ENVIRONMENTAL GROUP, INC.
ENGINEERING, ARCHITECTURE & SURVEYING, PC

REVISED REMEDIAL INVESTIGATION WORK PLAN

800 HIAWATHA BOULEVARD WEST
SYRACUSE, NEW YORK
(FORMER ROTH STEEL SITE)

NYSDEC BCP SITE #C734083

***Prepared for*:**

New York State
Department of Environmental Conservation
Region 7

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September 2016
Amended October 2017

REVISED REMEDIAL INVESTIGATION WORK PLAN
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CITY OF SYRACUSE, ONONDAGA COUNTY, NEW YORK

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1.0 INTRODUCTION AND PURPOSE

1.1 INTRODUCTION

This Revised Remedial Investigation Work Plan (RIWP) for the former Roth Steel Site has been prepared by Spectra Engineering, Architecture and Surveying, P.C. on behalf of Onondaga County Industrial Development Agency (OCIDA). It modifies prior RIWP versions that were submitted to NYSDEC in June and September 2016 and incorporates comments provided by NYSDEC in an August 3, 2017 comment letter, a September 11, 2017 meeting, and subsequent conversations. The initial June 2016 RIWP was also subject to a 30 day comment period that began on August 1, 2016. Spectra was notified on September 9, 2016 that no public comments were received.

The former Roth Steel site is located at 800 Hiawatha Boulevard West in the City of Syracuse, Onondaga County, New York and consists of approximately 24 acres of land. See Figure 1 for a general site location map. Roth Steel previously operated a scrap-metal processing facility at the Site since 1967 and abandoned the property in 2014 during the bankruptcy process. OCIDA purchased the property from the bankruptcy trustee on October 27, 2015 with the ultimate goal of achieving site cleanup and allowing future re-development. On behalf of OCIDA, a Brownfield Cleanup Program (BCP) application was submitted to NYSDEC by Spectra and accepted. A Brownfield Cleanup Agreement (BCA) was executed for the Site on January 21, 2016, with OCIDA being designated as a “volunteer” with respect to the BCP.

Portions of the Site have already been investigated under an Interim Remedial Measure (IRM) Investigation Plan (May 2016), which was approved by NYSDEC on May 17, 2016. That investigation focused on a portion of the Site where the Onondaga Lake Canalways Trail Extension may cross. In addition, waste-material samples (Automobile Shredder Residue (ASR) piles, drums) and limited groundwater and surface water samples were also collected.

Following the completion of the sampling activities associated with the IRM Investigation Plan, an IRM Work Plan was submitted to NYSDEC on July 22, 2016 proposing a series of initial response measures. Based on discussions with NYSDEC and USEPA, Revised IRM Work Plans were submitted in September and October 2016. The Revised IRM Work Plan also subdivided the Site into Operable Units (OU) 1 and 2. Initially, OU1 was a linear portion of the Site, located at its northern perimeter, where the Canalways Trail will be located. OU2 was the remainder of the Site. At the request of NYSDEC, the designations of OU1 and OU2 have been switched so that OU1 is now the main portion of the site and OU2 is the trail area (see Figure 2).

To fulfill federal Toxic Substances Control Act (TSCA) requirements, a Self-Implementing Cleanup and Disposal Notification relating to the trail was submitted to USEPA in December

2016 and amended by a February 17, 2017 correspondence. USEPA issued a conditional approval for these activities on March 15, 2017.

1.2 REMEDIAL INVESTIGATION WORK PLAN PURPOSE

This Revised RIWP pertains to areas of the Site that were not investigated during the IRM Investigation phase of the project. The Plan summarizes the existing environmental information at the Site and proposes a scope of work that includes:

- Better definition of soil “hot spots” identified in previous investigations;
- Additional soil borings and test pits to address other potentially contaminated areas;
- Determination of current groundwater quality across the Site;
- Soil vapor testing; and
- Collection of surface soil samples in the northwest portion of the Site, which may receive surface-water runoff, and other areas where contamination may exist.

This document also summarizes existing information from previous studies and outlines the methods to be used to further investigate the extent of environmental contamination. It includes procedures for collecting and evaluating environmental samples and an anticipated schedule for completing these activities. Quality assurance/quality control procedures (QAPP), a field health and safety plan (HASP), and a community air monitoring plan (CAMP) are also included.

1.3 SITE DESCRIPTION

The Site area is a triangular property approximately 24 acres in size, at the southern end of Onondaga Lake, and is bounded by: CSX Railroad Tracks to the northwest; the Metropolitan Wastewater Treatment Plant owned by Onondaga County to the north/northeast; Hiawatha Boulevard West to the east/southeast; and approximately 13 industrial businesses along State Fair Boulevard to the southwest (See Figures 1 and 2). Most of the Site is designated as OU1, comprised about 22.75 acres. The OU2 portion of the Site is a 1.25-acre linear strip of land located along the northeast perimeter of the property. It includes the Canalways Trail that will be primarily constructed “at grade”. The western section of the trail within OU2 will become elevated as the trail transitions to an overhead pedestrian bridge.

The former Roth Steel metal recycling facility operated from 1967 to 2014 in a commercial/industrial zoned area. The facility extracted ferrous and non-ferrous metals from scrap items, primarily automobiles. Vehicles and other scrap materials arrived onsite, were drained of fluids (e.g. fuel, engine oil, transmission fluid, coolant), weighed at one of two scales, and then were stored in an area east of the former lagoon until shredding on the north-central portion of the Site. After shredding, ferrous metals were transferred with magnets to a concrete pad. All non-ferrous materials were placed in a different pile and sorted into non-ferrous and non-metallic materials (ASR) by an eddy current sorter located south of the ASR Disposal Cell #2 (see Figure 2). The ASR was temporarily stored in a covered building near the eddy sorter until it was sent offsite for disposal or further material recovery. Figure 2 shows the general location of the shredder and eddy sorter areas.

The Site includes two automotive shredder residue (ASR) disposal cells located on the northwest side of the Site. Elevated PCB concentrations have been found in sections of these waste cells. A former storm water pond (lagoon) also exists in the central portion of the Site. Soil surrounding the pond has been impacted by ASR materials and it is likely that pond sediment is also impacted. The location of ASR Disposal Cells 1 and 2, and the former pond/lagoon are also shown on Figure 2. ASR waste and fill materials generally exist throughout much of the Site, including two large ASR piles located just east of the Eddy Sorter Area (Figure 2).

Roth Steel has been the sole owner of the Site since 1967 until OCIDA's purchase from the bankruptcy trustee in October 2015. Since operations ceased, several site changes have occurred. Most of the eddy sorter equipment, the shredder equipment, and a pad-mounted transformer and three pole mounted transformers have been removed. In addition, in November 2015, Spectra and its subcontractor (Action Technical Services) performed an initial interim remedial measure (IRM) at the request of the NYSDEC, to consolidate and secure various 55-gallon liquid drums, assorted plastic containers, aerosol cans, paint cans, and abandoned automotive fuel/propane tanks. These inventoried materials were moved and secured within the former Roth Steel facility Building 5. Any leaking drums were placed in over-pack containers. Various other small containers were placed on plastic sheeting.

Additional wastes were also placed in Building 5 as a result of site-related activities. During the drilling of a deep geotechnical boring by CHA/NYEG Drilling for the Canal Trailway Project, three totes of liquids and multiple drums of soil cuttings were generated and placed in Building 5. OCIDA agreed to characterize and dispose of these materials. In addition, at the request of NYSDEC, other liquid drums (water and oil) were moved from outside Buildings 1 and 2 into Building 5 for characterization and ultimately, off-site disposal. Those drums were moved by Paragon Environmental Services in June 2016 and included five partially filled oil drums (labeled as hydraulic oil) and one rainwater drum. In addition, a drum of suspected PCB capacitors, found in Building 4, was also removed from the site. Prior to removing the PCB capacitors, a certified asbestos abatement contractor (Asbestos Environmental Services, Inc.) entered Building 4 on November 19, 2016, placed the capacitors in sealed plastic bags, and moved them into Building 5. This material was treated as "asbestos-contaminated" due to the presence of broken floor tiles near the capacitor drum that contained asbestos. The “bagging” of the capacitors was conducted in accordance with a plan approved by the New York State Department of Labor (NYSDOL). The drum that contained the capacitors was also bagged and treated as PCB/asbestos waste.

The materials consolidated in Building 5 were characterized and disposed of as discussed in the Revised IRM Work Plan (October 2016) and IRM Completion Report (June 21, 2017). The various waste materials in Building 5 were segregated into groups of “like” materials by Spectra and its subcontractor (Veolia Environmental Services) based on physical appearance of the contents and any existing labels. Composite samples were collected from the waste materials on August 3, 2016 and submitted to Test America for analysis of VOCs, metals, PCBs, or physical properties, depending on the waste type. Based upon the results of this initial composite sampling, additional samples of certain individual containers were collected on September 14, 2016 and sent to the lab for further evaluation of VOCs, PCBs, flashpoint, or pH.

Based upon the laboratory testing, the majority of the materials were non-hazardous. However, two drums were classified as hazardous based on benzene; one drum was classified hazardous based on tetrachloroethylene; and one drilling-waste water container was hazardous because of an elevated pH level. In addition, a drum labeled as mineral spirits and a lab pack with miscellaneous small containers (e.g. aerosol cans, paints) were classified as ignitable hazardous waste.

Between December 22, 2016 and January 23, 2017, Veolia picked up and transported the waste materials to off-site disposal facilities. The majority of the wastes (hazardous and non-hazardous) were taken to the Veolia facility in West Carrollton, Ohio. The PCB/asbestos waste was taken to a U.S. Ecology facility in Belleville, Michigan. In total, 56 drums of “auto waste” liquids were removed, including the three that were classified as hazardous waste. Removal also included 11 drums of drill cuttings, 7 rainwater drums, three 250 gallon totes of drilling fluid (one of which was hazardous waste), one drum of DECON water, one drum of mineral spirits, the capacitor/asbestos materials, one drum of PPE, and one lab pack of aerosol cans/paints.

Additional removal of ASR has also been completed by OCIDA. Between February 20 and March 7, 2017, Neu-velle, LLC, with Spectra oversight, removed ASR Waste Pile 1 and 2 from the site. The ASR waste was excavated, loaded and transported to Ontario County and Seneca Meadows Landfills. In total, 2,545 tons of ASR were removed. 1,778 tons went to Seneca Meadows Landfill and 767 tons were taken to the Ontario County Landfill. NYSDEC and USEPA both approved that the ASR Piles could be disposed of as non-hazardous, solid waste.

Currently, the Site is vacant and primarily enclosed with a locked security fence. Vehicle access along Hiawatha Boulevard West is restricted by a locked gate.

2.0 GENERAL SITE INFORMATION

This section includes a brief description of the environmental setting of the Site including its hydrology and the artificial and natural materials beneath the Site, as well as previous site investigations.

2.1 ENVIRONMENTAL SETTING

Historical construction of the Erie Canal in the early 1800's led to a lower water elevation in Onondaga Lake, exposing previously submerged land at the southern end of the lake, including the Site. The majority of the topographic low areas were filled with various materials and these lands have been generally utilized for commercial and industrial purposes.

2.1.1 Geology

Fill material was used to raise the exposed land adjacent to the lake and allow site development. The fill at this site consists of a variety of materials including gravel with lesser amounts of sand and silt, ASR, concrete, cinders, ash, plastic, brick, glass, metal, and wood. Previously drilled shallow boreholes reveal that sandy fill generally composes the material from 1-12 feet below ground surface (BGS) across the Site. Solvay-process waste is also found between 8-12 BGS across most of the site. Underlying the fill and Solvay materials are native soils that are unconsolidated deposits, consisting of brown to gray sand intermixed with silt.

CHA recently drilled a deep borehole (in the northern portion of the Site) to a depth of 237 ft. between March 28 and April 7, 2016 near the CSX Railroad Tracks, as part of their work for the Canal Trailway Extension. Preliminary data from that subsurface log is provided below:

Depth	Description of Subsurface Material
0-9'	Fill – gravel, silt, sand, some concrete fragments
9-20'	Fill – mixed with Solvay waste
20-36'	Native soils begin – alternating sand and clay layers
36-64'	Clayey silt
64-108.5'	Silty clay
108.5-118.5'	Clayey silt
118.5-123.5'	Silty clay
123.5-133.5'	Sand
133.5-151.5'	Silty clay
151.5-153.5'	Sand
153.5-173.5'	Silty clay
173.5-183.5'	Clayey silt
183.5-188.5'	Silty clay

188.5-221’	Sand
221-227’	Weathered bedrock
227-237’	Bedrock – shale
237’	End of boring

The USGS Bedrock Geology Map of New York State (1970) shows that bedrock directly underlying the Site consists of the Silurian-aged shale of the Vernon Formation. This formation includes weathered and chemically altered bedrock comprised of siltstone and shale interlayered with gypsum deposits.

2.1.2 Surface Water Hydrology

Regional surface water in the Site vicinity generally flows to the northwest toward Onondaga Lake. However, surface water runoff collects in a large topographic low area in the central portion of the Site near the former shredder and eddy sorter. In addition, a former/lagoon pond that is currently filled with vegetation exists just south of the topographic low area. During heavy precipitation events, surface water may also run adjacent to a roadway along the southwest property line towards a wooded area located just west of ASR Disposal Cells #1 and #2.

2.1.3 Groundwater Hydrology

A series of groundwater elevation measurements have been taken between 2008 and 2013 during previous investigations by Brown and Caldwell, AECOM, and O’Brien & Gere. The groundwater at the Site is generally shallow and commonly encountered at depths of about 1-12 ft. BGS. The primary groundwater flow direction is to the northwest, towards Onondaga Lake (O’Brien and Gere, June 2013). Spectra completed a well inventory in Spring 2016 that included depth to water measurements. This information and an updated groundwater contour map are presented in Section 3.2. The shallow groundwater occurs under unconfined conditions within the fill materials. Several cross sections from the Site were previously prepared using soil boring and monitoring well logs to show the subsurface stratigraphy and the water table (Figure 3).

Hydraulic conductivity (K) measurements have also been taken in several monitoring wells (MW-1, 2/2A, 3/3A, 4, 5, 6/6A, 7/7A, 8/8A, and 9) across the Site. Hydraulic conductivity, sometimes referred to as “permeability”, is a measurement of how easily water moves through the pore spaces of soil or rock. These data are presented in Table 2 (O’Brien and Gere, June 2013) and show a two-order magnitude range of K values in these wells (e.g. MW-1 has a K value of 0.55×10^{-3} cm/sec, whereas K is 31.8×10^{-3} cm/sec in MW-8/8A). It is not unusual for hydraulic conductivity to vary by several orders of magnitude. For instance, the hydraulic conductivity of clay can be five orders of magnitude lower than sand and gravel.

2.2 PREVIOUS SITE INVESTIGATIONS

The former Roth Steel facility has been subject to several investigations since 1968. A brief summary of previous investigation is provided below. This summary does not include the IRM Investigation activities recently completed by Spectra and discussed in the Revised IRM Work Plan (September 2016).

- **Oil Contamination Study (Faltyn, 1968)**
  Thirteen soil borings were completed in the northwest corner of the main parcel (with very limited chemical analysis of soil samples) and a study of the peripheral drainage patterns were used to investigate the presence of oil on the Roth Steel property. Reportedly, oil was released at a discharge pipe onto the Roth Steel property by an adjacent property owner. Indications of oil and tar were detected at some locations within the first three feet BGS with isolated pockets extending to depths of 6 to 7 ft. BGS. Subsequent investigations, discussed below, have provided more rigorous environmental testing and sampling analysis in the vicinity of many of the Faltyn borings.

- **ASR Characterization Report (Baumgartner & Associates, 1993)**
  At the request of the NYSDEC, a study was conducted to investigate the chemical characteristics of Automotive Shredder Residue (ASR) on the Roth Steel property. Two areas of concern were identified, referred to as ASR Waste Cells #1 and #2. The study determined that the ASR in Cells #1 and #2 is buried 1 to 4 ft. below sand, ranges in thickness from 2 to 4 ft., and was estimated to be 6,300 cubic yards in volume. Twenty-eight of thirty samples contained PCBs averaging 48.5 to 78 ppm in Cells #1 and #2, respectively. TCLP samples were tested for cadmium and lead at 29 locations. In addition, a full TCLP test was performed on one sample from each cell. No samples exceeded the TCLP limits.

- **Geotechnical Study (CME Associates, 2004)**
  During this investigation, nine soil borings were advanced to a depth of 6 ft. in the Roth Steel facility parking lot, as part of a subsurface exploration study. The exact location of the borings is unknown as no map was included in the report. Boring logs indicate that the parking lot's subsurface contained fill deposits (silt, sand, gravel, slag, coal ash, glass, brick, ceramic, wire, and solvay waste) and a shallow water table, as high as 6 in. BGS. No environmental testing was performed.

