Skin)
Ceiling: 10 ppm, 11 mg/m³, as hydrogen cyanide (gas)

1990 NIOSH REL (Skin)
STEL: 4.7 ppm, 5 mg/m³ as hydrogen cyanide (gas)

1990 DFG (Germany) MAK (*Danger of cutaneous absorption*)
TWA: 10 ppm, 11mg/m³ as hydrogen cyanide (gas)

1985-86 Toxicity Data*
Mouse, intraperitoneal, LD_{50}: 3 mg/kg; toxic effects not yet reviewed

* See NIOSH, *RTECS* (GS7175000), for additional toxicity data.

Section 3. Physical Data

Boiling Point: Varies with specific CN⁻ compound
Melting Point: Varies with specific CN⁻ compound
Molecular Weight: 26.02
Density: Varies with specific CN⁻ compound
Water Solubility: Varies with specific CN⁻ compound

Appearance and Odor: Varies with specific CN⁻ compound, but usually has an almond odor.

Section 4. Fire and Explosion Data

Flash Point: None reported	**Autoignition Temperature:** None reported	**LEL:** None reported	**UEL:** None reported

Extinguishing Media: Cyanide is combustible. For small fires, use dry chemical, water spray or foam. *Do not use carbon dioxide* (CO_2)! For large fires, use water spray, fog, or regular foam. *Do not scatter* material with more water than needed to extinguish fire.
Unusual Fire or Explosion Hazards: Combustible by chemical reaction with heat, moisture, or acid. Many cyanides readily evolve hydrogen cyanide (HCN), a toxic flammable gas.
Special Fire-fighting Procedures: Since fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Structural firefighter's protective clothing *is ineffective* for fires involving cyanide. Wear chemical protective clothing that the shipper or manufacturer specifically recommends. If possible without risk, remove container from fire area. Fight fire from maximum distance. Stay away from ends of tanks. Be aware of runoff from fire control methods. Do not release to sewers or waterways. Remove and isolate contaminated clothing at the site.

Section 5. Reactivity Data

Stability/Polymerization: Cyanide is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Cyanide may react violently with hypochlorite solutions at pH 10 to 10.3, is explosive with nitrites if heated above 450 °C, and is incompatible with chlorates, fluorine, magnesium, nitrates, and all inorganic acids.
Conditions to Avoid: Avoid exposure to heat and contact with incompatibles.
Hazardous Products of Decomposition: Thermal oxidative decomposition of cyanide can produce carbon dioxide and toxic, flammable vapors of CN⁻.

Section 6. Health Hazard Data

Carcinogenicity: In 1990 reports, the IARC, NTP, and OSHA do not list cyanide as a carcinogen.
Summary of Risks: Cyanide is a potent, fast-acting, chemical asphyxiant (material which causes pulse and breathing obstruction) that prevents tissue utilization of oxygen by inhibiting the enzyme involved (cytochrome oxidase). Death can occur within seconds to minutes after inhalation of some cyanide gases, and may take as long as an hour after ingestion of a large amount of a cyanide salt due to a slower absorption. Toxicity is dependent on the form of cyanide the victim is exposed to. Mortality from acute exposures is high, but recovery is generally complete in nonfatal cases.
Medical Conditions Aggravated by Long-Term Exposure: None reported.

Continue next page

Section 6. Health Hazard Data, *continued*

Target Organs: Brain, heart, lungs, skin, blood.
Primary Entry Routes: Inhalation, ingestion, skin absorption.
Acute Effects: Inhalation of cyanide gases may cause rapid toxicity where the victim may only have time to utter a warning cry before succumbing to unconsciousness caused by asphyxiation. If exposure is small there may be a weak, rapid, irregular heartbeat with bright-pink coloration of the skin due to high oxyhemoglobin content in the veins before person loses consciousness. A telltale sign of inhalation or ingestion is the odor of bitter almonds on the breath, however up to half the population is genetically unable to detect this smell. Dialated pupils are common in severe poisonings. Contact with broken skin can cause cyanide absorption into the bloodstream. Cyanide ingestion can cause a bitter, burning taste, salivation, nausea, vomiting, anxiety, confusion, vertigo (dizziness), giddiness, sensation of stiffness in the lower jaw, and dyspnea (difficult respiration). In severe cases symptoms could progress to convulsions, paralysis, coma, cardiac arrhythmias, followed by death due to respiratory failure.
Chronic Effects: Chronic skin contact may cause cyanide rash, characterized by itching, and macular (blotches), papular (small, solid, conical, elevation of the skin), and vesicular (blister-like) eruptions. Chronic cyanide inhalation may cause appetite loss, headache, weakness, nausea, dizziness, and symptoms of irritation of the upper respiratory tract and eyes. Other symptoms of chronic exposure include goiter, B12 and folate abnormalities, chest discomfort, epistaxis (nose bleed), poor appetite and sleeping, and functional changes in hearing.
FIRST AID: *Emergency personnel should protect against contamination!*
Eyes: Gently lift the eyelids and flush immediately and continuously with flooding amounts of water until transported to an emergency medical facility. Consult a physician immediately.
Skin: *Quickly* remove contaminated clothing. Speed is extremely important. Rinse with flooding amounts of water for at least 15 min. Wash exposed area *extremely thoroughly* with soap and water. If irritation and pain persist, consult a physician.
Inhalation: Remove exposed person to fresh air and immediately begin administering 100% oxygen. Avoid mouth-to-mouth resuscitaton during CPR to prevent self-poisonings.
Ingestion: Obtain and prepare the Lilly cyanide antidote kit [Eli Lilly Co. (Stock No. M76)] for use in symptomatic patients. Never give anything by mouth to an unconscious or convulsing person. Do not induce vomiting with Ipecac syrup. Consider gastric lavage. Activated charcoal is said to be ineffective.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: If the victim is unconscious, bradycardia and absence of cyanosis may be key diagnostic signs. Consider administration of amyl nitrite followed by sodium nitrite and sodium thiosulfate (antidote kit). Consider use of 100% oxygen.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Immediately notify safety personnel, isolate area, deny entry, and stay upwind. Shut off all ignition sources—no flames, flares, or smoking in hazard area. Cleanup personnel should wear fully encapsulating, vapor-protective clothing for spills or leaks without fire. For small dry spills, carefully scoop into clean, dry, suitable container and cover loosely. For small solution spill, take up with earth, sand, vermiculite, or other absorbent, noncombustible material and place in suitable containers. For large spills, dike far ahead of solution spills for later disposal. Follow applicable OSHA regulations (29 CFR 1910.120).
Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.
EPA Designations
Listed as a RCRA Hazardous Waste (40 CFR 261.33): Hazardous Waste No. P030
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity: *An RQ is not being assigned to the general class* [* per Clean Water Act, Sec. 307(a)]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)
OSHA Designations
Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A)