- **Limited Phase II Investigation (Passero Associates, 2007)**
  Passero Associates conducted a limited Phase II ESA to characterize the condition of soil and groundwater on the Roth Steel property. They installed five soil borings to

investigate ASR Waste Cells #1 and #2 to a depth of at least 8 ft., and 12 additional borings across the material acceptance/processing/storage area to the south and east of the cells. Several soil samples were also collected from the onsite lagoon. Results show that PCBs, and to a less extent, metals and SVOCs in certain soil samples were in excess of NYSDEC cleanup levels. Groundwater in some areas was observed to be impacted by PCBs and moderate levels of VOCs. It should be noted, however, that the groundwater samples were collected from open geoprobe holes rather than properly constructed monitoring wells, therefore, the analytical results may be biased high due to elevated turbidity in the samples.

- **Site Investigation Report (O'Brien & Gere, 2013)**

  On December 28, 2007, a consent order (D7-1015-11-04) between Roth Steel Corporation and NYSDEC was signed which required a study to determine environmental impacts from the ASR Disposal Cells #1 and #2. This work was carried out by Brown and Caldwell in separate Petroleum and Solid Waste Investigations. Drafts reports of these investigations were submitted to NYSDEC in 2008 and 2009, respectively. NYSDEC review of the drafts led to the requirement of additional investigative activities. A Site Investigation Report was prepared by O'Brien & Gere (2013) and was the culmination of Petroleum and Solid Waste Investigations by Brown and Caldwell in 2009 (only reported in drafts), a Work Plan Addendum by AECOM in 2010, and subsequent investigation activities requested by the NYSDEC and conducted through March 2013.

  Analytical results detected many different constituents across the Roth Steel site including: gasoline related VOCs in groundwater; xylene and toluene in soil; chrysene in soil; PCBs in soil; and metals in soil (cadmium, chromium, lead, mercury, manganese and zinc) and groundwater (aluminum, barium, iron, lead, magnesium, manganese, and sodium).

- **Consent Order (R7-20121101-89) Post-Removal Letter Report (O'Brien & Gere, September 20, 2013)**

  The report presents sampling results from materials that remained in place after removal of an ASR pile that was located immediately northwest of the "former" pond. The samples were collected on August 8, 2013 from eight locations shortly after the ASR pile was removed, pursuant to a NYSDEC Consent Order. The ASR pile (2,179 tons) was taken to Seneca Meadows Landfill. Post removal samples (0-4", 4-16") were analyzed for PCBs, arsenic, barium, cadmium, lead, and selenium. The analytical results indicated that elevated levels of PCBs and metals remained on site.

3.0 EXISTING SOIL AND GROUNDWATER CONDITIONS

As indicated above, several environmental investigations have been completed at the Site since 1968. The investigations completed prior to 2016 included the establishment of approximately 120 soil borings/test pits, installation of 17 monitoring wells, and the collection of more than 90 soil samples, along with 62 groundwater samples. In addition to these studies, Spectra and CHA completed further testing in 2016, as summarized in the IRM Work Plan reports (July, September, October 2016). The level of investigation at the Site provides extensive information on the environmental conditions. The following sections summarize the existing soil and groundwater data.

3.1 SOIL CONDITIONS

Soil samples at the Site indicate that surface and subsurface soil has been impacted by prior site operations. Many locations exhibit elevated concentrations of PCBs and various metals. Table 1 and Figures 4 and 5 identify PCB sample results along with a designation of what samples exceeded the 6 NYCRR Part 375 Soil Cleanup Objectives for Commercial or Industrial Use. It should be noted that the 2016 data collected by CHA in OU2 was discussed in detail in the Revised IRM Work Plan (October 2016). The CHA sample locations and exceedances are shown on Figures 4, 6, and 7 of this Revised RIWP, with data tables also included in Appendix A.

PCB concentrations do occur at levels exceeding the hazardous waste threshold of 50 ppm at some areas of the site. The ASR disposal cells were summarized in detail within the Revised IRM Work Plan (October 2016). As presented in that report, data collected by Baumgartner and Associates in 1993 indicated that 20 of the 30 samples collected in ASR Disposal Cells 1 and 2 exceeded the 50 ppm hazardous waste threshold for PCBs. Spectra obtained significantly different results in 2016 when only three of 86 samples exceeded 50 ppm. As discussed in the Revised IRM Workplan, it does not appear that an USEPA or state certified laboratory was used in the Baumgartner study. As such, it is Spectra's opinion that those prior results should be considered "screening" level tests. In addition to the waste cells, elevated PCBs above 50 ppm have only been detected at three other sampling locations at the site; TP-1/TP-2 (1,187 ppm/247 ppm), BH-11 (94.3 ppm), and PNOV[1]-2 (85 ppm).

PCBs in soil samples collected from 0-1 ft. within the former lagoon exceed 6 NYCRR Part 375 Soil Cleanup Objectives for Commercial or Industrial Use, but remain below the hazardous

[1] PNOV samples were collected after the overlying ASR waste pile was removed.

waste threshold of 50 ppm. The highest level of PCBs in the lagoon was in B41 (38.3 ppm) in 2010. The adjacent north access area detected PCBs at 46.1 ppm.

As would be expected at a metal-salvage site, elevated metals exist in surface and subsurface soils. Numerous individual metals exceed NYSDEC Soil Cleanup Objectives for Commercial/Industrial Use with frequent exceedances for lead, cadmium, arsenic, barium, and copper. There are also less frequent exceedances for mercury, chromium, nickel, and zinc. Any sample location for metals is circled on Figure 6, with different designations for surface (top 1 ft.) and subsurface (deeper than 1 ft.) sample depths. Sample locations with metal exceedances are summarized on Figure 6 and Table 2 (Appendix A contains a list of all lab tests). The majority of the metal samples tested the upper 1 to 1.5 ft. depth zone.

As shown on Figure 6, there are many locations where lead is elevated, with the highest concentrations at PNOV-5 (27,700 ppm); Lagoon N. Access 5 ft. (11,300 ppm); MW-10 (4,650 ppm); B9 (1,690 ppm); TP-1 (1,720 ppm); TP-2 (1,880 ppm); PNOV-1 (1,640 ppm); BH-6 (2,850 ppm); and TP-13 (2,440 ppm).

It should be noted that several 2008 soil samples tabulated by O'Brien & Gere in Appendix A incorrectly listed multiple exceedances for manganese. The results originally listed for manganese should have been reported as magnesium (and vice versa). Based on Spectra's review of the original lab reports, there are no exceedances of either magnesium or manganese.

Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs) were also sampled for at 54 and 47 soil locations, respectively. All VOC/SVOC sample locations are circled on Figure 7, with different symbols for surface and subsurface depths. Phenols were included in the SVOC analytical group. VOCs did not exceed the 6 NYCRR Part 375 Soil Cleanup Objectives for Restricted Residential, Commercial, or Industrial Use at any sample locations. As shown on Figure 7 and Table 3, there were 11 sample locations where SVOCs exceeded Commercial/Industrial cleanup levels. However, contaminant concentrations were typically 3-4 ppm, or less. The most common constituent exceeding Soil Cleanup Objectives was benzo(a)pyrene, occurring at a maximum concentration of 5.19 ppm at TP-16. Sample locations without an SVOC exceedance are circled on Figure 7.

In addition to the exceedance summaries on Tables 2, 3, and Figures 6 and 7, all metals, VOC and SVOC samples that were collected are listed on Table 4 with the analytical results provided in Appendix A, along with comparisons to Protection of Groundwater SCOs.

O'Brien & Gere (2013) presented a summary table of all constituents detected in soil; the number of samples analyzed; the frequency of detections; the frequency of exceedances; and compares the concentrations to Protection of Groundwater SCOs for the 2008-2013 investigations at the Site. This summary table, included in Appendix A, shows:

- Total PCBs were detected from all 48 soil samples analyzed, and exceeded the Protection of Groundwater SCOs 11 times;
- Individual metals were detected at a frequency of 3 to 44 times in the 44 total soil samples analyzed, with individual constituents exceeding the Protection of Groundwater SCOs from 0 to 37 times (chromium had the largest number of exceedances);
- Individual VOCs were detected between 1 to 34 times in the 35 total soil samples analyzed, with constituents exceeding the Protection of Groundwater SCOs from 0 to 11 times, the most frequent being acetone; and
- Individual SVOCs were detected 1 to 34 times in the 42 total soil samples analyzed, with constituents exceeding the Protection of Groundwater SCOs from 0 to 11 times, the most frequent being chrysene.

PCBs and metals also exhibited frequent exceedances of the 6 NYCRR Part 375 Soil Cleanup Objectives (SCOs) for commercial use and industrial use. Although VOCs in soil were detected at times in exceedance of Protection of Groundwater SCOs, no VOCs exceeded Commercial/Industrial Use standards. A few SVOCs (primarily benzo(a)pyrene) did exceed the Soil Cleanup Objectives for commercial/industrial use. However, concentrations were typically less than 5 ppm, which is significantly below the NYSDEC alternative clean-up level for total SVOCs at commercial/industrial sites of 500 ppm (NYSDEC Policy CP-51). Based on these data, the primary constituents of concern in site soil are generally PCBs and metals.

3.2 GROUNDWATER CONDITIONS

Over the years, groundwater monitoring wells have been installed at 17 locations at the Site. Due to physical damage, several wells were replaced and were designated with the letter “A” suffix. As shown on Table 5, the wells are typically installed to depths of 13 to 15 ft., with a 10 ft. screen length. Monitoring well construction logs are provided in Appendix B.

During a recent inspection by Spectra, twelve of the installed monitoring wells were found in good condition (MW-2A, 6, 7, 8A, 9, 10A, 11, 13, 14, 15, 16, and 17). During that inspection, the depth of groundwater across the Site varied from 1.6 ft. BGS (MW-17) to 7.99 ft. BGS (MW-9). Groundwater was less than 1 ft. BGS at MW-12, but that well is damaged. A groundwater elevation-contour map based on the spring 2016 measurements was prepared by Spectra (see Figure 8). Consistent with prior maps, the downgradient groundwater quality is measured by MW-8A, 9, 13, 14, and 15 since groundwater flows to the northwest towards Onondaga Lake. Wells MW-7 and MW-6 have the highest groundwater elevations.

As summarized on Table 6, groundwater samples have been collected on multiple occasions at the 17 monitoring well locations between August 2008 and February 2013. In addition, “grab” groundwater samples were also collected from 14 geoprobe locations in September/October 2007 (Passero, 2007). During prior sample collection events, lab tests were conducted for PCBs, metals, VOCs, SVOCs, and glycols. Historical groundwater analytical data are contained in Appendix A and any exceedances of 6 NYCRR Part 703 groundwater standards are shown on Figures 9-11 and Tables 7-10.

As shown on these tables and figures, there have been multiple exceedances for PCBs, VOCs, SVOCs, and metals across the Site. The highest PCB concentration in a properly constructed monitoring well was 4.97 µg/L at MW-12 (July 2010). While there was a much higher PCB detection at GW-11 (25,000 µg/L), this was a grab sample collected from a geoprobe boring that did not contain a well screen or a sand pack. This type of sample is not generally considered representative of the dissolved phase concentration present in groundwater since it would be highly influenced by particulate-matter concentrations. During the most recent sampling event (February 2013), PCBs were not detected in any of the 13 wells that were sampled across the Site (MW-2, 3, 6, 7, 8, 9, 10, 11, 13, 14, 15, 16, and 17). However, there were several PCB exceedances in 2012 (MW-3, 7, 8, and 14) and monitoring well MW-12 has not been sampled since July 2010.

All of the monitoring wells at the Site have recorded exceedances for metals (inorganics). The most common exceedance is for sodium, which is not unexpected considering the presence of solvay waste beneath the entire site. Other frequently occurring metals include barium and iron. Less frequent exceedances occur for mercury and lead.

VOCs and SVOCs have also been detected above groundwater standards. The highest concentrations of VOCs occur at MW-3, which is located near the former automobile storage area. The VOCs in this well appear to be primarily related to gasoline compounds (benzene, ethylbenzene, toluene, and xylene), although vinyl chloride is also present. SVOCs are generally non-detect, with the exception of phenols, which have exceeded groundwater standards in 10 wells. Most of these exceedances occurred in 2008 and 2010.

4.0 WORK PLAN OBJECTIVES, QUALITATIVE EXPOSURE ASSESSMENT AND IDENTIFICATION OF DATA GAPS

4.1 OBJECTIVES

This RIWP describes the existing environmental conditions at the Site and will identify specific tasks to be completed during the remedial investigation. The investigation will further define the nature and extent of contamination, building upon the extensive existing data base.

Specific elements in this plan will include investigation of subsurface geology, soil contamination, groundwater flow, impacts to groundwater, and soil vapor. This RIWP also includes a qualitative exposure assessment, a quality assurance project plan (QAPP), a field health and safety plan (HASP), and a community air monitoring plan (CAMP). See Appendices C, D, and E for these plans.

The results of the remedial investigation will be compiled into a Remedial Investigation Report (RIR) that will be used to evaluate and select remedial measures to protect human health and the environment, considering the future potential usage for the Site.

4.2 QUALITATIVE EXPOSURE ASSESSMENT

As part of this RIWP, a qualitative exposure assessment is required to determine the route, intensity, frequency, and duration of actual or potential exposure of humans, fish, and wildlife to contaminants. This assessment considers the surrounding population that may be potentially exposed and the reasonably-anticipated future use of the Site and future groundwater use. This qualitative exposure assessment describes the current exposure setting, identifies current and reasonably foreseeable exposure pathways, and discusses contaminant fate and transport.

Although a future site use has not been established, it is likely that the Site will have an ultimate commercial and industrial end use. Commercial end-use may occur along the portion of the site that borders West Hiawatha Boulevard. The proposed trail that crosses the northern edge of the Site would be considered “passive” recreation, which is equivalent to commercial. The central portion of the site may be used for disposal of dredged sediment, which would constitute an “industrial” use.

4.2.1 Exposure Setting

As previously described in this document, the Site is currently a vacant former industrial-use property. Historical use of the Site was a metal scrapyard and automobile salvage facility. The current surrounding land uses include vacant property, commercial businesses, rail transport and waste-water treatment in an urban setting. Commercial/industrial businesses include CSX railroad tracks and the Onondaga County Metro Plant to the north; a metals plating facility, a vacant former tank manufacturing site, offices and a used car dealership are located to the southeast (across from Hiawatha Boulevard West); and an automobile sales/repair shop, truck stop, motel, rubbish removal company, fencing contractor, and industrial waste storage facility are located to the southwest along State Fair Boulevard. Onondaga Lake is located immediately north of the CSX railroad tracks, on the north side of the Site.

Municipal water and sewer are present at the Site and several sewer force mains and a water line are known to exist near the northern property boundary. The vast majority of the Site (~90% or greater) is comprised of previously disturbed, un-vegetated land and vacant buildings. Standing water currently exists within a topographic low area, located just south of the former shredder and eddy sorter. In addition, a former small pond/lagoon is located in the south-central portion of the Site. This former lagoon reportedly received pumped storm water when the Site was operational. Currently, this former lagoon is heavily vegetated (fragmities, reeds) and contains a small amount of standing water. A relatively small strip of land, along the northwest side of the Site contains trees and grass.

4.2.2 Current and Foreseeable Exposure Pathways

In evaluating the current and foreseeable exposure pathways for the Site, human and wildlife exposure potential should be considered for dermal contact with soil, surface water, and groundwater; ingestion of soil, surface water and groundwater; and inhalation of particulate matter and chemical vapors.

Based upon the exposure setting, including the physical nature of the Site and surrounding land uses, some exposure pathways are unlikely to be significant for current and foreseeable uses. Specifically, given the urban nature of the Site and the surrounding commercial/industrial setting, it is unlikely that the Site will have an adverse impact on fish and wildlife, since significant habitat does not occur on the Site. There is limited current exposure to birds, such as seagulls, who have been observed to land and contact the surface water that exists within the low topographic area at the Site. Spectra has recently collected three samples of this impounded surface water to assess contaminant concentrations. There is also a potential of limited quantities of surface water runoff from the Site to Onondaga Lake. However, there are not established point-source discharge locations and the majority of storm water collects within the previously mentioned low topographic area where it evaporates or infiltrates groundwater. During a high-flow event, storm water may run along a ditch line that exists next to a roadway along the southwest property line. This runoff would enter the wooded area at the northwest portion of the Site. Spectra will collect a surface soil sample in this area to determine whether contaminants have migrated to this area.

With regard to potential human exposure, there are no current site occupants or workers so exposure potential is very limited. The vast majority of the Site is fenced with a locked gate. In addition, building entrances where drums are staged (Building 4 and 5) have been further secured by locks and boarding. There are limited portions of the Site along the rail tracks that are not fenced.

Foreseeable exposure potential considers future site use, which may include passive recreation (walking trail), commercial or industrial use. In addition, less frequent future exposure could occur to periodic construction or utility workers. For these potential receptor groups, exposure may result from inhalation and dermal contact. In addition, a construction or utility worker might also be potentially exposed to soil by ingestion, in the event that good hygiene practices are not followed.

The potential vapor exposure pathway to future site occupants and the surrounding perimeter area will be further evaluated. Whether a potential exposure pathway actually presents a significant risk depends upon a number of factors including chemical concentration, contaminant toxicity, and exposure duration. In addition, there are a number of engineering controls and monitoring measures that could be implemented to reduce or eliminate future potential risks during construction, utility work, or site occupancy. Groundwater at the Site is not currently used for drinking, nor would it be consumed in the future.