Section 8. Special Protection Data

Goggles: Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Since contact lens use in industry is controversial, establish your own policy.
Respirator: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. Select the respirator based on its suitability provide adequate worker protection for the given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA with a full facepiece operated in pressure-demand or other positive-pressure mode. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.*
Other: Wear impervious gloves, boots, aprons, and gauntlets to prevent repeated or prolonged skin contact.
Ventilation: Provide general and local exhaust ventilation systems to maintain airborne concentrations below OSHA PEL (Sec. 2). Local exhaust ventilation is preferred since it prevents contaminant dispersion into the work area by controlling it at its source.(103)
Safety Stations: Make available in the work area emergency eyewash stations, safety/quick-drench showers, and washing facilities.
Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder contaminated work clothing before wearing. Remove this material from your shoes and clean personal protective equipment.
Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics. Cyanide detoxifying kits and instructions should be available in use areas. Instruct employees working in these areas on how and when to use these kits.

Section 9. Special Precautions and Comments

Storage Requirements: Avoid physical damage to containers. Store in tightly closed and properly labeled containers in cool, dry, well-ventilated area away from heat and incompatibles.
Engineering Controls: To reduce potential health hazards, use sufficient dilution or local exhaust ventilation to control hazardous airborne contaminants and to maintain concentrations at the lowest practical level.
Other Precautions: If respirators are used, implement a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Consider preplacement and periodic medical examinations of exposed workers that emphasize the heart, blood, and respiratory system.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Cyanide *or* cyanide mixture, dry	**IMO Shipping Name:** Cyanides, inorganic, n.o.s.
DOT Hazard Class: Poison B	**IMO Hazard Class:** 6.1
ID No.: UN1588	**ID No.:** UN1588
DOT Label: Poison	**IMO Label:** Poison
DOT Packaging Exceptions: 173.364	**IMDG Packaging Group:** I/II; Stow 'away from' acids
DOT Packaging Requirements: 173.370	

MSDS Collection **References:** 73, 101, 103, 126, 127, 136, 143, 146, 148, 153, 159, 161, 163
Prepared by: M Gannon, BA; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** AC Darlington, MPH, MD; **Edited by:** JR Stuart, MS

B
SAMPLE MEDICAL DATA SHEET

MEDICAL DATA SHEET

CONFIDENTIAL

THE FOLLOWING INFORMATION IS REQUESTED
TO DETERMINE YOUR CURRENT MEDICAL STATUS

Page 1 of 3

Name (Last, First, Middle Initial)			SSN
Employee Address (Number & Street)		City, State Zip Code	Telephone Number
Sex ☐M ☐F	Date of Birth	Name and Address of Person to Notify in an Emergency	Telephone Number
Personal Physician	Address	Telephone Number	Type of Examination ☐ Pre-Placement ☐ Periodic ☐ Other (Specify)
Division or Facility		Position	Employee Number
Work Location			
Please Check if you Have been Immunized for: ☐ Tetanus ☐ Small Pox ☐Polio ☐Others ☐ Don't Know ☐ Don't Know ☐ Don't Know ☐ Don't Know Last Date Last Date Last Date Last Date			Are You ☐ Right Handed ☐ Left Handed ☐ Ambidextrous

Family History				Check Each Box (If answer is Yes, state blood relationship)			
Relation	Age	State of Health	If Dead, Cause and Age		Yes	No	Relation
Father				Cancer			
Mother				Diabetes			
Spouse				Stomach Trouble			
Grandparents				Kidney Trouble			
				Heart Trouble			
				Tuberculosis			
				Mental Disorder			
Brothers and Sisters				Convulsions			
				Arthritis			
				Allergies			
				Other			
Children							

MEDICAL DATA SHEET

Personal History

Do you have or have you ever had, any of the following? (Check each applicable box)

	YES	NO		YES	NO		YES	NO
Asthma			Foot Trouble			Malaria		
Cancer, Cyst, Tumor, or Growth			Frequent Indigestion or Heartburn			Nervous Breakdown		
Chest Pain or Shortness of Breath			Frequent or Painful Urination			Nervous Trouble of any Sort		
Fever, Night Sweats			Frequent Trouble Sleeping			Numbness, Weakness		
Chronic Cough or Colds			Gall Bladder Trouble			Palpitation or Pounding Heart		
Convulsions, Fits			Goiter or Thyroid Problem			Prostate Trouble		
Fall Sickness			Hayfever or Allergies			Reaction from Medicines		
Coughing up or Spitting or			Headaches, Frequent or Severe			Recent Gain or Loss of Weight		
Vomiting blood			Heart Trouble			Rheumatism or Arthritis		
Expression of Excessive Worry			Hemorrhoids or Rectal Trouble			Scarlet Fever or Rheumatic Fever		
Diabetes or Sugar in Urine			Hernia or Rupture			Skin Rash or Hives		
Dizziness			High Blood Pressure			Stomach Troubles, Ulcers		
Ear, Nose, or Throat Trouble			Jaundice or Hepatitis			Swelling of Ankles or Feet		
Epilepsy			Kidney Trouble or Blood in Urine			Swollen or Painful Joints		
Eye Trouble			Liver Trouble			Tuberculosis or Pleurisy		
Fainting			"Locked" Knee or "Trick Joint"			Varicose Veins		
Fatigue, Chronic or Frequent			Loss of Appetite, Chronic			Other		
Female Disorders			Venereal Disease			Other		

Injuries: Please Check Any Injuries You Have Had:

☐ Fracture/Broken Bones
☐ Back Injury
☐ Low Back Pain
☐ None
☐ Other Injury
☐ Severe Cuts
☐ Severe Burns
☐ Lost Consciousness
☐ Dislocations
☐ Loss of Arm
☐ Loss of Leg
☐ Loss of Finger(s)
☐ Loss of Toe(s)

Check Yes or No. If Yes, Give Details in Blank Areas	Yes	No	Details
Any time loss from work in the past two years due to illness?			
Any brace or support worn?			
Discharged or disqualified from Armed Services for any reason?			
Military Service - Dates and Locations			
Applied for, or received Workermen's Compensation?			
Been exposed to work with dusts, radiation, excessive noise, chemicals?			
Have you been unable to hold a job because of:	▨	▨	▨
a. Sensitivity to chemicals, dust, sunlight, etc.			
b. Inability to perform certain motions			
c. Inability to assume certain positions			
d. Other medical reasons			
Had surgery recommended or performed. Date and Time.			
Are you taking medicines now			
Have you been turned down on a physical examination or been informed of any abnormal findings from a physical examination			
Do you smoke – If yes, quantity per day			
Do you use alcoholic beverages – If yes, quantity per day			
Have you live or traveled outside the Continental USA			

C

ACCIDENT REPORT FORM

META ACCIDENT REPORT FORM

Report No. ______

Site: ______________________________ Project No. ______________

Location: ____

Date of Report: ________________ Preparer's Name: ________________

Name and Address of Injured/Involved Party: ________________________

SSN: ________________ Age: ____________ Sex: ____________

Years of Service: ______ Time on Present Job: ________ Title/Classification: ________

Division/Department: ____________ Date of Accident: ____________ Time: ________

Accident Location: ____

Accident Category: ______ Property Damage ______ Injury or Illness ______ Near Miss ______ Other

Contributing Factors:

- _____ Motor Vehicle
- _____ Slip or Trip Condition
- _____ Chemical Exposure
- _____ Animal or Insect
- _____ Machine Operation
- _____ Fire
- _____ Explosion
- _____ Electrical Hazard
- _____ Other, please specify ______________

DAMAGE ASSESSMENT

Property Damaged : $ ________________ Amount of Damage: $ ________________

INJURY ASSESSMENT

Nature of Injury or Illness: ______________________________________

CLASSIFICATION OF INJURY:

- _____ Fracture
- _____ Dislocation
- _____ Sprain
- _____ Abrasion
- _____ Laceration
- _____ Puncture
- _____ Bite
- _____ Dermal Allergy
- _____ Heat Burn
- _____ Chemical Burn
- _____ Radiation Burn
- _____ Bruise
- _____ Blister
- _____ Toxic Respiratory
- _____ Exposure
- _____ Other, please specify ______________
- _____ Cold Exposure
- _____ Frostbite
- _____ Heat Stroke
- _____ Heat Exhaustion
- _____ Concussion
- _____ Faint/Dizziness
- _____ Toxic Ingestion

Severity of Injury or Illness:

- _____ Non-disabling
- _____ Medical Treatment
- _____ Disabling
- _____ Fatality

META ACCIDENT REPORT FORM

Page 2 of 3

Report No. ______

Part of Body Affected: ______

Degree of Disability: ______

Estimated Number of Days Away from Job: ______

Date Medical Care Was Received: ______

Where Medical Care Was Received: ______

Address (if off-site): ______

ACCIDENT DESCRIPTION (OR NEAR MISS CONDITION)

Describe the causative agents most directly related to accident or near miss (e.g., object, substance, material, machinery, equipment, weather or other conditions): ______

Describe any unsafe mechanical / physical / environmental condition(s) contributing to the accident or near miss. (Be specific): ______

Describe any unsafe act(s) by the injured/involved party contributing to the accident or near miss. (Be specific, must be answered): ______

Describe any personal factors that may have contributed to the accident or near miss. (Improper attitude, lack of knowledge or skill, slow reaction, fatigue): ______

Was the selection of personal protective equipment in use by the injured/involved party a contributing factor in this accident or near miss? ______

What level of personal protection equipment was required by the project HASP at the time of the accident (note any modification thereof): ______

Report No. ________

Was injured/involved party using required equipment? ________________

If not, how/why did actual equipment use differ from plan? ________________

What can be done to prevent a recurrence of this type of accident? (e.g., equipment modification, safety equipment, improved procedures or training): ________________

Provide detailed narrative description (e.g., How/why did accident occur? What objects, equipment, tools, circumstances, and assigned duties were involved? Be specific): ________________

Witnesses to accident: ________________

Signature of Preparer: ________________

Signature of Site Leader: ________________

D
OSHA FORM 300

OSHA's Form 300

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name ____________________

City ________________ State ________

Identify the person			**Describe the case**			**Classify the case**										
						Using these four categories, check ONLY the most serious result for each case:				*Enter the number of days the injured or ill worker was:*		*Check the "injury" column or choose one type of illness:*				
						Death	**Days away from work**	**Remained at work**				(M)				
(A) Case no.	(B) Employee's name	(C) Job title (*e.g., Welder*)	(D) Date of injury or onset of illness	(E) Where the event occurred (*e.g., Loading dock north end*)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (*e.g., Second degree burns on right forearm from acetylene torch*)	(G)	(H)	(I) Job transfer or restriction	(J) Other record-able cases	(K) On job transfer or restriction	(L) Away from work	(1) Injury	(2) Skin disorder	(3) Respiratory condition	(4) Poisoning	(5) All other illnesses
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
					Page totals ➤	___	___	___	___	___	___	Injury (1)	Skin disorder (2)	Respiratory condition (3)	Poisoning (4)	All other illnesses (5)

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Public reporting burden for this collection of information is estimated to average 14 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistics, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

Page __ of __

E

EMPLOYER'S FIRST REPORT OF INJURY FORM

STANDARD FORM FOR
EMPLOYER'S FIRST REPORT OF INJURY

PLEASE SUBMIT THIS REPORT IN TRIPLICATE

Page 1 of 2

Employer

1. Employer ____________________
2. Office address: No. & Street ____________________
   City ____________ State ________ Zip Code ________
3. Insured by (name of company) ____________________
4. Give nature of business ____________________

Time and Place

5. (a) Location of site or place where accident occurred ____________________
   (b) If injured in a mine, did accident occur on surface, under ground, shaft, drift or mill ____________________
6. Date of injury ________ 19 __ Day of week ________ Hour of day ___a.m. ___p.m.
7. Date disability began ________ 19 ___ a.m. _____ p.m. _____
8. Was injured paid in full for this day ____________________
9. When did supervisor first know of injury ____________________
10. Name of supervisor ____________________