4.2.3 Preliminary Evaluation of Fate and Transport

Various chemical constituents have been detected in the soil and groundwater beneath the Site during previous investigations. The primary compounds detected fall within two major chemical groups, polychlorinated biphenyls (PCBs) and metals. To a lesser extent, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs) are also found. The VOCs are generally consistent with gasoline or petroleum-related materials. Specific VOC constituents include benzene, ethylbenzene, toluene, xylene, and methyl tert-butyl ether (MTBE). Vinyl chloride is also present. These compounds have been detected in the soil and are soluble in groundwater to varying degrees, with MTBE being the most soluble. VOCs exceed groundwater standards at several locations. Compounds that become dissolved within groundwater can be transported in a northerly direction toward Onondaga Lake, consistent with the groundwater flow. VOCs also have a tendency to partition into the soil vapor and may move in the vadose zone from their original source area. Over time, many petroleum-related VOCs are subject to natural decomposition in the subsurface by biological and chemical processes.

SVOCs include heavy hydrocarbons and a series of compounds known as polyaromatic hydrocarbons (PAHs). These compounds are also associated with coal ash and asphalt. SVOCs are found sporadically in the soil at the Site, primarily benzo(a)pyrene. SVOCs are generally not as soluble in groundwater and do not partition to soil vapor as readily as VOCs. SVOCs have a greater tendency to adhere to soil particles within the subsurface and groundwater exceedances for SVOCs at the site is limited to total phenols in some "older" data sets.

PCBs and metals are widespread at the Site and are the primary contaminants. In general, PCBs have a low solubility in water and tend to be adsorbed onto soil particles. In water, a small fraction of PCBs may become dissolved and be transported with groundwater. PCBs in surface water or sediment can bioaccumulate in fish and reach levels higher than the initial concentrations. PCBs attached to soil can become airborne and transported with dust. Metals are soluble in water to varying degrees, depending on the particular inorganic compound, its molecular state, and the physical conditions of the groundwater (e.g. temperature, pH, dissolved oxygen, etc.). Metals that are attached to soil particles can also become airborne as dust.

4.3 OFF-SITE AND UPGRADIENT SOURCE OF CONTAMINANTS

Due to the nature of the surrounding properties, it is quite likely that off-site and upgradient sources of contamination exist. Properties located to the southeast, across Hiawatha Boulevard West include two vacant properties, 723 Hiawatha and the former Hudson Service Station. 723 Hiawatha was formerly utilized for tank fabrication, painting, and pipe coating. It contained a service garage and several aboveground and belowground (UST) storage tanks. The former Hudson Service Station was reported to have two 12,000 gallon USTs that were removed and a NYSDEC spill number.

Properties along State Fair Boulevard to the southwest include a gas station/truck stop and an industrial waste removal firm. Spills have been reported for the truck stop, including a 566 gallon diesel fuel spill in August 2014. The previously referenced report by Norbert Faltyn (October 1968), also documented petroleum migration onto the Roth Steel site from an adjacent property owner.

4.4 IDENTIFICATION OF DATA GAPS

A large amount of historic soil and groundwater data exists for the majority of the Site but additional data is required to further assess specific areas where elevated contamination was encountered. In addition, investigation activities will be conducted to assess areas not previously evaluated, including soil vapor and surface water runoff locations. In identifying the data gaps, Spectra has considered prior written comments from NYSDEC, site inspections with NYSDEC, the existing environmental data base, verbal comments provided by NYSDEC in July 2016/September 2017 meetings and an August 3, 2017 comment letter. The general data gaps to be investigated, which are discussed in more detail in the next section include:

- Further delineation of hot spots near TP-1, PNOV-2, PNOV-5, MW-10, and the former lagoon;
- Further investigation of groundwater quality;
- Investigation of soil vapor;
- Sampling of soil where surface water runoff drains along the northwest portion of the property;
- Miscellaneous soil sampling near select building/loading docks; and
- Grid-based sampling (borings/test pits) in areas where ASR waste may be buried or high metals may be present due to past operations.

These data gaps are in addition to ones that were subject to the IRM investigation and are reported in the Revised IRM Work Plan (October 2016), the Self-Implementing Cleanup and Disposal Notification (December 2016), and the February 17, 2017 modification to the Notification.

5.0 PROPOSED INVESTIGATION PLAN

The following sections discuss the proposed RIWP sampling activities and rationale. Tables 11 and 12 summarize the proposed work scope and sampling locations are shown on Figures 8 and 12. The proposed sampling locations are approximate and may be adjusted (with NYSDEC approval) based upon field conditions and physical obstructions. For instance, test pit locations will be relocated if buried concrete blocks or a concrete pad are encountered.

5.1 SOIL "HOT SPOT" AREAS

As indicated on Table 1 and Figure 4, there are many locations where PCBs exceed the NYSDEC Soil Cleanup Objectives (SCOs) for Commercial (1 ppm) and Industrial (25 ppm) usage. In addition, there are some locations (besides ASR Disposal Cells #1 and #2) where PCBs exceed 50 ppm, the NYSDEC threshold for hazardous waste. The areas in the vicinity of sample locations TP-1, TP-2, P-11 and PNOV-2 are considered to be PCB "hot spots" that warrant additional sampling. PCBs near sample locations TP-1, TP-2, and P-11 were found at depths of 4 to 8 ft., with contaminant levels of 94-1187 ppm. To further investigate this area, four soil borings (B-1 through B-4) will be drilled in the vicinity of TP-1/TP-2 and P11 to a depth of 10 ft. or to the bottom of fill, whichever is deeper. These borings will be placed in a general 75 ft. grid and continuous cores will be collected with lab testing for PCBs as indicated in Table 11.

PCBs above 50 ppm were also detected at location PNOV-2 (85 ppm, 4-16"). This sample was collected to document residual PCB concentrations following removal of an ASR waste pile. Surrounding samples to north, east, and south also detected PCBs but at concentrations less than 50 ppm. To further investigate this area, six new borings (B-6 through B-11) will be drilled in the vicinity of PNOV-2. These borings will be drilled using a general 75 ft. grid. Soil cores will be segmented starting at the surface and sent for sequential PCB testing. At a minimum, PCB testing of the 0-1 ft., 1-2 ft. and 2-4 ft. intervals will be performed. If PCBs do not exceed 10 ppm for two successive depth intervals, the deeper depths will not be analyzed.

As requested by DEC, additional PCB samples will also be collected in the suspected ASR area around the "former pond". As shown on Figure 12 and described in Table 11, these samples will generally follow a 75 ft. grid pattern and include B12-B17, B28, TP2 and MW12R.

Two additional sample locations B-5 and TP-1 will be established to evaluate metals and PCB contamination that may exist near the shredder.

Lead and cadmium were also detected in soils at concentrations that could represent hazardous waste based on toxicity characteristics. The elevated lead samples were at MW-10 (4,650 ppm, 6-8 ft.), Lagoon N. Access (11,300 ppm, 5 ft.), and PNOV-5 (27,700 ppm, 0-4 in.). Elevated cadmium was found at B-1 (2,140 ppm, 0-0.5 ft.). To further assess metal concentrations, soil will be tested in the vicinity of each prior location and targeted samples will be collected and analyzed (based on the DOC of the existing data). Borings B-11, B-12, and B-21 will investigate lead near Lagoon N. Access, PNOV-5, and MW-10, respectively. Test Pit TP-3 will assess cadmium near B1. At each location where a specific metal compound is targeted, a total metals sample will be collected at the intervals specified in Table 11. Based on these results, the highest concentration for each boring may be submitted for TCLP analysis, depending on the "totals" analysis. Test Pit TP-3 will also be used to generally assess PCBs and other metal in an area where materials/waste was stored.

To further evaluate potential contamination in the former vehicle processing area, additional samples will be collected in a general 150 ft. grid. In addition to TP-3 (mentioned above), other locations will include TP-4, B-18/B-19, and SS-1. Samples will be collected for PCBs and metals, as indicated on Table 11. Testing depths were selected based on the consideration of nearby existing data.

Hot spot sampling will also include testing for VOCs at replacement well MW-3 (R). Although elevated VOCs have not been encountered in the site soil, VOCs were elevated in prior groundwater samples collected from MW-3 in prior years. While drilling MW-3(R), a field PID meter will be used to screen soil cores from all depths. Based upon these screening measurements, at least one soil interval will be selected for VOC lab testing.

5.2 General Soil Samples

To evaluate "general" conditions at the Site, several other borings, surface samples, and test pits are proposed. These locations were established based on discussions with NYSDEC. A 200 ft. grid was established for the overall Site (see Figure 12) with the goal of collecting at least one sample within a given grid. Sample locations include areas of suspect buried waste, former drum storage areas, and loading dock areas. Other locations were selected to provide analytical results in parts of the site with no existing data.

A summary of these general sample locations and rational is provided below:

Location	Rationale
B-20	Waste storage area by Building 1
B-22	Potential waste storage area
B-23, SS-5	Former drum storage and loading docks near Building 2
B-24	Overhead door bays, Building 3

B-25, TP-5	Potential buried waste area between Buildings 3 and 4
B-26	Surface waste near Building 5
B-27, SS-4	Former drum storage areas near Building 6
B-29	Topographic low area between shredder and eddy sorter
MW-18	DEC requested new monitoring well
B-30, B-31, SS-3	Provide data along roadway/grass strip in the northwest section of the site
SS-2	Area that receives surface water runoff along northwest section of the site

Table 11 lists the proposed depths and sampling intervals/parameters for each of these locations. At the majority of these general soil sampling locations, the upper 1 ft. will include testing for PCBs, metals, VOCs, and SVOCs.

As indicated in footnote 2 to Table 11, additional VOC and SVOC testing may be done at other depths if elevated PID readings or oil staining are observed.

5.3 GROUNDWATER SAMPLING

As discussed in Section 3.2, extensive groundwater sampling has previously been done at the Site. In addition, downgradient perimeter wells MW-8A, 9 and 15 were sampled in May 2016 as part of the recently proposed IRM Investigation Work Plan. To further evaluate groundwater conditions, monitoring wells MW-3 and MW-12 will be replaced and sampled. MW-12 previously detected elevated PCBs and VOCs in 2010 but was not sampled again. In addition, MW-3 had elevated VOCs in several sampling events between 2008 and 2013. OCIDA proposes to re-sample MW-9 plus collect groundwater samples at MW-2A, MW-6, MW-7, MW-13, and MW-16. In addition, a new well (MW-18) to be located just south of ASR Disposal Cell #1 will be installed and sampled.

A summary of the wells to be sampled is provided in Table 12 and the wells are shown on Figure 8. The wells will be sampled using low flow methods and the majority of locations will be tested for PCBs, metals, and VOCs. MW-2A and MW-16 will be tested for metals only. Groundwater depths will also be collected from all site monitoring wells and a current groundwater flow map will be prepared. Well casing elevations will be re-surveyed to verify current conditions.

5.4 SOIL VAPOR

As previously discussed, elevated VOCs have not been found in site soil and no soil samples exceeded 6 NYCRR Part 375 Soil Cleanup Objectives for Restricted Residential use. Despite this, elevated VOCs have been detected in groundwater at a few monitoring wells. To evaluate the potential for off-site soil vapor migration, Spectra proposes to install three soil vapor probes at various locations around the site perimeter. These locations, recommended by NYSDOH, are shown on Figure 12. The probes will be installed to a depth of approximately 5 ft. using the suggested NYSDOH procedures, including tracer gas testing to ensure integrity. A soil gas sample will be collected using a summa canister and VOCs will be tested using the TO-15 analytical method. Depending upon the results of the RIWP and future development plans, additional soil vapor probes may need to be installed if elevated VOCs are encountered at areas where new buildings could be built.

6.0 INVESTIGATION METHODS

6.1 SOIL BORING AND TEST PIT PROCEDURES

A geoprobe (hydraulic push rig) or hollow stem auger drilling will be utilized to complete soil borings. During the advancement of the proposed borings, soil samples will be collected continuously to the bottom of each boring. Individual soil samples will be geologically characterized and screened in the field using a photoionization detector (PID) capable of detecting total volatile organic vapors associated with fuel oils, petroleum products, and other volatile organic compounds. Based on the existing environmental database, elevated VOCs are not anticipated. However, as a contingency, PID screening in the field will be done and at least one VOC sample will be collected from any boring where elevated PID readings (above 25 ppm) indicate possible contamination. Any zone tested for VOCs (because of elevated PID readings or staining) will also be tested for SVOCs. All PID readings will be documented in field notes and boring logs. Test pits will be dug with a standard backhoe/excavator and will generally have a width of 3-4 ft. and a length of 6-8 ft. Soil samples will be described and collected from the bucket and the field oversight staff will not enter the test pit.

All soil borings and test pits will be advanced to the depth specified in the prior section. The depths may be increased if field evidence of contamination (e.g. ASR, odor, free product, elevated PID readings) persists. However, test pits will not extend below the groundwater table.

Soil samples will be collected using standard soil sampling methods and will be submitted to a NYSDOH ELAP-approved laboratory for analysis. Soil samples will be analyzed in accordance with the standard laboratory methods and procedures. Depending upon the specific objective (see Table 11), soil samples will be analyzed for PCBs by EPA Method 8082, Target Analyte List (TAL) metals, or volatile/semi-volatile organic compounds by EPA methods 8260/8270 Target Compound List (TCL). Soil depth-intervals for PCB testing will not exceed 2 ft. in length.

Drill cuttings will be placed back in the borings and any excess soil will be drummed for possible off-site disposal, depending on contaminant levels. The soil from the test pits will be placed back in the excavation at the approximate depth that it was removed. However, any obvious petroleum impacted soil will be placed on plastic sheeting and covered pending the result of lab testing. Disposition of these soils will be discussed with NYSDEC. Soil sampling equipment and the test pit bucket will be decontaminated between sampling events with Alconox and potable water-wash followed by a potable-water rinse.

6.2 GROUNDWATER INVESTIGATION PROCEDURES

6.2.1 Monitoring Well Installation Procedures

A 4-inch diameter (I.D.) hollow stem auger drill rig will be used to install the replacement and new monitoring wells. All wells will be constructed with 10-feet of 2-inch diameter schedule 40 (10-slot) PVC well screens, No.1 or No.2 graded sand packs, schedule 40 PVC riser pipe, bentonite seals, and protective road boxes. The screens will be installed to bridge the water table in order to detect any potential light non-aqueous phase liquid (LNAPL) or "sheens" that could be present. Determination of the actual well depth and screen interval will be made on site by Spectra personnel at the time of the well installation, based upon observed field conditions.

6.2.2 Groundwater Well Development

Any newly installed monitoring well will be developed following installation. At a minimum the well will be allowed to sit overnight prior to development. Prior to well development, Spectra will perform a depth-to-water measurement to determine the stabilized groundwater depths, calculate the volume of standing water, and document any LNAPL or sheens, if present. During development, the well will be surged by physical agitation with a bailer, pump or surge block. Groundwater will be pumped until it is visually free of suspended sediment, with a goal of achieving turbidity of 50 NTU or less. A minimum of five casing volumes will be removed during development, unless the well becomes dewatered before that. Development activities will cease after 50 minutes if asymptomatic conditions are achieved. All well development water will be containerized for sampling and disposal.

6.2.3 Groundwater Sampling Procedures

Groundwater samples will be collected from newly installed wells approximately one week following their proper development. Prior to sampling, Spectra will perform a complete round of depth to groundwater measurements to determine the stabilized depths, calculate groundwater elevations, and document any LNAPLs or sheens, if present.

Following the depth to water measurements, Spectra will collect groundwater samples for analysis using the low-flow methodology. Low-flow sampling will be performed using a peristaltic pump with tubing inserted to the approximate mid-screen depth of the well. If a specific water bearing zone is present, the pump will be lowered to this depth. The pump depth will be at least 1 ft. below the top of the water table. The pump will be set to a minimal flow rate (0.5 to 1 L/min) and water quality parameters (i.e. redox, dissolved oxygen, temperature, turbidity, pH, conductivity) will be measured every 3-5 minutes as the purge water is removed. Depth to water will be measured with a goal of causing less than 1 ft. of drawdown during purging. When field parameters have stabilized (three successive readings within ± 0.1 for pH, ± 3% for conductivity, ± 10 mv for redox, and 10% for turbidity and dissolved oxygen), a groundwater sample will be collected. The goal is to achieve a stabilized turbidity of 50 NTU or less, prior to sample collection and to collect any VOC sample at a pumping rate of between 100-250 ml/min. Groundwater samples will be analyzed for volatile organic compounds by EPA method 8260 TCL, PCBs by Method 8082 and TAL metals. All groundwater and QA/QC samples will be submitted to a NYSDOH ELAP-approved laboratory.

6.2.4 Soil Boring, Test Pit and Monitoring Well Survey

All new soil borings, test pits and monitoring wells will be surveyed to provide coordinate and elevation data relative to a local datum. The survey will establish elevation controls in order to ascertain water table elevations at each well location to determine groundwater flow direction. All existing monitoring wells will also be surveyed to develop a consistent reference with the past monitoring well elevations.