Injured Person

11. Name of Injured ____________________
12. Address: No. & Street ____________________
    City ____________ State ________ Zip Code ________
13. Check: () Married () Single () Divorced () Widowed () Widower ()Male ()Female
14. Age _____ Did you have on file employment certificate or permit? ____________
15. (a) Occupation when injured ____________________
    (b) Was this his or her registered occupation _____. If not, state in what work regularly employed ____________________
16. (a) How Long employed by you ______ (b) Wages per day $____________
17. (a) No. hours worked per day ________ (b) Wages per day $____________
    (c) No. of days worked per week ______ (d) Average weekly earnings $________
    (e) If board, lodging, fuel or other advantages were furnished in addition to wages, give estimate value per day, week or month ____________

Cause of Injury

18. Machine, tool or thing causing injury ____________________
19. Kind of power (hand, foot electrical, steam, etc.) ____________________
20. Part of machine on which accident occurred ____________________
21. (a) Was safety appliance or regulation provided? ____________________
    (b) Was it in use at the time ____________________
22. Was accident caused by injured's failure to use or observe safety appliance or regulation? ____________________
23. Describe fully how accident occurred, and state what employee was doing when injured: ____________________
    ____
    ____
    ____
    ____
24. Names and addresses of witnesses: ____________________
    ____

Nature of Injury	25. Nature and location of injury (describe fully exact location of amputations or fractures, right or left ____________ ____________ ____________ 26. Probable length of disability ____________ 27. Has injured returned to work? ____________ If so, date and hour ____________ At what wage $ ____________ 28. At what occupation ____________ 29. (a) Name and address of physician ____________ ____________ (b) Name and address of hospital ____________ ____________
Cases Fatal	30. Has injured died ____________ If so, give date of death ____________

Date of this report ____________ Firm Name ____________

Signed by ____________

Official Title ____________

F
SAMPLE RECORD

RECORD OF SAFETY MEETINGS

Location: **Date:**

Acting HSO: **Time:**

Name of Attendee		Affiliation
PRINT	SIGN	

G

RG&E CONTRACTOR SAFETY AND HEALTH OBLIGATIONS

Contract No. __________

--APPENDIX A--
CONTRACTOR SAFETY AND HEALTH OBLIGATIONS

1. Rochester Gas & Electric Corporation strives to hire Contractors who conduct their activities in a manner consistent with appropriate safety, health and environmental regulations and good practices. A Contractor working for Rochester Gas & Electric Corporation is an independent Contractor as to all work performed under the contract. A Contractor, and its subcontractors, shall be evaluated by Rochester Gas & Electric Corporation on their performance and work practices relating to safety and health issues. The evaluation of a Contractor will include an assessment of its safety, health, and related work practices, record keeping, and if applicable, prior work experience. This evaluation will be one of the criteria used for inviting a Contractor to bid on future Rochester Gas & Electric Corporation projects. The following are minimum safety performance standards that Rochester Gas & Electric Corporation is expecting Contractors to maintain during the performance of all work hereunder. Contractors shall take all additional precautions necessary or proper to prevent injury or death to persons or damage to property and/or the environment.

1.1 The Contractor shall comply with all applicable safety, health and environmental laws, rules and regulations at locations where services are performed for Rochester Gas & Electric Corporation. The Contractor is similarly responsible for requiring compliance by all subcontractors.

1.2 Unless otherwise provided for in written contractual arrangements made with Rochester Gas & Electric Corporation, the Contractor shall provide their employees with appropriate functional equipment, tools, materials and personal protective equipment necessary to perform the job in an efficient, safe and healthy manner.

1.2.1 The Contractor shall ensure that all necessary personal protective equipment is made available to Contractor's employees, and properly used. Where required, employees will be medically evaluated prior to using personal protective equipment. The contractor will be responsible for proper maintenance, sanitation and disposal of all personal protective equipment used by the Contractor's employees.

1.3 Unless otherwise provided for in written contractual arrangements made with Rochester Gas & Electric Corporation or unless statutory requirements dictate otherwise, the Contractor shall verify in writing that their employees have been provided with appropriate safety, health and/or environmental training as required by federal, state or local laws, rules, codes and regulations.

1.3.1 The Contractor shall provide, in writing, a verification within 30 days prior to the start of work that required training has been completed. Documentation of individual employee training shall be subject to audit by the Rochester Gas & Electric Corporation Contract Administrator.

1.3.2 The Contractor shall verify that site-specific and job-specific safety and health rules (Attachment A - Safety Rules and Regulations for Contractors) have been disseminated to their employees and subcontractor's employees. Verification will be sent to Rochester Gas & Electric Corporation Health & Safety Services. Documentation demonstrating that this information has been disseminated shall be subject to audit by Rochester Gas & Electric Corporation.

1.4 The Contractor shall immediately notify the Rochester Gas & Electric Corporation project monitor of any employee accident resulting in reportable injuries, injuries to Rochester Gas & Electric Corporation employees or third parties, or damage to Rochester Gas & Electric Corporation or a third party's property. "Reportable injuries" as used herein shall mean any recordable occupational injuries or illnesses as defined in 29 CFR 1904.12(c). The Contractor shall furnish to the Rochester Gas & Electric Corporation project monitor copies of any regulatory, administrative or statutory reports prepared by them concerning an accident, injury or occupational illness within one day.

The Contractor shall assist Rochester Gas & Electric Corporation in the investigation and documentation of Contractor OSHA Recordable injuries, illnesses or "near misses" if Rochester Gas & Electric Corporation elects to conduct such an investigation.

1.5 The Contractor shall immediately inform Rochester Gas & Electric Corporation of inspection(s) conducted or to be conducted by regulatory agencies and the results of said inspection(s) when such inspections are conducted on or related to a Rochester Gas & Electric Corporation job site covered by this Contract.

1.6 The Contractor shall conduct routine safety and health assessments of their general work practices and operational integrity inspections of theirs and subcontractor's equipment in accordance with the operations manuals relating to such equipment or in accordance with prudent operating or industry standards or recommendations.

1.6.1 Reports of such assessments and inspections shall be signed by the Contractor's supervisor in charge and submitted to the Rochester Gas & Electric Corporation project monitor.

1.7 The Contractor shall take prompt and appropriate action to correct unsafe work practices by their employees and subcontractors that could endanger persons, property or environment.

1.8 Depending on the size and scope of the job, the Rochester Gas & Electric Corporation project monitor may require the contractor to hold daily or weekly safety meetings with their employees. These meetings should address facility and job hazards, accidents and near-misses, site-specific safety and health rules, and applicable policies and procedures. Meeting attendance and topics discussed must be documented and made available to the Rochester Gas & Electric Corporation project monitor.

2. In addition to all applicable federal, state and local laws, rules and regulations, the Contractor shall adhere to site-specific Rochester Gas & Electric Corporation-imposed safety practices while performing work for Rochester Gas & Electric Corporation (see attached Safety Rules and Regulations for Contractors).

3. Nothing contained in this Appendix A shall be interpreted to enlarge the legal duty or liability of Rochester Gas & Electric Corporation to the Contractor, their agents, employees, subcontractors or related third parties.

The Contractor shall communicate the requirements of this Appendix A to all subcontractors of the Contractor and shall be responsible for insuring that all subcontractors are in compliance with the provisions herein.

Rochester Gas & Electric Corporation shall have the right during the performance of this Contract to inspect or audit the Contractor's records and worksites to insure that the Contractor is in compliance with this Appendix A and all State, Federal and local laws, rules and regulations. The Contractor shall cooperate and provide all records or documentation requested in such audit in a timely manner. Failure to cooperate or to have maintained sufficient records to document compliance with this Appendix A shall be considered a material breach of Contract.

The Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the work and shall provide all necessary protection to prevent damage, injury or loss to:

a) all employees on the work and all other persons who may be affected thereby;
b) all the work and all materials and equipment to be incorporated therein, whether in storage on or off the site, under the care, custody or control of the Contractor or any of his subcontractors; and
c) other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadway, structures and utilities not designated for removal, relocation or replacement in the course of construction.

Contractor shall submit to Rochester Gas & Electric Corporation, Material Safety Data Sheets for all materials and chemicals used in connection with the work prior to delivery of these materials to any Rochester Gas & Electric Corporation location. Contractor shall also comply with Rochester Gas & Electric Corporation's chemical labeling procedures. Rochester Gas & Electric Corporation will make available copies of the following to Contractors working at Rochester Gas & Electric Corporation's locations where these materials are used or stored:

(i) The chemical labeling procedures;
(ii) The locations of the Material Safety Data Sheets; and
(iii) The list of chemicals at the work location.

ATTACHMENT A
SAFETY RULES AND REGULATIONS FOR CONTRACTORS

Rochester Gas & Electric Corporation's intent in issuing this document is to provide the Contractor with minimum safety requirements when working on Rochester Gas & Electric Corporation Projects. All work performed shall be in accordance with Rochester Gas & Electric Corporation's contract specifications.

Contractors shall comply with all applicable federal, state, local and Rochester Gas & Electric Corporation standards, ordinances, regulations and the rules and regulations of any agency having jurisdiction on the premises. In the case of conflicting requirements, the most stringent shall prevail. Each Contractor shall have a current written safety program on file with Rochester Gas & Electric Corporation Contract Administration. Any conditions deemed unsafe by Rochester Gas & Electric Corporation shall be immediately corrected by the Contractor.

Contractors may be required to provide documentation of employee qualifications for specific safety requirements such as working with electrical equipment, asbestos, lead, trenching & shoring, mercury, confined spaces, fall protection, etc.

Contractors shall communicate the required safety rules and regulations to their employees in a documented tailboard meeting prior to the start of the job. Contractors are responsible for interpreting these rules for non-English speaking and reading-impaired employees.

Contractors are responsible for informing all subcontractors of the safety rules and regulations set forth here and in the contract terms and conditions.

All questions pertaining to this document shall be directed to the local Rochester Gas & Electric Corporation Project Monitor or Rochester Gas & Electric Corporation Health and Safety Representative.

A. ACCIDENTS

1. The Rochester Gas & Electric Corporation Project Monitor shall be notified immediately of any accidents involving personal injury or property damage. Appropriate reports shall be completed in 10 working days.

B. ASBESTOS (ref: 29 CFR 1926.1101)

Contractors shall not disturb known or suspected asbestos-containing materials. When these materials are encountered and could potentially be disturbed by the work being performed, work should immediately be stopped. The Contractor shall immediately notify the Rochester Gas & Electric Corporation project monitor.

C. CONFINED SPACES (ref: 29 CFR 1926.21)

The Contractor is responsible for complying with all applicable confined-space work practices and standards. Contractor employees working in confined space conditions must have demonstrated competency in proper confined-space work practices (achieved by training and experience). The Contractor shall have a means of emergency rescue arranged prior to start of work in permit required confined spaces.

D. **CRANES** (ref: 29 CFR 1926.550)

Rochester Gas & Electric Corporation cranes shall not be used by the Contractor. Specific exceptions to this rule shall be written and made part of the contract. Cranes will be operated by qualified employees, with licenses when required. If a license is required, the operator will have the license with them when operating subject cranes. Lift plans may be necessary before work begins. Documentation will be submitted to the Rochester Gas & Electric Corporation project monitor.

E. **DRUGS AND ALCOHOL**

1. Possession or use of unauthorized drugs or alcoholic beverages is strictly prohibited on Rochester Gas & Electric Corporation premises or while working for Rochester Gas & Electric Corporation. Reporting to work on Rochester Gas & Electric Corporation property under the influence of unauthorized drugs or alcohol is strictly prohibited; any person under the influence of unauthorized drugs or alcohol shall not be permitted on the premises of a Rochester Gas & Electric project.

2. When applicable, Contractors must comply with U.S. Department of Transportation and Nuclear Regulatory Commission regulations.

3. When applicable, Contractors must comply with the Rochester Gas & Electric Corporation Drug and Alcohol Abuse Policy for Contractors and Consultants.

F. **ELECTRICAL** (ref: 29 CFR 1926.402-408, 416, 417; 29 CFR 1926, subpart V)

1. Only authorized and qualified personnel shall work on installation and maintenance of electrical equipment. The project monitor may request documentation of employee qualification.

2. All equipment used shall have required approvals and be free from known defects.

3. The Contractor will utilize a lockout/tagout procedure or recognized isolation/tagging procedure, as specified by Rochester Gas & Electric Corporation.

4. GFCIs (ground fault circuit interrupters) in working order shall be used for all electrical tools and equipment unless an assured equipment grounding conductor program is in place.

5. All non-qualified Contractor employees and equipment shall stay a minimum of 10 feet away from overhead, energized lines. Non-qualified Contractor employees are not permitted to enter an energized substation unless they are accompanied by qualified personnel.

6. Mobile radio antennas shall be lowered prior to taking any vehicles inside a substation.

7. No metal measuring tapes or tapes containing a metal wrap shall be used near uninsulated energized circuits, equipment, poles or substation structures. Metal tapes may be used at the project monitor's discretion for making critical measurements at ground level or on dead and grounded portions of the structure.