6.3 SOIL VAPOR SAMPLING

The soil vapor points will be installed using a geoprobe or hollow-stem auger to achieve the desired depth of the sample point and incorporate the following:

- A porous inert backfill material to create a sampling zone 1-2 feet in length;
- Fitted with inert tubing of an appropriate size and of laboratory or food grade quality to the surface;
- Sealed above the sampling zone with bentonite slurry for a minimum distance of 3 feet to prevent outdoor air infiltration, with the remainder of the borehole being backfilled with clean material; and
- Completed with a flush mount protective road box or with steel stick-up protective casing.

Soil vapor sampling will be completed in accordance with the New York State Department of Health Final (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006 (including tracer gas testing to verify the surface seal). All soil vapor points will be surveyed using the same coordinate system established for the soil borings and monitoring wells.

6.4 DATA QUALITY OBJECTIVES, QUALITY ASSURANCE, QUALITY CONTROL

6.4.1 Data Quality Objectives

The analytical results will be reviewed with respect to laboratory compliance with EPA methods and with the NYSDEC Analytical Services Protocol. All analytical data packages will be provided in Category B (as defined by ASP) deliverable format.

The objectives of the data quality review are to ensure that the sampling results are representative of site conditions and that evaluation of the data will lead to a proper determination of the significance of the results and a determination of any remedial measures that might be required.

Appendix C contains a Quality Assurance Project Plan (QAPP) for the remedial investigation of the Site. General QA/QC procedures are also discussed below.

6.4.2 Quality Assurance/Quality Control

6.4.2.1 General QA/QC

Spectra and the selected laboratory will perform sampling and analysis in accordance with accepted EPA SW-846 methods including appropriate QA/QC samples including blind field duplicates, matrix spike/matrix spike (MS/MSD) duplicates, trip blanks, and internal lab reference standards. The laboratory will be NYSDOH ELAP-approved and will be approved for performing all analysis and procedures. Field duplicates and MS/MSD samples will be collected at a rate of 1 for 20 samples. A trip blank will be provided for every separate cooler that contains samples for VOC analysis.

6.4.2.2 Laboratory QA/QC

The laboratory selected to perform the analysis of the collected soil and groundwater samples will perform all required internal QA/QC evaluations consistent with the EPA methods used. Any deviations from standards, discrepancies, and data qualifications will be noted.

6.4.2.3 Data Review

All analytical results will initially be reviewed by Spectra for quality with respect to practicable quantification limits, method detection limits, holding times, and analytical methods. This review will include an evaluation of all QA/QC samples and the laboratory QA/QC results. In addition, a third-party independent data validator will prepare a Data Usability Report (DUSR), consistent with DER-10 (NYSDEC guidance). Any inconsistencies will be noted and appropriately qualified.

7.0 SCHEDULE

7.1 GENERAL FIELD ACTIVITIES PLAN AND REPORTING SCHEDULE

Subject to plan approval, coordination with NYSDEC personnel, and contractor schedules, it is anticipated that the field investigative measures and Remedial Investigation report can be completed within 3-4 months based on the following assumed timeline:

- Soil boring, soil sampling, monitoring well installation, installation and testing of soil vapor test points (4-6 weeks);
- Monitoring well measurements, development, sampling and well survey (1 week following installation); and
- Preparation of the Remedial Investigation Report (2 months following field sampling).

Detailed documentation of the site investigative activities will be maintained during the field activities. Reporting will include discussions of findings and submission of a final written report, including all laboratory documentation to NYSDEC.

REFERENCES

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W.Z. Baumgartner & Associates, Inc. “Residue Characterization Report.” Brentwood, Tennessee. December 1993.

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TABLES

Table 1:
Soil Analytical Results (PCBs)
800 Hiawatha Blvd Site

PCBs	Soil Cleanup Objectives				September/October 1993														
					Cell 1														
	Restricted Residential	Commercial	Industrial	Hazardous Waste Criteria	1-1	1-2	1-4	1-5	1-6	1-7	1-8	1-9	1-12	1-16	1-17	1-19	1-20	1-22	1-23
Total PCBs	1	1	25	50	**7.2**	**35.9***	<5.6	**42***	**129.1***	**54.6***	**74.8***	**67.6***	**45.9***	**29***	**69.2***	**54.8***	**94.9***	**11.8**	<4.88

Source: Baumgartner and Associates, December 1993

PCBs	Soil Cleanup Objectives				September/October 1993														
					Cell 2														
	Restricted Residential	Commercial	Industrial	Hazardous Waste Criteria	2-2	2-4	2-5	2-8	2-11	2-12	2-15	2-16	2-19	2-24	2-28	2-31	2-32	2-33	2-37
Total PCBs	1	1	25	50	**86.8***	**92.1***	**106.9***	**86.3***	**59.7***	**58.2***	**104.7***	**58.6***	**46***	**103.3***	**101***	**15.1**	**71.6***	**91.1***	**88.4***

Source: Baumgartner and Associates, December 1993

PCBs	Soil Cleanup Objectives				October 2007																			
	Restricted Residential	Commercial	Industrial	Hazardous Waste Criteria	BH-1 (0'-4')	BH-1 (4'-8')	BH-2 (0'-4')	BH-2 (4'-8')	BH-3 (0'-4')	BH-3 (4'-8')	BH-4 (0'-4')	BH-4 (4'-8')	BH-5 (0'-4')	BH-5 (4'-8')	BH-6 (0'-4')	BH-8 (7'-8')	BH-9 (0'-12')	BH-10 (4'-8')	BH-11 (0'-4')	BH-12 (0'-8')	TP-13 (4')	TP-14 (4')	BH-15 (7'-8')	TP-16
Total PCBs	1	1	25	50	ND	ND	ND	ND	ND	ND	ND	ND	0.006	ND	**31.5***	ND	**1.01**	**5.53**	**94.3***	ND	**7.36**	**3.5**	ND	ND

PCBs	Soil Cleanup Objectives				October 2007					
	Restricted Residential	Commercial	Industrial	Hazardous Waste Criteria	BH-17 (4')	BH 19 (7 '-8 ')	Lagoon 1 Center	Lagoon 2 N Access	Lagoon Surficial	Lagoon N Access (5 ')
Total PCBs	1	1	25	50	**29.47***	ND	**7.35**	**46.1***	**12.1**	**41.3***

Source: Passero Associates, October 2007 (The Passero sample prefixes "BH" and "TP" correspond to the "P" location on the Figure 4)

PCBs	Soil Cleanup Objectives				2008															2011				
	Restricted Residential	Commercial	Industrial	Hazardous Waste Criteria	B01 (0'-0.5')	B06 (0.5'-1.0')	B08 (0'-0.5')	B09 (4.5'-5.0')	B10 (0.5'-1.0')	B12 (0'-0.5')	B13 (0.5'-1.0')	B15 (0'-0.5')	B16 (0.5'-1.0')	B18 (0.5'-1.0')	B19 (0'-0.5')	B22 (0'-0.5')	B24 (1.5'-2.0')	B27 (0'-0.5')	B29 (0'-0.5')	B31 (0'-1')	B32 (0'-1')	B33 (0'-1')	B34 (0'-1')	B34 Dup (0'-1')
Total PCBs	1	1	25	50	0.513	0.586	0.6	0.203	0.6	0.54	0.236	0.364	**2.73**	**1.64**	0.67	0.334	**1.84**	0.97	0.179	0.55	**2.09 J**	0.81 J	0.23 J	0.22 J

PCBs	Soil Cleanup Objectives				2011		2010																	
	Restricted Residential	Commercial	Industrial	Hazardous Waste Criteria	B35 (0'-1')	B36 (0'-1')	B37 (0' - 2')	B37 (2' - 4')	B37 (5' - 7')	B38 (0'-1')	B39 (0'-1')	B40 (0'-1')	B41 (0'-1')	B42 (0'-1')	B43 (0'-1')	B44 (0'-1')	B45 (0'-1')	B46 (0'-1')	B46 Dup (0'-1')	B47 (0'-1')	B48 (0'-1')	MW-10 (0'-2')	MW-10 (6'-8')	MW-11 (0'-2')
Total PCBs	1	1	25	50	0.431 J	U	0.52	**3.4**	0.271	**1.9**	**15.2**	0.042 J	**38.3***	0.51	0.43	**6.4**	0.169	**25.4***	**35.11***	**2.1**	**3.2**	**5.78**	0.42	**1.05**

PCBs	Soil Cleanup Objectives				2010				2013				2011	
	Restricted Residential	Commercial	Industrial	Hazardous Waste Criteria	MW-11 (10'-12')	MW-12 (4'-6')	MW-12 (8'-10')	MW-13 (2'-4')	MW-16 (0'-2')	MW-16 (4'-6')	MW-17 (0'-2')	MW-17 (6'-8')	TP-1 (0'-4')	TP-2 (4'-8')
Total PCBs	1	1	25	50	0.036	**3.76 J**	0.23	0.611	**30.8***	**12**	0.46 J	**1.69**	**1187* J**	**247***

Source: O'Brien and Gere, June 2013

PCBs	Soil Cleanup Objectives				August 2013																	
	Restricted Residential	Commercial	Industrial	Hazardous Waste Criteria	PNOV-1 (0-4 in)	PNOV-1 (4-16 in)	PNOV-2 (0-4 in)	PNOV-2 (4-16 in)	PNOV-3 (0-4 in)	PNOV-3 (4-16 in)	PNOV-4 (0-4 in)	PNOV-4 (4-16 in)	PNOV-5 (0-4 in)	PNOV-5 (4-16 in)	PNOV-6 (0-4 in)	PNOV-6 (4-16 in)	PNOV-7 (0-4 in)	PNOV-7 (4-16 in)	PNOV-8 (0-4 in)	PNOV-8 Dup (0-4 in)	PNOV-8 (4-16 in)	PNOU-8 Dup (4-16 in)
Total PCBs	1	1	25	50	**25.1***	**22.0**	**25.7***	**85.0**	**12.2**	**14.2**	**15.1**	**14.3**	**12.2**	**13.1**	**19.3**	**9.6**	**20.8**	**32.5***	**19.1**	**12.0**	**14.5**	NA

Source:O'Brien and Gere, September 2013

NOTES:

1. All results in mg/kg or ppm.
2. **Bold Red** Concentration exceeds Restricted Residential and Commercial Soil Cleanup Objectives.
3. **Bold Red** Concentration exceeds Hazardous Waste Criteria for PCBs (50 ppm).
4. * Concentration exceeds Restricted Residential, Commercial, and Industrial Soil Cleanup Objectives.

Table 1: Soil Analytical Results (PCBs)
May/June 2016 Sample Summary Table - Waste Cell Area

Boring #	Sample ID	Depth (in.)	DTW (in.)	Total PCBs (ppm)	Qual	Material Description
(16) 2-1	SS (16) 2-1	0-12		6.19	J	ASR & Sandy Soil
	2-1A	37-60		**173**	J	ASR & Sandy Soil
	2-1B	60-67		6.91		Gravel & Sandy Soil
	2-1C	74-84		15.3	J	Fill
	2-1D	86-100	▽90	1.92		ASR & Fill
	2-1E	100-120		0.0230	J	Solvay Waste
(16) 2-2	SS (16) 2-2	0-12		12.5		ASR & Sandy Soil
	2-2A	17-37		**96.6**		ASR & Sandy Soil
	2-2B	37-60		44.4		ASR & Sandy Soil
	2-2C	70-100	▽84	0.0314	J	Gravel & Fine Soil
	2-2D	100-120		0.0300	J	Fine Soil
	2-2E	120-134		0.0285	J	Gravel & Fine Soil
	2-2F	134-157		ND		Solvay Waste & Fill
	2-2G	157-170		ND		Solvay Waste
(16) 2-3	2-3A	40-60		21.4		ASR & Sandy Soil
	2-3B	70-80		0.0753	J	Gravel & Asphalt Residue
	2-3C	80-104	▽90	ND		Gravel & Fine Soil
	2-3D	104-120		ND		Fine Soil with Concretions
	2-3E	120-140		ND		Gravel & Fine Soil
	2-3F	140-160		ND		Fine Soil
	2-3G	160-180		0.0513	J	Solvay Waste
(16) 2-4	SS-2-4	0-12		18.3	(J)	ASR & Sandy Soil
	SS-2-4 DUP	0-12		22.3	(J)	ASR & Sandy Soil
	2-4A	35-50		38.1	J	ASR & Sandy Soil
	2-4B	50-60		0.309		Fine Soil with Concretions
	2-4C	95-110		13.8	J	ASR
	2-4D	110-120		0.980		Fine Soil
	2-4E	150-180	▽150	0.117	J	Fine Soil with Shells
	2-4F	180-186		0.207	J	Fine Soil with Shells
	2-4F Dup	180-186		0.263	J	Fine Soil with Shells
(16) 1-5	1-5A	24-42		7.94		Sand & Gravel
	1-5B	42-60		0.0232	J	Fine Gravel & Fine Soil
	1-5C	60-65		3.12	J	ASR & Sandy Soil
	1-5D	65-86		0.206	J	Coarse Gravel & Fine Soil
	1-5E	86-109	▽90	ND		Fine Gravel & Fine Soil
	1-5F	120-142		ND		Fine Soil
	1-5G	142-148		ND		Fine Soil
(16) 1-6	1-6A	16-37		3.23		ASR, Coarse Gravel, & Sandy Soil
	1-6B	37-53		ND		Fine-Med. Gravel & Sandy Soil
	1-6C	74-98		0.635		Med.-Coarse Gravel & Sandy Soil
	1-6D	98-106		0.294	J	Fine Soil
	1-6E	106-120		0.0757	J	Fine Soil
	1-6F	120-140	▽126	0.0526	J	Fine Soil
	1-6F Dup	120-140		ND		Fine Soil
	1-6G	140-160		ND		Fine Soil & Gravel
(16) 1-7	B-7 (0-12")	0-12		4.34		ASR & Sandy Soil
	1-7A	37-44		3.58		ASR & Sandy Soil
	1-7B	60-84		8.09	J	ASR & Fine Soil
	1-7C	84-108	▽96	0.0242	J	ASR & Fine Gravel
	1-7D	108-120		ND		ASR & Fine Gravel
	1-7E	120-144		0.190	J	ASR & Med.-Fine Gravel
	1-7F	144-168		ND		ASR
	1-7G	168-180		0.0250	J	Solvay Waste
(16) 1-8	1-8A	16-42		47.8		ASR, Med. Gravel, & Sandy Soil
	1-8B	42-60		18.1		Compacted Fine Soil & ASR
	1-8C	80-97	▽90	26.9	J	Med. Gravel, Fine Soil, & ASR
	1-8D	97-120		0.0907	J	Fine - Med. Gravel & ASR
	1-8E	120-136		0.366		Fine - Med. Gravel & ASR
	1-8F	136-140		ND		Fine - Med. Gravel & ASR
	1-8G	140-146		ND		ASR
(16) 1-9	1-9A	23-41		18.9	J	ASR & Med. Gravel
	1-9B	41-60		30.6	J	ASR & Sandy Soil
	1-9C	75-98	▽84	0.128	J	Fine - Med. Gravel & ASR
	1-9C Dup	75-98		0.0373	J	Fine - Med. Gravel & ASR
	1-9D	98-120		0.0534	J	Fine - Med. Gravel & Fill
	1-9E	120-133		0.0726	J	Fine - Med. Gravel & Fill
	1-9F	133-140		ND		Solvay Waste

Table 1: Soil Analytical Results (PCBs)
May/June 2016 Sample Summary Table - Waste Cell Area

Boring #	Sample ID	Depth (in.)	DTW (in.)	Total PCBs (ppm)	Qual	Material Description
(16) 2-10	B-10 (0-16")	0-16		11.2		ASR & Med. - Fine Gravel
	B-10 (16-24")	16-24		2.06		Fine - Med. Gravel & Fine Stone Dust
	B-10 (2.0-5.5')	24-66		28.3	J	ASR & Sandy Soil
	B-10 (5.5-6.5')	66-78	▽66	4.75		Fine - Coarse Sand, Gravel, Cinders
	B-10 (6.5-9.5')	78-114		0.157	J	Fine - Coarse Sand, Gravel, Cinders
	B-10 (9.5-10.5')	114-126		ND		Coarse Sand, fine - med. gravel
	B-10 (10.5-12')	126-144		ND		Solvay Waste
(16) 1-11	1-11A	0-12		3.87		ASR & Sandy Soil
	1-11B	24-28		7.9	(J)	ASR & Med. - Coarse Gravel
	1-11C	48-60		**304**		ASR & Fine Soil
	1-11D	72-96	▽96	0.245		Organic Debris & Fill
(16) 1-12	1-12A	5-16		6		ASR & Sandy Soil
	1-12B	40-44		5.1	(J)	Fine-Med. Soil & Fill
	1-12C	48-51		2.19	J	Fine-Med. Soil & Fill
	1-12D	88-92	▽96	1.5		ASR & Sandy Soil
(16) 2-13	2-13A	0-12		1.06	J	ASR & Sandy Soil
	2-13B	36-40		2.11		ASR & Sandy Soil
	2-13C	48-60		0.0346	U	ASR & Fine Soil
	2-13D	74-80	▽75	0.0461	U	ASR & Fine Soil
(16) 2-14	2-14A	0-12		0.364		Coarse Sand Only
	2-14B	45-48		12.1	J	ASR & Sandy Soil
	2-14C	48-60		14.9		ASR & Fine Soil
	2-14D	80-82	▽96	0.145	J	Sand & ASR
Surficial	BERM 1	6-12		10.3		ASR and Sandy Soil
	BERM 2	6-12		3.97		Sandy Soil
	BERM 3	6-12		3.70		Sandy Soil

Notes: Soil samples were collected between May 24 and June 9, 2016; Results reported in ppm (mg/kg).