8. Metal tools utilizing cable slings, winch cable, chains, loose sections and ends of conductors, or other similar objects, shall be kept under control by the worker to prevent contact with energized conductors or equipment and the worker's body.

G. **EXCAVATIONS** (ref: 29 CFR 1926.650-652)

1. The general requirements of the OSHA 1926.650, 651, 652 excavation standard, including the provision for a competent person, shall be understood and followed by all Contractor employees.

2. All excavations which workers may enter that are 5 feet or more in depth, or a depth where there is danger of cave-in, shall be protected by a shoring or shielding system, or by a benching or sloping system.

Requirements include but are not limited to the following items:

- contractor shall provide adequate barriers/barricades (special considerations for excavations left overnight)
- air monitoring where indicated
- Notification to Underground Facilities Protective Organization
- providing adequate access and egress
- hand dig when within two feet of any underground facility

3. The Contractor shall promptly notify appropriate utilities of any damage done, prior to closing the trench.

H. **FIRE REGULATIONS** (ref: 29 CFR 1926.150, 152)

Contractors shall provide fire extinguishers sealed, fire service ready, inspected and in good working order and properly maintained at all times when live gas work is being done. At least one 20 pound dry chemical fire extinguisher shall be on the ground near the edge of the excavation.

2. Contractors shall provide a trained fire watch as dictated by the job hazard assessment.

3. When required, hot work permits shall be obtained from the Rochester Gas & Electric Corporation project monitor for such activities as welding, cutting, burning, anything that causes a spark, uses an open flame, or involves temperatures high enough to ignite combustible materials.

4. All acetylene and oxygen cylinders shall be stored and used in accordance with OSHA regulations (ref: 29 CFR 1926.350), and transported per DOT specifications. Flashback arresters shall be installed at the welding tip and at the regulator.

5. Open flames, sparks or smoking shall be prohibited in areas so marked or designated, and where a recognized combustible/flammable hazard exists.

6. Fire detection and/or suppression systems shall not be disabled or blocked without notifying the Rochester Gas & Electric Corporation project monitor and obtaining his/her consent.

7. Flammable/combustible material shall be stored in approved containers and locations. Quantities in excess of one day's use shall be reported to the Rochester Gas & Electric Corporation project monitor.

HAZARD COMMUNICATION (ref: 29 CFR 1926.59)

1. The Contractor must have a written program that complies with OSHA's Hazard Communication standard.

2. Contractors shall provide to the Rochester Gas & Electric Corporation project monitor a list of chemicals and Material Safety Data Sheets (MSDS) for each chemical that they will bring onto Rochester Gas & Electric Corporation property or use on a Rochester Gas & Electric Corporation project.

3. Contractor chemical containers will be properly labeled. Rochester Gas & Electric Corporation Contractor chemical labels will be used as required.

4. All unused chemicals which Contractors have brought onto Rochester Gas & Electric Corporation property or used for a Rochester Gas & Electric Corporation project shall be the responsibility of the contractor to properly dispose of and/or remove.

5. The Rochester Gas & Electric Corporation project monitor shall make Contractors aware of Rochester Gas & Electric Corporation's Hazard Communication Program, notify them of any chemicals that they may be exposed to while working on ROCHESTER GAS & ELECTRIC CORPORATION property, and provide access to the applicable MSDS.

J. **HOUSEKEEPING** (ref: 29 CFR 1926.25)

1. Good housekeeping practices shall be strictly adhered to daily. The work site shall be kept clean and orderly.

2. Trash shall be promptly removed from the work site and from the customer's property.

3. Boards with protruding nails shall not be left lying around. All nails shall be withdrawn or hammered down.

4. Contractors shall not block means of access or egress, or safety equipment.

K. **LADDERS AND SCAFFOLDING** (ref: 29 CFR 1926.451, 1050-1053, 1060)

1. Contractors shall not use Rochester Gas & Electric Corporation ladders without permission from the Rochester Gas & Electric Corporation project monitor.

2. Contractors are required to furnish their own ladders and equipment free of defects. Specific exceptions to this rule shall be written and made part of the contract.

3. All straight and extension ladders shall be properly maintained and equipped with approved safety feet.

4. Metal ladders shall not be used while working in proximity to energized electrical facilities.

5. All scaffolding erection and use shall be in compliance with OSHA standards. A professional engineered approval of scaffolding plan(s) shall be submitted as required.

L. **LEAD** (ref: 29 CFR 1926.62)

Contractors shall not disturb known or suspected lead-containing materials. When these materials are encountered and could potentially be disturbed by the work being performed, work shall be stopped immediately. The Contractor shall immediately notify the Rochester Gas & Electric Corporation project monitor.

M. **MEDICAL SERVICES** (ref: 29 CFR 1926.50)

1. When a medical facility is not reasonably accessible for the treatment of injured employees, personnel trained to render first aid and CPR shall be available at the worksite. The personnel designated to provide CPR and first aid must have current certifications and must carry evidence of their training while on site.

2. First aid supplies approved by a consulting physician shall be readily available at the worksite.

N. **MOTOR VEHICLES** (ref: 29 CFR 1926.600-02)

1. Contractors shall not use Rochester Gas & Electric Corporation vehicles without permission. Contractors shall transport employees in a safe manner (e.g., riding in the back of a pick-up and in places other than the operator's seat, (i.e., a backhoe bucket or fender) is prohibited).

2. Contractor employees shall possess the necessary license classification for vehicle(s) being driven.

O. **OVERHEAD WORK** (ref: 29 CFR 1926.500-503)

1. Personnel shall be protected from falling tools, equipment and material.

2. All girders, beams and overhead surfaces shall be kept free of loose material.

P. **PERSONAL SAFETY EQUIPMENT** (ref: 29 CFR 1926.28,52,95,100-103,353,500-503)

1. Eye and Face Protection - Approved and appropriate eye and/or face protection shall be worn when an eye or face hazard exists. Personnel involved in welding operations shall wear eye protection with filter lenses or plates of the proper shade number. The eye and face protection must meet the requirements of ANSI Z87.1-1968.

2. Head Protection - OSHA approved hard hats shall be worn at the work site. Bump caps, metal hard hats, and metal hard caps are prohibited.

3. Clothing - Contractors employees shall be properly clothed at all times. Natural fabric clothing or flame retardant clothing is required while working on energized gas pipelines, energized electrical equipment and whenever a flame hazard exists.

4. Gloves - Suitable gloves will be worn when there is a potential for hand injury.

5. Footguards - Footguards must be worn when using jackhammers, tampers or similar equipment and when there is a potential foot hazard. Additional safety footwear will be selected based on the potential hazard.

6. Hearing Protection - All personnel subjected to sound exceeding OSHA permissible noise exposures shall have available and wear appropriate hearing protection.

7. Respirators - The contractor shall provide respirators based on the hazard encountered. Contractor respirator use will be in compliance with OSHA requirements.

8. Fall protection - Whenever work site conditions involve a potential for a fall hazard of 6 feet or more, the contractor shall use appropriate fall protection.

Q. **RADIATION** (ref: 29 CFR 1926.53)

1. The Contractor shall inform the Rochester Gas & Electric Corporation project monitor whenever an ionizing radiation source is used.

2. The Rochester Gas & Electric Corporation project monitor will inform the Contractor when work is necessary near a Rochester Gas & Electric Corporation ionizing radiation source.

3. If work is required in the proximity of an ionizing radiation source, the Contractor shall comply with all applicable regulations.

R. **TOOLS** (ref: 29 CFR 1926.301-304)

1. Contractors shall not use Rochester Gas & Electric Corporation tools without permission.

2. Tools shall be kept defect free and if defects are found, immediately taken out of service.

3. Tools shall be maintained as per manufacturer's specifications and governing regulations.

4. Tools shall not be retrofitted or changed.

S. **WATER** (ref: 29 CFR 1926.106)

When Contractors work over or near water and where the danger of drowning exists, the contractor must comply with all provisions of OSHA (i.e., training, Coast Guard approved life jackets, ring buoys, skiffs, fall protection etc.).

T. **WORK AREA PROTECTION**

1. Adequate work area protection shall be used by Contractors. All work area protection shall be in accordance with the New York Manual of Uniform Traffic Control Devices.

2. All contractors working in the road right-of-way:
    a. must wear high visibility orange clothing or reflective vests.
    b. shall use reflective vests for flagging and night work.

<u>MISCELLANEOUS REQUIREMENTS</u> (ref: 29 CFR 1926.20-21)

1. Contractor employees shall not enter any building or area where their work does not require their presence.

2. Firearms and weapons are forbidden on Rochester Gas & Electric Corporation work sites.

3. Unauthorized explosives or explosive materials are forbidden on Rochester Gas & Electric Corporation work sites.

4. The Contractor shall maintain current safety and health signs and erect new ones if the hazard changes. The contractor shall also remove signs from the work site when there is no longer a hazard present.

5. The Contractor shall have a program to provide for frequent and regular inspections of the job site, materials, and equipment by designated competent persons.

6. The Contractor shall instruct each employee in the recognition and avoidance of unsafe conditions and in the regulations applicable to his/her work environment to control or eliminate any hazards or other exposure to illness or injury.

7. The Contractor shall permit only those employees qualified by training or experience to operate equipment and machinery.

D
COMMUNITY AIR MONITORING PLAN

FINAL COMMUNITY AIR MONITORING PLAN (CAMP) FOR THE WORK PLAN FOR CHARACTERIZATION AND DESIGN OF INTERIM REMEDIAL MEASURE FOR THE OIL/TAR SEPARATOR AREA AT THE RG&E WEST STATION FORMER MGP SITE ROCHESTER, NEW YORK

SITE #: V00593-8

INDEX #: B8-0535-98-07

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February 2006

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1.0 INTRODUCTION

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities do not spread contamination off-site through the air. The proper implementation of the community air monitoring program is essential to the protection of public health.

2.0 PURPOSE

The purpose of this CAMP is to provide real-time monitoring for airborne volatile organic compounds (VOCs) and particulates at the downwind perimeter of the work area during any test pitting or other excavations carried out at the West Station Former MGP site (Site) during environmental investigations. During soil boring and monitoring well installations, VOCs and particulates will be recorded and managed in the work zone immediately surrounding the boring/well location. A companion document to this CAMP entitled Odor Management Plan (OMP) provides actions to control odors during intrusive site activities should odors or elevated VOCs and/or particulates warrant such actions.

3.0 SCOPE

The chemicals of potential concern at the Site are VOCs (primarily benzene, toluene, ethylbenzene, and xylenes (BTEX)) and polycyclic aromatic hydrocarbon (PAH) compounds. VOCs will be monitored using a photoionization detector with a 10.2 eV electrodeless ultraviolet discharge lamp. PAHs are non-volatile and any airborne emissions would be associated with particulates. Particulates will be monitored using a particulate air monitor equipped with a micro-processor to measure and record real-time recordings of airborne particulate concentration in milligrams per cubic meter (mg/m^3).

During ground intrusive test pit activities or other excavations, air monitoring will be conducted continuously at the perimeter of the work area as described herein.

The air monitoring will be conducted with the following equipment (or equivalent):

2 - MiniRAE 2000 PGM-7600 photoionization detector (PID)

2 - DataRam DR-4000 portable particle sizing aerosol monitor/data logger

1 - VRAE PGM-7800 Multi Gas Monitor

1 - 1 Sensidyne AP-205 Gas Detection pump with benzene detector tubes

4.0 AIR QUALITY MONITORING

Air quality monitoring will be performed for organic vapors and airborne particulates as outlined below.

4.1 VOC MONITORING RESPONSE LEVELS AND ACTIONS

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. The field personnel will be prepared to monitor multiple locations in the event that there is little wind or the wind direction changes frequently. Several perimeter locations will be established during these conditions and the air monitoring technician will check each of these stations frequently during all intrusive fieldwork activities. Monitoring instrumentation will include a PID and a particulate air monitor as described in Section 3.0. The monitoring instruments will be calibrated at least daily. The equipment should 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 exceeds 5 parts per million (ppm) above background for 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area persists 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 can resume provided that the total organic vapor level 200 feet downwind of the work area or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less-but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

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

All 15-minute readings must be recorded and be available for State (NYSDEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

4.2 PARTICULATE MONITORING, RESPONSE LEVELS, AND ACTIONS

Particulate concentrations will be monitored continuously during ground intrusive activities involving test pits or excavations at the downwind perimeter of the work area.

The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration will be visually assessed during all work activities.

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

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

All readings must be recorded and be available for State (NYSDEC and NYSDOH) personnel to review.