Bold Red - Value exceeds 50 ppm

ND - Non-detect

DTW - Depth to groundwater

U - The compound was not detected at the indicated concentration.

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL.

(J) -Data qualified based on DUSR evaluation.

Table 2:
Soil Exceedances (Metals)
800 Hiawatha Blvd Site

Metals	Soil Cleanup Objectives			October 2007												
	Restricted Residential	Commercial	Industrial	BH-6 (0'-4')	BH-8 (7'-8')	BH-9 (0'-12')	BH-10 (4'-8')	BH-11 (0'-4')	BH-12 (0'-8')	TP-13 (4')	TP-14 (4')	BH-17 (4')	Lagoon 1 Center	Lagoon 2 N Access	Lagoon Surficial	Lagoon N Access (5 ')
Arsenic	16	16	16	**53.4***	**20.4***	--	**35.9***	**27.7***	--	**28.4***	--	--	**24***	**20.3***	--	**17.3***
Barium	400	400	10,000	**3360**	**759**	--	--	**2020**	**3080**	--	--	--	--	--	**461**	**849**
Cadmium	4.3	9.3	60	**96.5***	**4.52**	**23.7**	**9.92**	**79***	--	**22.5**	**5.33**	**7.38**	**5.98**	**22.5**	**18.4**	**9.03**
Chromium	110	400	800	**226**	--	**181**	--	**154**	**140**	**360**	**197**	**152**	--	**312**	**199**	**264**
Copper	270	270	10,000	---	---	---	---	---	---	---	---	---	---	---	---	---
Lead	400	1000	3,900	**2850**	--	**595**	**864**	**1180**	**534**	**2440**	--	**762**	--	**897**	**881**	**11300***
Mercury	0.81	2.8	5.7	**0.894**	--	--	--	**3.46**	--	**3.68**	--	**1.01**	--	**1.01**	--	--
Nickel	310	310	10,000	---	---	---	---	---	---	---	---	---	---	---	---	---
Zinc	10,000	10,000	10,000	---	---	---	---	---	---	---	---	---	---	---	---	---

Source: Passero Associates, October 2007 (The October 2007 Passero samples with "BH" and "TP" prefixes correspond to the "P" sample locations on Figure 5.)

METALS	Soil Cleanup Objectives			2008												
	Restricted Residential	Commercial	Industrial	B01 (0'-0.5')	B06 (0.5'-1.0')	B08 (0'-0.5')	B09 (4.5'-5.0')	B10 (0.5'-1.0')	B12 (0'-0.5')	B13 (0.5'-1.0')	B15 (0'-0.5')	B16 (0.5'-1.0')	B18 (0.5'-1.0')	B19 (0'-0.5')	B22 (0'-0.5')	B24 (1.5'-2.0')
Arsenic	16	16	16	---	---	---	**26.1***	---	---	---	---	---	---	---	---	---
Barium	400	400	10,000	---	---	---	**3010**	---	---	---	---	---	---	---	---	---
Cadmium	4.3	9.3	60	**2140***	---	---	**23.6**	---	---	---	---	**11**	---	---	---	---
Chromium (hex)	110	400	800	---	---	---	**208**	---	---	**185**	---	---	---	---	---	---
Copper	270	270	10,000	---	---	---	---	---	---	---	---	**5460**	---	---	---	---
Lead	400	1000	3,900	---	---	---	**1690**	---	---	---	---	---	---	**830**	---	---
Mercury	0.81	2.8	5.7	---	---	---	**6.4***	---	---	**2.38**	---	**2.2**	---	---	---	---
Nickel	310	310	10,000	---	---	---	---	---	---	---	---	---	---	---	---	---
Zinc	10,000	10,000	10,000	---	---	---	**21400***	---	---	---	---	---	---	---	---	---

METALS	Soil Cleanup Objectives			2008		2011					2010					
	Restricted Residential	Commercial	Industrial	B27 (0'-0.5')	B29 (0'-0.5')	B32 (0'-1')	B33 (0'-1')	B34 (0'-1')	B34 Dup (0'-1')	B35 (0'-1')	B37 (2' - 4')	B37 (5' - 7')	B38 (0'-1')	B39 (0'-1')	B41 (0'-1')	B43 (0'-1')
Arsenic	16	16	16	---	---	---	---	---	---	---	---	**16.1***	---	---	---	---
Barium	400	400	10,000	---	---	---	---	---	---	---	**481**	**564**	---	**406**	**660**	---
Cadmium	4.3	9.3	60	---	---	---	**22.3**	**14.8**	**14.7**	**26.1**	**4.34**	---	**4.94**	**22.9**	**27.4**	---
Chromium (hex)	110	400	800	---	---	---	---	---	---	**1092***	---	---	---	---	**120**	---
Copper	270	270	10,000	---	---	**472**	---	---	**726**	---	**506**	**473**	---	**513**	**819**	**1230**
Lead	400	1000	3,900	---	---	---	---	---	---	---	**639**	**650**	**873**	**1130**	**1370**	---
Mercury	0.81	2.8	5.7	---	---	---	**2.9**	**1.5**	**1.4**	**1.9**	---	---	**0.913**	**2.39**	**6.77***	---
Nickel	310	310	10,000	---	---	---	---	---	---	---	---	**320**	---	---	---	---
Zinc	10,000	10,000	10,000	---	---	---	---	---	---	---	---	---	---	---	**12800***	---

Table 2:
Soil Exceedances (Metals)
800 Hiawatha Blvd Site

METALS	Soil Cleanup Objectives			2010									2013	2011	
	Restricted Residential	Commercial	Industrial	B44 (0'-1')	B46 (0'-1')	B46 Dup (0'-1')	B48 (0'-1')	MW-10 (0'-2')	MW-10 (6'-8')	MW-12 (4'-6')	MW-12 (8'-10')	MW-13 (2'-4')	MW-16 (0'-2')	TP-1 (0'-4')	TP-2 (4'-8')
Arsenic	16	16	16	---	---	---	---	---	---	---	---	---	---	**19.5***	**22.2***
Barium	400	400	10,000	---	**417**	**466**	**430**	---	---	---	**765**	---	**552**	**1440**	**1860**
Cadmium	4.3	9.3	60	---	**32.2**	**32.7**	**7.80**	**10.1**	---	**10.6**	---	---	**24.4**	**125***	**104***
Chromium (hex)	110	400	800	---	---	---	---	---	---	---	---	---	**148**	---	**133**
Copper	270	270	10,000	**554**	**1070**	**735**	**1290**	**363**	**4840**	**278**	---	---	**632**	**1350**	**1090**
Lead	400	1000	3,900	---	**1050**	**1050**	**645**	---	**4650***	**662**	---	---	**931**	**1720**	**1880**
Mercury	0.81	2.8	5.7	---	**2.64**	**3.77**	**1.33**	**1.06**	**5.74***	---	**11.7***	**3.88**	**1.3**	**2.5**	**2.9**
Nickel	310	310	10,000	---	---	---	---	---	---	---	---	---	---	**351**	**419**
Zinc	10,000	10,000	10,000	---	---	---	---	---	---	---	---	---	---	**10400***	**32500***

Source: O'Brien and Gere, June 2013

Metals	Soil Cleanup Objectives			August 2013												
	Restricted Residential	Commercial	Industrial	PNOV-1 (0-4 in)	PNOV-1 (4-16 in)	PNOV-2 (0-4 in)	PNOV-2 (4-16 in)	PNOV-3 (0-4 in)	PNOV-3 (4-16 in)	PNOV-4 (0-4 in)	PNOV-4 (4-16 in)	PNOV-5 (0-4 in)	PNOV-5 (4-16 in)	PNOV-6 (0-4 in)	PNOV-6 (4-16 in)	PNOV-7 (0-4 in)
Arsenic	16	16	16	**19.0 ***	**16.8 ***	**26.3 ***	**26.5 ***	--	--	--	--	**46.5 ***	**20.1***	--	--	**22.3***
Barium	400	400	10,000	**1370** ^	**1700** ^	**843** ^	**1530**	**465**	-- ^	-- ^	**873**	**518** ^	**1330**^	**465**^	**488**^	**511**
Cadmium	4.3	9.3	60	**155.0 ***	**118.0 ***	**74.5***	**145.0 ***	**32.2**	**8.7**	**35.7**	**46.9**	**49.9**	**30.3**	**24.7**	**30.0**	**32.7**
Chromium (hex)	110	400	800	---	---	---	---	---	---	---	---	---	---	---	---	---
Copper	270	270	10,000	---	---	---	---	---	---	---	---	---	---	---	---	---
Lead	400	1000	3,900	**1640**	**1090**	**1100**	**1410**	**738**	--	**662**	**776**	**27700 ***	**1270**	**700**	**990**	**1070**
Mercury	0.81	2.8	5.7	---	---	---	---	---	---	---	---	---	---	---	---	---
Nickel	310	310	10,000	---	---	---	---	---	---	---	---	---	---	---	---	---
Zinc	10,000	10,000	10,000	---	---	---	---	---	---	---	---	---	---	---	---	---

Metals	Soil Cleanup Objectives			August 2013			
	Restricted Residential	Commercial	Industrial	PNOV-7 (4-16 in)	PNOV-8 (0-4 in)	PNOV-8 Dup (0-4 in)	PNOV-8 (4-16 in)
Arsenic	16	16	16	--	**44.4 ***	--	--
Barium	400	400	10,000	**836**	--	**411**	**626**
Cadmium	4.3	9.3	60	**104***	**26.7**	**22.9**	**36.4**
Chromium (hex)	110	400	800	---	---	---	---
Copper	270	270	10,000	---	---	---	---
Lead	400	1000	3,900	**930**	**602**	**627**	**1060**
Mercury	0.81	2.8	5.7	---	---	---	---
Nickel	310	310	10,000	---	---	---	---
Zinc	10,000	10,000	10,000	---	---	---	---

Source: O'Brien and Gere, September 2013

NOTES:

1. All results in mg/kg or ppm.
2. ^ - Instrument related quality control exceeded the control limits
3. **Bold Red** Concentration exceeds Restricted Residential Soil Cleanup Objectives.
4. **Bold Red** Concentration exceeds both Restricted Residential and Commercial Soil Cleanup Objectives.
5. * Concentration exceeds Restricted Residential, Commercial, and Industrial Soil Cleanup Objectives.
6. Only constituents with exceedances of Restricted Residential, Comercial, and/or Industrial Soil Cleanup Objectives are shown.
7. --- Concentration is below Soil Cleanup Objectives.

Table 3
Soil Exceedances (SVOCs)
800 Hiawatha Blvd Site

SVOCs	Soil Cleanup Objectives			October 2007						2008					2010			
	Restricted Residential	Commercial	Industrial	BH-6 (0'-4')	BH-10 (4'-8')	TP-14 (4')	TP-16	BH-17 (4')	Lagoon N Access (5 ')	B01 (0'-0.5')	B09 (4.5'-5.0')	B10 (0.5'-1.0')	B13 (0.5'-1.0')	B16 (0.5'-1.0')	B37 (2 '- 4')	B37 (5'-7')	B41 (0'-1')	B46 (0'-1')
Benzo (a) anthracene	1	5.6	11	**1.320**	**5.110**	**1.040**	**7.750**	**2.990**	**4.180**	**3 J**	--	--	--	--	**4.7**	**1.3 J**	**1.2 J**	**2.3 J**
Benzo (a) pyrene	1	1	1.1	--	**4.69***	--	**5.19***	**1.43***	**3.31***	***3.4 J**	***1.4 J**	--	--	--	***3.7**	***1.2 J**	--	***1.9 J**
Benzo (b) fluoranthene	1	5.6	11	--	**4.560**	--	**4.670**	**1.910**	**3.350**	**5.3**	--	**1.1 J**	**1.3 J**	**1.1 J**	**3.5**	**1.2 J**	**1.1 J**	**2.2 J**
Benzo (k) fluoranthene	3.9	56	110	--	--	--	**3.930**	--	--	--	--	--	--	--	--	--	--	--
Chrysene	3.9	56	110	--	**5.150**	--	**6.080**	--	**4.550**	--	--	--	--	--	--	--	--	--
Dibenz[a,h]anthracene	0.33	0.56	1.1	--	**1.13***	--	**0.638**	--	--	--	--	--	--	--	**0.6 J**	--	--	--
Indeno (1,2,3-cd) pyrene	0.5	5.6	11	--	**3.450**	--	**2.360**	**1.070**	--	**1.8 J**	**0.53 J**	--	--	--	--	**0.62 J**	**0.55 J**	**1.2 J**

SVOCs	Soil Cleanup Objectives			2010					
	Restricted Residential	Commercial	Industrial	B46 Dup (0'-1')	B48 (0'-1')	MW-10 (6'-8')	MW-11 (0'-2')	MW-11 (10'-12')	MW-13 (2'-4')
Benzo[a]anthracene	1	5.6	11	**2.2 J**	**2.6**	**3.5**	**5**	**1.2**	--
Benzo[a]pyrene	1	1	1.1	***2 J**	***2.3**	***3.1**	***3.8**	--	--
Benzo[b]fluoranthene	1	5.6	11	**1.8 J**	**2.7**	**3.7**	**4.5**	--	**1.1 J**
Benzo (k) fluoranthene	3.9	56	110	--	--	--	--	--	--
Chrysene	3.9	56	110	--	--	**5.5**		--	--
Dibenz[a,h]anthracene	0.33	0.56	1.1	--	**0.41 J**	**0.59 J**	**0.58 J**	--	--
Indeno[1,2,3-cd]pyrene	0.5	5.6	11	**1.1**	**1.2 J**	**1.7 J**	**1.9**	--	**0.55 J**

NOTES:

1. All results in mg/kg or ppm.
2. **Bold Red** Concentration exceeds Restricted Residential Soil Cleanup Objectives.
3. **Bold Red** Concentration exceeds both Restricted Residential and Commercial Soil Cleanup Objectives
4. * Concentration exceeds Restricted Residential, Commercial and Industrial Soil Cleanup Objectives.
5. Only Constituents with Exceedances of Restricted Residential, Comercial, and/or Industrial Soil Cleanup Objectives are Shown.
6. The October 2007 Passero samples with the "BH" and "TP" prefixes correspond to the "P" sample locations on Figure 6.
7. -- Concentration is below Soil Cleanup Objectives.

Table 4:
Soil Sampling Summary (VOCs, SVOCs, Metals, Glycols)
800 Hiawatha Boulevard Site

Sample Location	Date	Depth (feet bgs)	Analysis			
			VOCs	SVOCs	Metals	Glycols
BH-1	September 2007	0-4, 4-8	X			
BH-2	September 2007	0-4, 4-8	X			
BH-3	September 2007	0-4, 4-8	X			
BH-4	September 2007	0-4, 4-8	X			
BH-5	September 2007	0-4, 4-8	X			
BH-6	October 2007	0-4	X	X	X	
BH-8	October 2007	7-8	X	X	X	
BH-9	October 2007	0-12	X	X	X	
BH-10	October 2007	4-8	X	X	X	
BH-11	October 2007	0-4	X	X	X	
BH-12	October 2007	0-8	X	X	X	
BH-15	October 2007	7-8	X	X	X	
BH-17	October 2007	4	X	X	X	
BH-19	October 2007	7-8	X	X	X	
TP-13	October 2007	4	X	X	X	
TP-14	October 2007	4	X	X	X	
TP-16	October 2007	--	X	X	X	
Lagoon 1 Center	October 2007	Surficial	X	X	X	
Lagoon 2 N Access	October 2007	Surficial	X	X	X	
Lagoon Surficial	October 2007	Surficial	X	X	X	
Lagoon N Access 5'	October 2007	Surficial	X	X	X	
B1	2008	0-0.5	X	X	X	X
B6	2008	0.5-1	X	X	X	X
B8	2008	0-0.5	X	X	X	X
B9	2008	4.5-5	X	X	X	X
B10	2008	0.5-1	X	X	X	X
B12	2008	0-0.5	X	X	X	X
B13	2008	0.5-1	X	X	X	X
B15	2008	0-0.5	X	X	X	X
B16	2008	0.5-1	X	X	X	X
B18	2008	0.5-1	X	X	X	X
B19	2008	0-0.5	X	X	X	X
B22	2008	0-0.5	X	X	X	X
B24	2008	1.5-2	X	X	X	X
B27	2008	0-0.5	X	X	X	X
B29	2008	0-0.5	X	X	X	X
B31	2011	0-1			X	
B32	2011	0-1			X	
B33	2011	0-1			X	
B34	2011	0-1			X	
B34 Dup	2011	0-1			X	
B35	2011	0-1			X	
B36	2011	0-1			X	
B37	2010	0-2, 2-4, 5-7	X	X	X	X
B38	2010	0-1	X	X	X	X
B39	2010	0-1	X	X	X	X
B40	2010	0-1	X	X	X	X
B41	2010	0-1	X	X	X	X
B42	2010	0-1	X	X	X	X
B43	2010	0-1	X	X	X	X
B44	2010	0-1	X	X	X	X
B45	2010	0-1	X	X	X	X
B46	2010	0-1	X	X	X	X
B47	2010	0-1	X	X	X	X
B48	2010	0-1	X	X	X	X
MW-10	2010	0-2, 6-8	X	X	X	X
MW-11	2010	0-2, 10-12	X	X	X	X
MW-12	2010	4-6, 8-10	X	X	X	X
MW-13	2010	2-4	X	X	X	X
MW-16	2013	0-2, 4-6[1]	X		X	
MW-17	2013	0-2[1], 6-8	X			
TP1	2011	0-4			X	
TP2	2011	4-8			X	
PNOV-1	2013	0-1			X	
PNOV-2	2013	0-1			X	
PNOV-3	2013	0-1.33			X	
PNOV-4	2013	0-1.25			X	
PNOV-5	2013	0-1.33			X	
PNOV-6	2013	0-1.33			X	
PNOV-7	2013	0-1.17			X	
PNOV-8	2013	0-0.83			X	
PNOV-8 Dup	2013	0-0.83			X	

Notes:

1. [1] Not analyzed - VOCs, Metals
2. The "BH" and "TP" prefix samples (2007) correspond to the "P" sample locations on Figures 4, 5, and 6.

Table 5:
Monitoring Well Construction and Status
800 Hiawatha Blvd Site

Monitoring Well	Status[1]	Installation Date	Diameter (in)	Top of Casing[2]	Ground Elevation[3]	Screened Interval (ft bgs)	Depth to Water[4]	Installation Depth to Bottom (ft bgs)	Current Depth to Bottom[4]	Groundwater Elevation
MW-1	Broken	8/12/2008	2	375.72	373.72	5-15	-	15	-	-
MW-2	Missing	8/12/2008	2	377.34	375.34	5-15	-	15	-	-
MW-2A	Good	2/13/2013	2	377.09	375.02	5-15	8.2	15	17.15	368.89
MW-3	Missing	8/12/2008	2	375.831	373.83	5-15	-	15	-	-
MW3A	Missing	8/11/2011	2	371.58	371.76	5-15	-	15	-	-
MW-4	Missing	8/13/2008	2	376.63	374.63	5-15	-	15	-	-
MW-5	Missing	8/13/2008	2	376	374.00	5-15	-	15	-	-
MW-6	Good	8/14/2008	2	376.431	374.43	5-15	5.25	15	16.35	371.181
MW-7	Good	9/12/2008	2	376.26	374.26	3-13	4.35	13	15.20	371.91
MW-8	Missing	9/12/2008	2	377.79	375.79	3-13	-	13	-	-
MW-8A	Good	8/8/2011	2	376.43	373.90	3-13	10.26	13	15.82	366.17
MW-9	Good	9/12/2008	2	374.86	373.07	3-13	9.78	13	14.93	365.08
MW-10	Missing	6/22/2010	2	372.91	371.25	2-12	-	12	-	-
MW-10A	Existing	3/29/2011	2	371.99	370.65	2-12	NM	12	NM	NM
MW-11	Good	6/22/2010	2	373.52	371.69	3-13	5.14	13	14.80	368.38
MW-12	Damaged	6/23/2010	2	372.83	371.00	2-12	1.95	12	3.55	370.88
MW-13	Good	6/22/2010	2	374.06	371.98	2-12	5.37	12	14.10	368.69
MW-14	Good	9/29/2011	2	374.39	372.42	4-14	5.73	14	16.00	368.66
MW-15	Good	5/18/2012	2	370.59	368.65	2-12	5.51	12	13.90	365.08
MW-16	Good	2/13/2013	2	375.32	373.31	4-14	6.44	14	16.25	368.88
MW-17	Good	2/14/2013	2	374.1	372.56	4-14	3.16	14	16.02	370.94

NOTES:

[1] Current Status based on inventory on 4/15/16 and 5/25/16 (MW-12 only).

[2] Top of PVC well casing, reported in feet, as described in OBG Site Investigation Report, 2013.

[3] Measurement collected from concrete base of monitoring well and reported in feet.

[4] Measured on 4/15/16 and 5/25/16 (MW-12 only). Reported in feet below top of casing.

5. NM = Not Measured.

Table 6:
Groundwater Sampling Summary
800 Hiawatha Boulevard Site

Groundwater Sampling Event	Date	Wells	Constituents
Passero Associates	September 2007	GW-1, 2, 3, 4, 5	VOCs (8260), PCBs (8082)
	October 2007	GW-6, 7, 8, 9, 10, 11, 12, 15, 19, Retention Tank	VOCs (8260), SVOCs (8270), PCBs (8082)
Brown and Caldwell	August 2008	MW-1, 2, 3, 4, 5, 6	VOCs (8260), SVOCs (8270), PCBs (8082), Metals (6010), Glycols (8015)
	September 2008	MW-7, 8, 9	VOCs (8260), SVOCs (8270), PCBs (8082), Metals (6010)
AECOM	2010	MW-1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, PW-1	VOCs (8260), SVOCs (8270), PCBs (8082), Metals (6010), Glycols (8015)
	2012	MW-3, 6, 7, 8, 9, 10, 11, 13, 14, 15	VOCs (8260), SVOCs (8270), PCBs (8082), Metals (6010)
O'Brien & Gere	2013	MW-2A, 3A, 6, 7, 8A, 9, 10, 11, 13, 14, 15, 16, 17	VOCs (8260), PCBs (8082), Metals (6010)

Table 7:
Groundwater Exceedances (PCBs)
800 Hiawatha Blvd Site

PCBs	Groundwater Standard (Part 703)	September 28, 2007					October 11, 2007						
		GW-1	GW-2	GW-3	GW-4	GW-5	GW-6	GW-7	GW-8	GW-9	GW-10	GW-11	GW-15
Total PCBs	0.09	U	U	U	**4.11**	U	**78.0**	U	**26.0**	U	U	**25,000**	U

Source: Passero Associates, October 2007 (The Passero sample prefixes "GW" correspond to the "P" location on the Figure 7)

PCBs	Groundwater Standard (Part 703)	MW-1		MW-2			MW-3				MW-4			MW-5		MW-6				MW-7					MW-8				
		Aug 2008	Jul 2010	Aug 2008	Jul 2010	Feb 2013	Aug 2008	Jul 2010	Jul 2012	Feb 2013	Aug 2008	Jul 2010	Jul 2010	Aug 2008	Sep 2008	Aug 2008	Jul 2010	Jul 2012	Feb 2013	Sep 2008	Jul 2010	Jul 2012	Jul 2012 D	Feb 2013	Sep 2008	Sep 2008	Jul 2010	Jul 2012	Feb 2013
Total PCBs	0.09	U	U	U	U	U	U	U	**0.21** J	U	0.0003 J	U	U	U	U	U	U	U	U	0.0006	**0.73**	**1.4**	**0.72**	U	U	U	U	**4.8**	U

PCBs	Groundwater Standard (Part 703)	MW-9				MW-10			MW-11			MW-12	MW-13			MW-14			MW-15		MW-16	MW-17
		Sep 2008	Jul 2010	Jul 2012	Feb 2013	Jul 2010	Jul 2012	Feb 2013	Jul 2010	Jul 2012	Feb 2013	Jul 2010	Jul 2010	Jul 2012	Feb 2013	Jul 2012	Feb 2013	Feb 2013	Jul 2012	Feb 2013	Feb 2013	Feb 2013
Total PCBs	0.09	U	U	U	U	U	U	U	U	U	U	**4.97**	U	U	U	**0.49**	U	U	U	U	U	U

Source: O'Brien and Gere, June 2013

<u>NOTES:</u>

1. All Results in ug/L (ppb)
2. U: Result under detection limit.
3. **Bold Red** Concentration exceeds NYSDEC Part 703 Water Quailty Standard for Ambient Groundwater

<u>Qualifiers:</u>

J Below quantitation limit, estimated concentration

B Analyte found in associated blank.

Table 8:
Groundwater Exceedances (SVOCs)
800 Hiawatha Blvd Site

SVOCs	Groundwater	MW-1		MW-2			MW-3				MW-4			MW-5		MW-6				MW-7					MW-8				
	Standard (Part 703)	Aug 2008	Jul 2010	Aug	Jul 2010	Feb 2013	Aug 2008	Jul 2010	Jul 2012	Feb 2013	Aug 2008	Jul 2010	Jul 2010 D	Aug 2008	Sep 2008 D	Aug 2008	Jul 2010	Jul 2012	Feb 2013	Sep 2008	Jul 2010	Jul 2012	Jul 2012 D	Feb 2013	Sep 2008	Sep 2008 D	Jul 2010	Jul 2012	Feb 2013
Total Phenols	1	**5** J	U	**2** J	U	U	**62**	**13.9**	U	U	**22**	**9.68** J	**10.3** J	**9**	**15.5**	**21**	**7.6** J	U	U	U	U	U	U	U	0.8	0.4	U	U	U
2,4-Dinitrotoluene	5	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2,6-Dinitrotoluene	5	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Chloronaphthalene	5	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Nitroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	**10**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
3,3'-Dichlorobenzidine	5	U	U	U	U	U	U	UJ	U	U	U	U	U	**5**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
3-Nitroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	**10**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Chloroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Nitroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	**10**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Bis(2-chloroethoxy)methane	5	U	UJ	U	UJ	U	U	U	U	U	U	UJ	UJ	**5**	U	U	UJ	U	U	U	UJ	U	U	U	U	U	UJ	U	U
Bis(2-chloroethyl)ether	1	U	UJ	U	UJ	U	U	U	U	U	U	UJ	UJ	**5**	U	U	UJ	U	U	U	UJ	U	U	U	U	U	UJ	U	U
Bis(2-ethylhexyl) phthalate	5	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachlorobenzene	0.04	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachlorobutadiene	0.5	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachlorocyclopentadiene	5	U	U	U	U	U	U	UJ	U	U	U	U	U	**5**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Nitrobenzene	0.4	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U

SVOCs	Groundwater	MW-9				MW-10			MW-11			MW-12	MW-13			MW-14			MW-15		MW-16	MW-17
	Standard (Part 703)	Sep 2008	Jul 2010	Jul	Feb 2013	Jul 2010	Jul 2012	Feb 2013	Jul 2010	Jul 2012	Feb 2013	Jul 2010	Jul 2010	Jul 2012	Feb 2013	Jul 2012	Feb 2013	Feb 2013	Jul 2012	Feb 2013	Feb 2013	Feb 2013
Total Phenols	1	**3** J	U	U	U	**41**	U	U	**8.4** J	U	U	**35.3**	U	U	U	U	U	U	U	U	U	U
2,4-Dinitrotoluene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2,6-Dinitrotoluene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Chloronaphthalene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Nitroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
3,3'-Dichlorobenzidine	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
3-Nitroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Chloroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Nitroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Bis(2-chloroethoxy)methane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Bis(2-chloroethyl)ether	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Bis(2-ethylhexyl) phthalate	5	U	U	U	U	U	U	U	U	U	U	4.5 J	U	U	U	U	U	U	U	U	U	U
Hexachlorobenzene	0.04	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachlorobutadiene	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachlorocyclopentadiene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Nitrobenzene	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U

Source: O'Brien and Gere, June 2013

NOTES:

1. All Results in ug/L (ppb)
2. U: Result under detection limit.
3. **Bold Red** Concentration exceeds NYSDEC Part 703 Water Quailty Standard for Ambient Groundwater

Qualifiers:

J Below quantitation limit, estimated concentration
B Analyte found in associated blank.

Table 9:
Groundwater Exceedances (Metals)

Metals	Groundwater Standard (Part 703)	MW-1		MW-2			MW-3				MW-4			MW-5	
		Aug 2008	Jul 2010	Aug 2008	Jul 2010	Feb 2013	Aug 2008	Jul 2010	Jul 2012	Feb 2013	Aug 2008	Jul 2010	Jul 2010 D	Aug 2008	Sep 2008 D
Antimony	0.003	U	U	U	U	U	U	U	U	U	U	U	U	**0.0055**	**0.0055**
Arsenic	0.025	0.008	U	U	U	U	0.0041 B	U	**0.026**	0.0084 J	0.0049 B	U	U	0.0037	0.0037
Barium	1	**1.98**	**1.09**	0.616	**1.67**	**1.9**	**2.39**	**1.94**	0.94 B	0.64	**1.29**	0.223	0.231	**1.7**	**1.7**
Cadmium	0.005	U	U	U	U	U	U	U	U	U	U	U	U	0.0027	0.0027
Copper	0.2	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Iron	0.3	**1.19**	**1.99** J	**1.64**	**9.22** J	**8.6**	**0.333**	**1.13** J	0.12 B	0.074	**0.355**	0.035 J	0.023 J	**16.4**	**16.6**
Lead	0.025	0.0052	U	0.0084	0.0036	U	0.018	U	0.0033	U	0.0051	U	U	0.0067	0.0081
Manganese	0.3	0.0262	**0.315**	0.0204	0.0501	0.033	0.0076	0.0775	0.0026 J	0.0047	0.0086	0.0003 J	0.0002 J	0.138	0.139
Mercury	0.0007	U	0.0001 J	U	0.0001 J	U	**0.0017**	0.0002	U	U	U	U	U	0.00012	0.00012
Selenium	0.01	U	U	U	U	U	U	U	U	U	U	U	U	0.0061	0.0061
Sodium	20	**432**	**180** J	**189**	**228** J	**208**	**328**	**229** J	**353** B	**564**	**174**	**225** J	**234** J	**300**	**312**

Metals	Groundwater Standard (Part 703)	MW-6				MW-7					MW-8				
		Aug 2008	Jul 2010	Jul 2012	Feb 2013	Sep 2008	Jul 2010	Jul 2012	Jul 2012 D	Feb 2013	Sep 2008	Sep 2008 D	Jul 2010	Jul 2012	Feb 2013
Antimony	0.003	U	**0.02**	U	U	U	U	U	U	U	**0.0055**	**0.0055**	U	U	U
Arsenic	0.025	U	0.01	U	U	U	U	U	U	U	U	U	U	U	U
Barium	1	0.169	0.245	0.18 B	0.22	**1.29**	**3.15**	0.063 B	0.62	0.7	0.0646	0.0657	0.0408	0.038 B	0.058
Cadmium	0.005	U	U	U	U	0.0012	**0.0064**	0.0047	0.0044	0.00	0.00033	0.00033	U	U	U
Copper	0.2	0.002 B	0.0044 J	U	0.0069 J	0.0791	**0.243**	**0.24**	**0.21**	0.027	0.0013	0.0013	0.0029 J	U	0.0046 J
Iron	0.3	0.19	U	0.21 B	0.022 J	**9.8**	**16.9** J	**6.3** B	**6.4**	**2.5**	**1.69**	**1.63**	0.096 J	0.06 B	**0.71**
Lead	0.025	U	U	0.0065	U	**0.0479**	**0.239**	**0.15**	**0.14**	0.022	0.0029	0.0029	U	U	U
Manganese	0.3	0.0115	0.0008 J	0.0028	0.0004 J	0.211	0.239	0.086	0.085	0.065	0.188	0.183	0.0264	0.016 B	0.22
Mercury	0.0007	**0.001**	0.0003	**0.00085**	**0.00081**	**0.00148** B	**0.0007**	0.00015 J	0.00014 J	U	0.00012	0.00012	0.0001 J	U	U
Selenium	0.01	U	U	U	U	U	U	U	U	U	0.0061	0.0061	U	U	U
Sodium	20	**262**	**214 J**	**312**	**310**	**126**	**209** J	**124**	**127**	**96.7**	**182**	**190**	**203** J	**201** B	**204**

Metals	Groundwater Standard (Part 703)	MW-9				MW-10			MW-11			MW-12	MW-13		
		Sep 2008	Jul 2010	Jul 2012	Feb 2013	Jul 2010	Jul 2012	Feb 2013	Jul 2010	Jul 2012	Feb 2013	Jul 2010	Jul 2010	Jul 2012	Feb 2013
Antimony	0.003	U	U	U	U	**0.0076** J	U	U	U	U	U	U	U	U	U
Arsenic	0.025	U	U	U	U	0.0154	U	U	U	U	U	0.01 J	U	U	U
Barium	1	0.0936	0.108	0.088 B	0.087	**1.7600**	0.89 B	**1.3**	0.576	0.07 B	0.61	**1.23**	0.0496	U	0.063
Cadmium	0.005	U	U	U	U	U	0.0006 J	U	U	U	U	0.0016	U	U	U
Copper	0.2	U	0.0024 J	U	0.0035 J	0.0032 J	0.0018 J	0.0056 J	0.0047 J	U	0.0025 J	0.0354 J	0.0045	U	0.0028 J
Iron	0.3	0.0736	0.042 J	0.071 B	0.044 J	0.0700 J	**2.1** B	**3**	**2.03** J	0.24 B	**1.7**	**2.5000** J	0.246 J	U	0.14
Lead	0.025	U	U	U	U	0.0072	U	0.0086	0.0115	0.0039 J	U	**0.1020**	0.0049 J	U	U
Manganese	0.3	0.0036 B	0.0009 J	0.00094 JB	U	0.0035	0.053 B	0.041	0.0707	0.02 B	0.11	0.0258	0.0209	U	0.038
Mercury	0.0007	**0.00467**	**0.0009**	0.00036	0.0006	0.0001 J	U	U	U	U	U	0.0002	0.0006	U	U
Selenium	0.01	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Sodium	20	**246**	**264** J	**214** B	**287**	**696** J	**480** B	**474**	**287** J	**288** B	**243**	**549** J	**251** J	U	**200**

Metals	Groundwater Standard (Part 703)	MW-14			MW-15		MW-16	MW-17
		Jul 2012	Feb 2013	Feb 2013 D	Jul 2012	Feb 2013	Feb 2013	Feb 2013
Antimony	0.003	U	U	U	U	U	U	U
Arsenic	0.025	U	U	U	U	U	0.018	U
Barium	1	U	0.05	0.05	0.15 B	0.083	**2.6**	0.11
Cadmium	0.005	U	U	U	U	U	0.0013	0.0005 J
Copper	0.2	U	0.0049 J	0.0032 J	U	0.0098 J	0.012	0.0097 J
Iron	0.3	U	U	U	U	0.07	**5.6**	**1.3**
Lead	0.025	U	U	U	U	U	**0.041**	0.0087
Manganese	0.3	U	U	U	0.00087 JB	0.03	0.17	**0.47**
Mercury	0.0007	U	U	U	0.00067	U	U	U
Selenium	0.01	U	U	**0.01** J	U	U	U	U
Sodium	20	U	**217**	**222**	**430** B	**187**	**380**	**232**

Source: O'Brien and Gere, June 2013

NOTES:

1. All Results in mg/L (ppm)
2. U: Result under detection limit.
3. **Bold Red** Concentration exceeds NYSDEC Part 703 Water Quilty Standard for Ambient Groundwater

Qualifiers:

J Below quantitation limit, estimated concentration

B Analyte found in associated blank.