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1
INTRODUCTION

The purpose of this Odor Management Plan (OMP) is to provide actions to control odors during intrusive site activities at the RG&E property located at 254 Mill Street, Rochester, New York (Site). This property is the site of a former manufactured gas plant (MGP). The investigation program will be conducted using test pit excavations and subsurface soil borings that may generate nuisance odors. RG&E considers the control of odors to be a priority during activities to be implemented at the Site.

This plan is part of the work plan for the West Station Former MGP IRM, and a companion document to the Community Air Monitoring Plan (CAMP) and the site-specific Health and Safety Plan (HASP). The CAMP requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated characterization work area. The HASP specifies procedures that are to be used to protect site workers and the public during the site investigation.

This portion of the work plan is intended to provide site managers, representatives of NYSEC and NYSDOH, and the public with information summarizing typical odor control options, and to provide guidance for their implementation. A description of potential sources of odors and methods to be used for odor control is presented in the following sections.

1.1 POTENTIAL SOURCES OF ODORS

Generally, the materials encountered at former MGP sites are well defined. They principally contain VOCs, polycyclic aromatic hydrocarbons (PAHs), and a number of inorganic constituents, including metal-complexed cyanide compounds, and metals. Constituents of MGP tar or petroleum products can produce distinctive odors when they are unearthed during intrusive investigation activities. MGP materials can produce odors that are similar to mothballs, roofing tar, or asphalt driveway sealer.

2
ODOR MONITORING

The CAMP specifies continual monitoring of VOCs and particulates during intrusive subsurface field work. This OMP specifies the procedures and actions to be employed should VOCs and/or particulates be detected above action levels specified in the CAMP, or to minimize nuisance odors during the field work.

The field investigation personnel will record observations of odors generated during the implementation of the work plan. Odors will be recorded as weak, moderate, or strong, based on olfactory responses. When odors attributable to MGP material are noted in the work area, observations also will be made at the downwind limit of the RGE property, in order to assess the potential for off-site migration of odors. The downwind fence line odor monitoring will be performed in conjunction with the VOC and particulate monitoring program described in the CAMP.

Upon detection of moderate or strong odors at the site perimeter, site controls, starting in the work area, will be implemented. The site controls described in the following sections will be used to assist with odor mitigation. Note that the goal of the OMP is to minimize, and to prevent where practicable, the off-site migration of odors. Therefore, corrective actions in response to nuisance odors will be implemented only when those odors are detected at the site perimeter.

3
ODOR MITIGATION

If odor mitigation becomes necessary due to activities on-site, site controls will be implemented, as described in the following section.

3.1 SITE CONTROLS

Site controls are intended to limit the production of odors from on-site activities and to minimize the off-site migration of nuisance odors.

3.1.1 Primary Controls

Several primary odor controls will be implemented such as:

- Every effort will be made to minimize the amount of time that ambient air is exposed to odiferous material at the site.
- If test pits are excavated, it may be possible to move some amount of soil around within the footprint of the test pit excavation in order to minimize the amount of soil removal and subsequent stockpiling of impacted soil at the ground surface. The use of in-excavation stockpiling of test pit soil will be evaluated on a case-by-case basis, and will be completed only if it does not impede the collection of subsurface soils or the full delineation of the subsurface features being investigated.
- Drill cuttings from hollow stem auger borings will be containerized as soon as possible during completion of each soil boring.
- Meteorological conditions are also a factor in the generation and migration of odors. Some site activities may be limited to times when specific meteorological conditions prevail, such as when winds are blowing away from a specific receptor.

3.1.2 Secondary Site Controls

If moderate or strong odors remain at the RG&E downwind property line after primary odor controls have been implemented, secondary controls will be used to control those odors. The field team leader will work through the applicable list of secondary controls until the perimeter odor issues are resolved. The field team leader will work closely with RGE during this task. Final selection of controls will be dependent on field conditions encountered and the effectiveness and availability of the control technology.

Secondary controls may include the following:

- For stockpiled impacted soil, temporary tarps or polyethylene covers will be used to control odors.
- Three agents that can be sprayed over impacted soil have been determined to be effective in controlling emissions. They include BioSolve® vapor suppression, hydro-mulch, and odor suppressant foam. These agents may be used where tarps cannot be effectively deployed over the source material, or where tarps are ineffective in controlling odors:
- BioSolve® is a biodegradable, water based product that has the unique ability to encapsulate hydrocarbon VOC vapor. The product is mixed with water at a 3-5% concentration and can be applied with wide variety of water application spray methods. BioSolve® emulsifies and encapsulates the hydrocarbon almost instantly, and is not subject to breaches or drawdown (like some foam applications) that allow for revolitalization, making it an ideal choice in windy conditions, and on sloped surfaces.
- Hydromulch - Although it is unlikely that it will be necessary, a modified hydromulch slurry may be used to cover inactive sources for extended periods of time (up to several days). The hydromulch, typically cellulose fibers (HydroSealR) is modified by mixing a tackifier (glue) with the mulch and water to form a slurry. It is applied using a standard hydroseed applicator to a thickness of ¼ inch. The material forms a sticky, cohesive, and somewhat flexible cover. Reapplication may be necessary if the applied layer becomes desiccated or begins to crack.

- Odor Suppressant Foam - Odor suppressant foam can provide immediate, localized control of odor emissions. The foam is made by the injection of air into a foam concentrate/water mixture using a Pneumatic Foam Unit (PFU). The foam is applied via a hose to cover source areas to a depth of 3 to 6 inches. Short-term foam (such as Rusmar AC-600) is recommended to control VOC and odor emissions from active excavations and stockpiles. It is shipped as a concentrate and diluted with water at the site. Under normal conditions this foam can last for several hours. However, it has been observed to degrade quickly in direct sunlight, so frequent and liberal application to all areas that require odor control is advisable.

3.2 RECORD KEEPING AND COMMUNICATION

Similar to readings recorded during the monitoring specified in the CAMP, odor monitoring results will be recorded in the field log book or other air monitoring forms, and be available for State (NYSDEC and NYSDOH) personnel to review.

The field team leader also will provide information on odor monitoring and odor management to residents of the neighborhood should they inquire. In the event that odors persist after these efforts, work will be temporarily discontinued until a mutually agreeable solution with RGE, NYSDEC, and NYSDOH staff can be worked out which allows the work to be completed while minimizing the off-site transport of nuisance odors.