Table 10:
Groundwater Exceedances (VOCs)
800 Hiawatha Blvd Site

VOCs	Groundwater Standard (Part 703)	Sep 2007				
		GW-1	GW-2	GW-3	GW-4	GW-5
1,1,2-Trichloroethane	1	U	U	U	U	U
1,2-Dibromo-3-chloropropane	0.04	U	U	U	U	U
1,2-Dichloroethane	0.6	U	U	U	U	U
1,2-Dichloropropane	1	U	U	U	U	U
Benzene	1	U	U	U	**2.01**	U
Chloroethane	5	U	U	U	U	U
Total Dichloropropene	0.4	U	U	U	U	U
Ethylbenzene	5	U	U	U	U	U
Isopropylbenzene	5	U	U	U	U	U
Methyl tert-Butyl Ether	10	U	U	U	U	U
Methylene Chloride	5	U	U	U	U	U
Styrene	5	U	U	U	U	U
Toluene	5	U	U	U	U	U
Trichlorofluoromethane	5	U	U	U	4.99	U
Vinyl chloride	2	U	U	U	U	U
Xylenes, total	5	U	U	U	U	U

VOCs	Groundwater Standard (Part 703)	Oct 2007								
		GW-6	GW-7	GW-8	GW-9	GW-10	GW-11	GW-12	GW-15	GW-19
1,1,2-Trichloroethane	1	U	U	U	U	U	U	U	U	U
1,2-Dibromo-3-chloropropane	0.04	U	U	U	U	U	U	U	U	U
1,2-Dichloroethane	0.6	U	U	U	U	U	U	U	U	U
1,2-Dichloropropane	1	U	U	U	U	U	U	U	U	U
Total Dichloropropene	0.4	U	U	U	U	U	U	U	U	U
Benzene	1	U	U	**4.98**	U	U	U	U	U	**44.4**
Chloroethane	5	U	U	U	U	U	**524**	U	U	U
Ethylbenzene	5	U	U	U	U	U	U	U	U	**17.7**
Isopropylbenzene	5	U	U	U	U	U	U	U	U	U
Methyl tert-Butyl Ether	10	U	2.67	5.35	2.5	U	U	5.36	3.71	86.9
Methylene Chloride	5	U	U	U	U	U	U	U	U	U
Styrene	5	U	U	U	U	U	U	U	U	U
Toluene	5	U	U	**8.32**	U	U	U	U	U	**220**
Trichlorofluoromethane	5	U	U	**19.6**	U	4.99	U	U	U	U
Vinyl chloride	2	U	U	U	U	U	U	U	U	U
Xylenes, total	5	U	U	U	U	U	U	U	U	**88**

Source: Passero Associates, October 2007 (The Passero sample prefixes "GW" correspond to the "P" location on the Figure 8)

VOCs	Groundwater Standard (Part 703)	MW-1		MW-2			MW-3				MW-4			MW-5		MW-6			
		Aug 2008	Jul 2010	Aug 2008	Jul 2010	Feb 2013	Aug 2008	Jul 2010	Jul 2012	Feb 2013	Aug 2008	Jul 2010	Jul 2010 D	Aug 2008	Sep 2008 D	Aug 2008	Jul 2010	Jul 2012	Feb 2013
1,1,2-Trichloroethane	1	U	U	U	UJ	U	U	U	U	U	U	U	U	**1**	U	U	U	U	U
1,2-Dibromo-3-chloropropane	0.04	U	UJ	U	UJ	U	U	UJ	U	U	U	UJ	UJ	**1**	U	U	UJ	U	U
1,2-Dichloroethane	0.6	U	U	U	U	U	**0.94** J	U	U	U	U	U	U	**1**	U	U	U	U	U
1,2-Dichloropropane	1	U	U	U	U	U	U	U	U	U	U	U	U	**1**	U	U	U	U	U
Total Dichloropropene	0.4	U	U	U	U	U	U	U	U	U	U	U	U	**2**	U	U	U	U	U
Benzene	1	**3.9**	0.85 J	**1.7**	0.58 J	U	**12**	**90**	**130**	**570**	**2.6** J	**2.0**	**1.9**	0.7 J	0.68 J	U	**2.3**	**8.1** J	**7.8**
Chloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
Ethylbenzene	5	0.92 J	0.98 J	U	U	U	**12**	**5.0**	**150**	**250**	**6**	2.6	2.6	0.59 J	0.57 J	1.8	U	U	U
Isopropylbenzene	5	U	U	U	U	U	U	U	U	**12**	U	0.85 J	0.86 J	1	U	U	U	U	U
Methyl tert-Butyl Ether	10	**110**	1.7	**24**	**17**	**14**	**80**	**13**	**67**	**93**	**24**	**26**	**27**	**25**	**25**	**32**	9.5	**21**	**23**
Methylene Chloride	5	U	U	U	U	U	U	**52**	U	U	U	U	U	1	U	U	U	U	U
Styrene	5	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
Toluene	5	1.2	U	U	U	U	**7.3**	**71**	**500**	**610**	**16**	**11**	**11**	1.1	0.1 J	4.7	1.4	U	4.9 J
Trichlorofluoromethane	5	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
Vinyl chloride	2	1.1	U	U	U	U	**2.7**	1.4	U	**18**	**10**	**9.5**	**10**	1	U	0.98 J	U	U	U
Xylenes, total	5	4.9	U	U	U	U	**56**	**29**	**680**	**930**	**33**	**15**	**15**	3.9	3.7	**7.4**	2.7	U	**5.6** J

Table 10:
Groundwater Exceedances (VOCs)
800 Hiawatha Blvd Site

VOCs	Groundwater	MW-7					MW-8					MW-9				MW-10			MW-11
	Standard (Part 703)	Sep 2008	Jul 2010	Jul 2012	Jul 2012 D	Feb 2013	Sep 2008	Sep 2008 D	Jul 2010	Jul 2012	Feb 2013	Sep 2008	Jul 2010	Jul 2012	Feb 2013	Jul 2010	Jul 2012	Feb 2013	Jul 2010
1,1,2-Trichloroethane	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	UJ	U	U
1,2-Dibromo-3-chloropropane	0.04	U	UJ	U	U	U	U	U	UJ	U	U	U	UJ	U	U	UJ	U	U	UJ
1,2-Dichloroethane	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichloropropane	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Total Dichloropropene	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzene	1	U	0.79 J	U	U	U	U	U	U	U	U	U	U	U	U	**7.5**	**2.9** J	U	0.96 J
Chloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Ethylbenzene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	**6.4**	U	U	U
Isopropylbenzene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Methyl tert-Butyl Ether	10	U	0.58 J	U	U	0.33 J	1.8 J	1.8 J	2.6	2.1 J	2.5	1.2 J	2.5	1.7 J	2.8	**38**	**24**	**18** J	3.8
Methylene Chloride	5	**8.2** B	U	U	U	U	**5.4**	**9.1** B	U	U	U	**5.4** B	U	U	U	U	U	U	U
Styrene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	2.9	U	U	U
Toluene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	**12**	3.4 J	U	U
Trichlorofluoromethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Vinyl chloride	2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Xylenes, total	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	**20**	4.1 J	U	U

VOCs	Groundwater	MW-11		MW-12	MW-13			MW-14			MW-15		MW-16	MW-17
	Standard (Part 703)	Jul 2012	Feb 2013	Jul 2010	Jul 2010	Jul 2012	Feb 2013	Jul 2012	Feb 2013	Feb 2013 D	Jul 2012	Feb 2013	Feb 2013	Feb 2013
1,1,2-Trichloroethane	1	U	U	U	UJ	UJ	U	U	U	U	U	U	U	U
1,2-Dibromo-3-chloropropane	0.04	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichloroethane	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichloropropane	1	U	U	U	U	U	U	U	U	U	U	U	U	U
Total Dichloropropene	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzene	1	U	U	**13**	0.61 J	U	U	U	**1.2**	**1.2**	U	U	U	0.72 J
Chloroethane	5	U	U	U	0.61 J	U	U	U	U	U	U	U	U	U
Ethylbenzene	5	U	U	**13**	U	U	U	U	U	U	U	U	U	U
Isopropylbenzene	5	U	U	U	U	U	U	U	U	U	U	U	U	U
Methyl tert-Butyl Ether	10	**11**	2.7 J	**22**	9.6	4.3 J	4.3	**12**	**13**	**13**	U	U	**64**	0.62 J
Methylene Chloride	5	U	U	0.99 J	U	U	U	U	U	U	U	U	U	U
Styrene	5	U	U	**9.0**	U	U	U	U	U	U	U	U	U	U
Toluene	5	U	U	**46**	U	U	U	U	U	U	U	U	U	U
Trichlorofluoromethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U
Vinyl chloride	2	U	U	**4.9**	U	U	U	U	1.4	1.4	U	U	U	U
Xylenes, total	5	U	U	**59**	U	U	U	U	U	U	U	U	U	2.1

Source: O'Brien and Gere, June 2013

NOTES:

1. All Results in ug/L (ppb)
2. U: Result under detection limit.
3. **Bold Red** Concentration exceeds NYSDEC Part 703 Water Quailty Standard for Ambient Groundwater

Qualifiers:

J Below quantitation limit, estimated concentration

B Analyte found in associated blank.

Table 11: Proposed Boring and Soil Samples

Sample Locations	Depth (ft. bgs)	Samples
B-1, B-2, B-4, MW-18	10 or base of fill	PCBs; 0-1’, 1-2’, 2’ increments thereafter
B-3	10 or base of fill	PCBs: 0-1, 1-2, 2' increments thereafter Metals: 0-1', one subsurface based on field observations
B-5	8 or base of fill	PCBs; 0-1’, 1-2’, 2-4’, deeper (TBD) (see note 1) Metals: 0-1’, one subsurface based on field observations
TP-1	4 or base of fill	PCBs: 1-2’, 2-4’, deeper (TBD) Metals: one subsurface based on field observations
B-6	6	PCBs; 0-1’, 1-2’, 2-4’, 4-6’
B-7	8 or base of fill	PCBs; 0-1’, 1-2’, 2-4’, deeper (TBD) Metals: 0-1’, one subsurface based on field observations
B-8, B-9	8 or base of fill	PCBs; 1-2’, 2-4’, deeper (TBD)
MW-12R	12	PCBs; 0-1’, 1-2’, 2-4’ Metals; 0-1’, TCLP Mercury 8-10'
B-10, B-11	8 or base of fill	PCBs; 1-2’, 2-4’, deeper (TBD) Metals; one subsurface based on field observations, (B-11, TCLP TBD)
B-12	8 or base of fill	PCBs; 0-1’, 1-2’, 2-4’, deeper (TBD) Metals; 0-1’, one subsurface based on field observations (TCLP TBD)
B-13, B-14	8 or base of fill	PCBs; 0-1’, 1-2’, 2-4’, deeper (TBD)
B-15	8 or base of fill	PCBs; 1-2’, 2-4’, deeper (TBD)
B-16	8 or base of fill	PCBs; 0-1’, 1-2’, 2-4’, deeper (TBD) Metals; one subsurface based on field observations
B-17	8 or base of fill	PCBs; 0-1’, 1-2’, 2-4’, deeper (TBD)
TP-2	4 or base of fill	PCBs; 0-1’, 1-2’, 2-4’, deeper (TBD) Metals; 0-1’, one subsurface based on field observations
TP-3	4 or base of fill	PCBs; 2-4’ Metals: one subsurface based on field observations (TCLP TBD)
SS-1	0.5	PCBs and metals 0-2 inches
B-18	8 or base of fill	PCBs; 1-2’, 2-4’ Metals; one subsurface based on field observations
B-19	8 or base of fill	PCBs; 2-4' Metals; one subsurface based on field observations
TP-4	4 or base of fill	PCBs; 1-2’ Metals; one subsurface based on field observations
B-21	10	Lead and Mercury; 4-6’, 6-8’, 8-10’ (TCLP TBD)
B-20, B-29	8 or base of fill	PCBs; 0-1’, 1-2’, 2-4’ deeper (TBD) Metals; 0-1’, one subsurface based on field observations
TP-5	4 or base of fill	PCBs; 0-1’, 1-2’, 2-4’ Metals; 0-1’, one subsurface based on field observations VOCs, SVOCs; 0-1'
SS-2 to SS-5	0.5	PCBs, metals; 0-2 inches VOCs, SVOCs; 2-6 inches
MW-3R	12	VOCs; top of groundwater table or zone with elevated PID readings
B-28	3	PCBs; 0-1', 1-3' Metals; 0-1', 1-3' (TCLP TBD)
B-22 through B-27, B-30, B-31	8 or base of fill	PCBs; 0-1', 1-2', 2-4', deeper (TBD) VOCs, SVOCs; 0-1' (deeper intervals if elevated PID readings or oil staining) Metals: 0-1', one subsurface based on field observations

Notes:

1. At locations where deeper PCB samples are (TBD), the soil cores will be segmented into 2 ft. intervals from depths of 4 ft. to the bottom of the boring. If PCBs are less than 10 ppm for two consecutive shallower depth intervals, the deeper depths will not be analyzed for PCBs unless ASR is observed.
2. At locations where VOC/SVOC testing is not specifically listed, VOCs/SVOCs will be tested on intervals if elevated PID readings or oil staining is observed.
3. Borings and test pits will extend to the listed depth or base of fill, whichever is deeper.
4. Test pits will not extent into the saturated zone.
5. All sample locations will have the prefix (17) to distinguish them from historical locations: e.g. proposed boring B-1 will be designated as (17) B-1.
6. Proposed sample locations near the buildings may be adjusted based upon field observations.
7. TCLP analysis on select intervals listed above as (TBD) may also be performed pending the results of the "totals" metals analysis.
8. Depending upon the site development plans, additional surface samples and testing depths (6"-12") may be necessary.

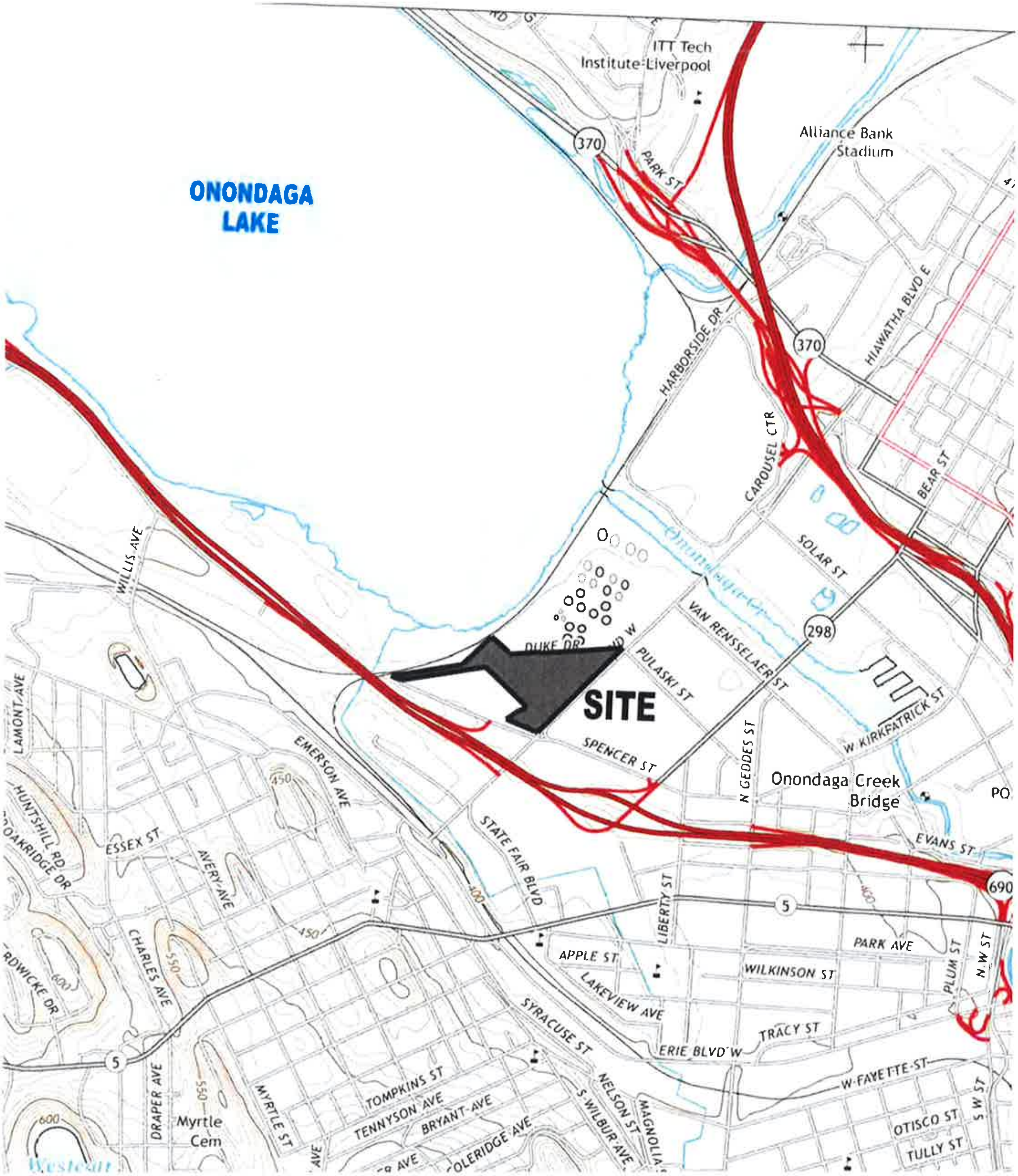
Table 12:
Proposed Monitoring Wells/Groundwater Sampling
800 Hiawatha Blvd Site

Sample Location	Samples
MW-2A	metals
MW-3R[2]	metals, PCBs, VOCs
MW-6	metals, PCBs, VOCs
MW-7	metals, PCBs, VOCs
MW-9	metals, PCBs, VOCs
MW-12R[2]	metals, PCBs, VOCs
MW-13	metals, PCBs, VOCs
MW-16	metals
MW-18[2]	metals, PCBs, VOCs

Notes:

1. MW-8A and 15 were sampled in May 2016 and are not proposed for re-sampling.
2. Indicates a new or replacement well

FIGURES



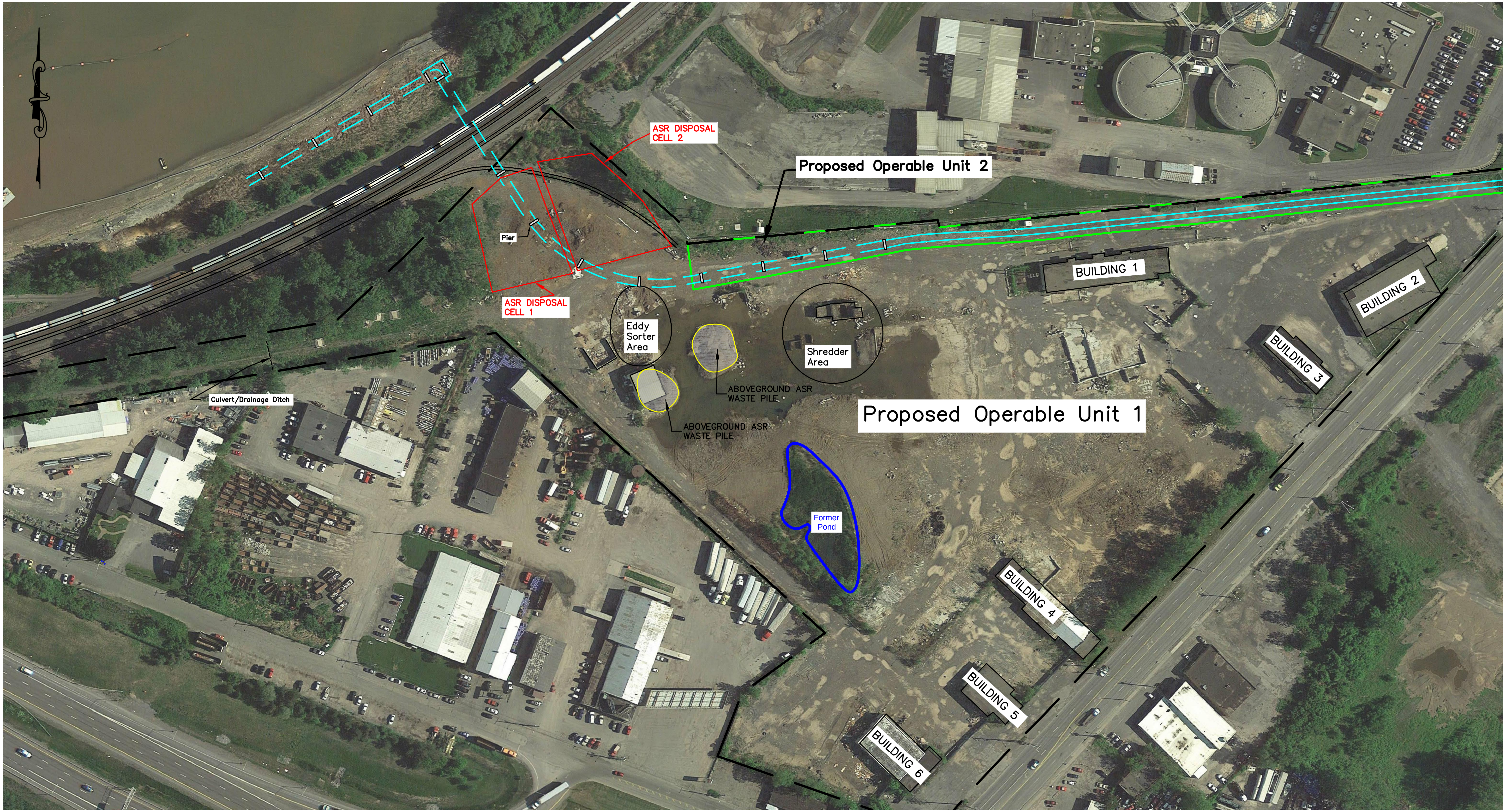
REF.: USGS - SYRACUSE WEST (NY) QUAD., 2013

SPECTRA
ENGINEERING, ARCHITECTURE, & SURVEYING, P.C.
19 British American Blvd
Latham, N.Y. 12110

Site Location Map
800 Hiawatha Boulevard Site
Syracuse, New York

CITY OF SYRACUSE | ONONDAGA CO., NY

PROJ. #: 16140	DATE: 4/29/16	SCALE: NTS	DWG. NO. 16140B	FIGURE 1



LEGEND

- APPROXIMATE PROPERTY BOUNDARY
- ELEVATED PORTION OF WALKING TRAIL (PROPOSED)
- GROUND LEVEL PORTION OF WALKING TRAIL (PROPOSED)
- BRIDGE PIERS
- ABOVEGROUND ASR WASTE STORAGE PILES
- PROPOSED OPERABLE UNIT BOUNDARIES

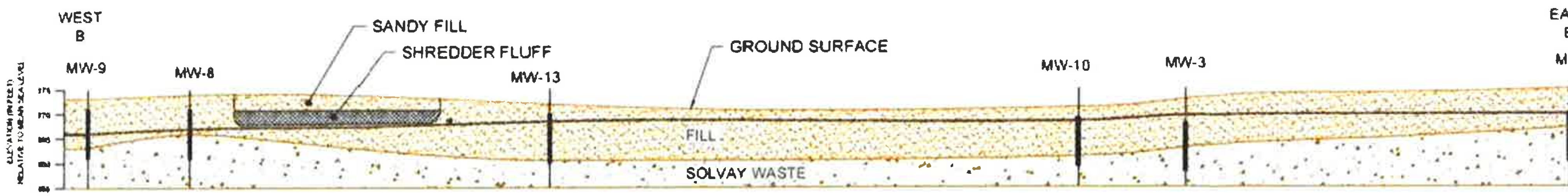
0 75' 150'
1"=150'

SPECTRA
ENGINEERING, ARCHITECTURE, & SURVEYING, P.C.
19 British American Blvd
Latham, N.Y. 12110

Aerial Site Map
800 Hiawatha Blvd
Syracuse, New York

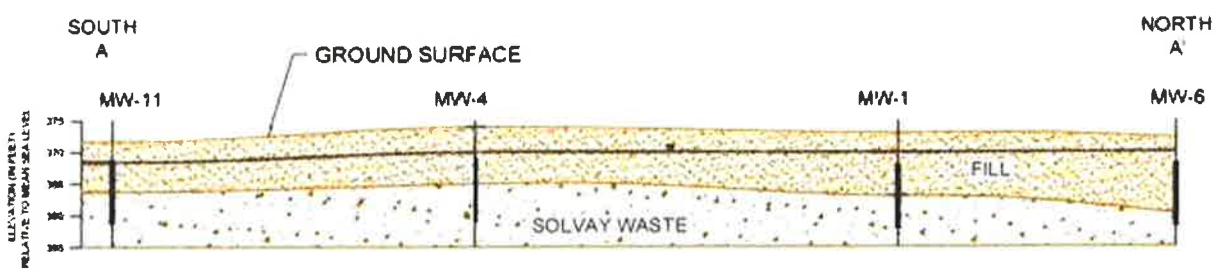
CITY OF SYRACUSE | ONONDAGA CO., NY

PROJ. No.: 16140	DATE: 10/10/17	SCALE: 1"=150'	DWG. NO. RRWP	FIGURE 2



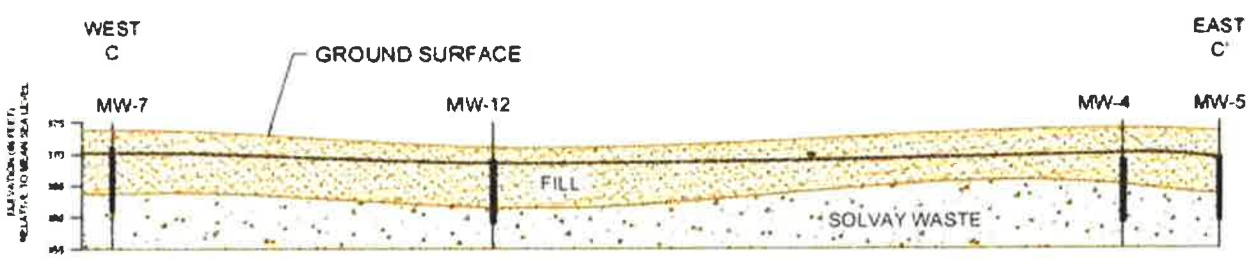
SECTION B–B'

SCALE: HORIZ. 1"=120'



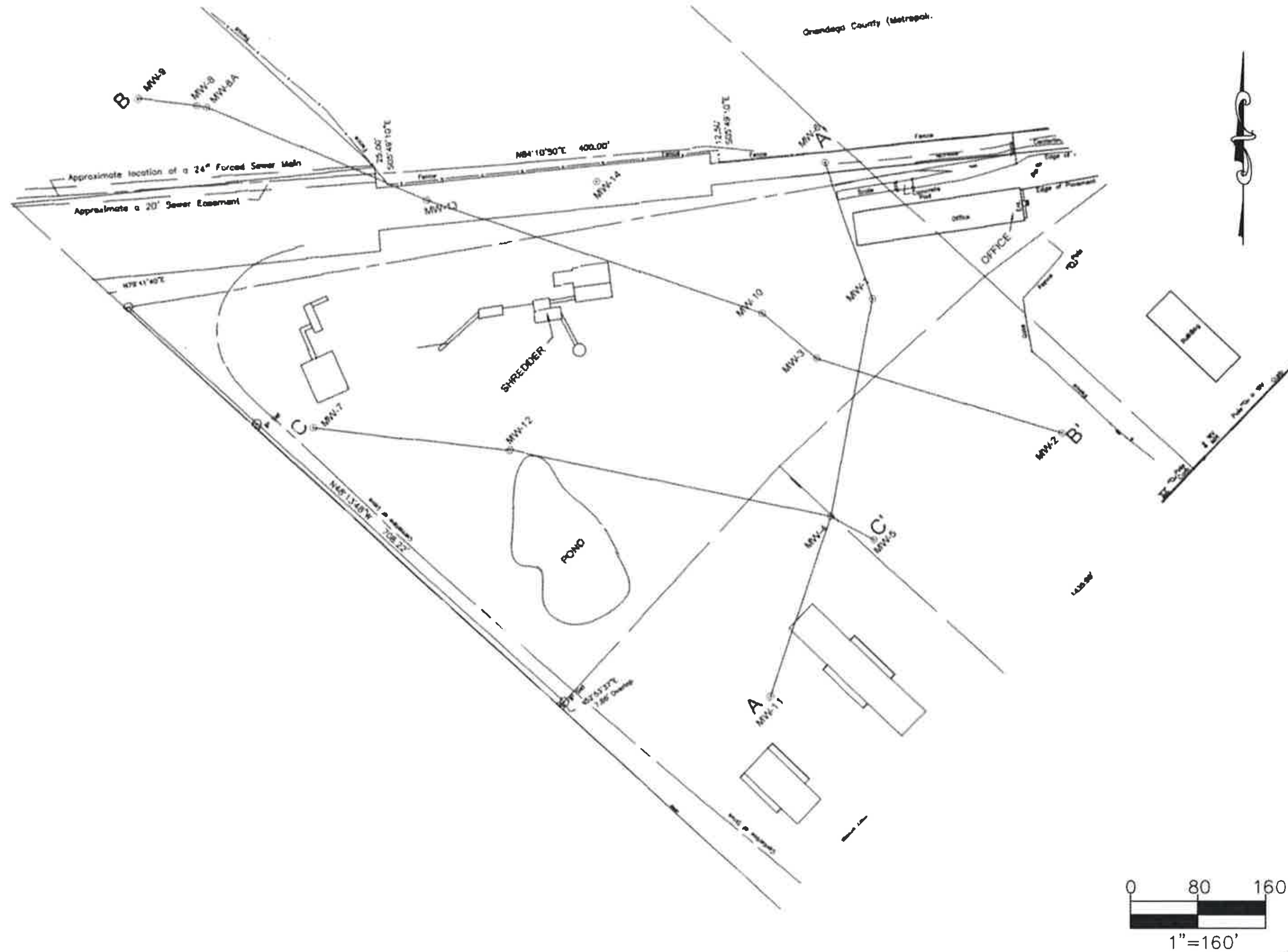
SECTION A–A'

SCALE: HORIZ. 1"=120'



SECTION C–C'

SCALE: HORIZ. 1"=120'



LEGEND

MW-12 ⊙ ROTH STEEL MONITORING WELL LOCATIONS

FILL – GRAVEL, SAND, SILT

SOLVAY WASTE

SHREDDER FLUFF (APPROXIMATE LIMITS)

GROUNDWATER TABLE (7/1/10)

Notes:

1. Cross sections and original site plan from O'Brien and Gere (2013).

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Cross Sections
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PROJ. No.: 16140	DATE: 6/1/16	SCALE: As shown	DWG. NO. 16140B	FIGURE 3

LEGEND

APPROXIMATE DISPOSAL CELL LOCATIONS

BAUMGARTNER WASTE CELL SAMPLE LOCATIONS

PASSERO SAMPLE LOCATIONS

BROWN AND CALDWELL SAMPLE LOCATIONS

AECOM SAMPLE LOCATIONS

FATLYN SOIL TEST BORINGS

O'BRIEN AND GERE SAMPLE LOCATIONS

CLOUGH HARBOR and ASSOCIATES SAMPLE LOCATIONS (SB 1 – SB 13)

PROPERTY BOUNDARY

PROPOSED ELEVATED TRAIL

PROPOSED GROUND-LEVEL TRAIL

BRIDGE PIERS

MONITORING WELL – WORKING CONDITION

MONITORING WELL – DAMAGED OR MISSING

DISPOSAL CELL SAMPLE LOCATIONS (Spectra May/June 2016)

12.2 CONCENTRATION EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVES

28.0* CONCENTRATION EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVES

85.0 CONCENTRATION EXCEEDS HAZARDOUS WASTE THRESHOLD (50 ppm)

NOTES:
1. All sample locations are approximate.
2. Only Total PCB results are shown.
3. Sample results are in mg/kg (ppm)
4. All depths are in feet unless otherwise noted.

0 40 80
1"=80'

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Total PCBs in Soil
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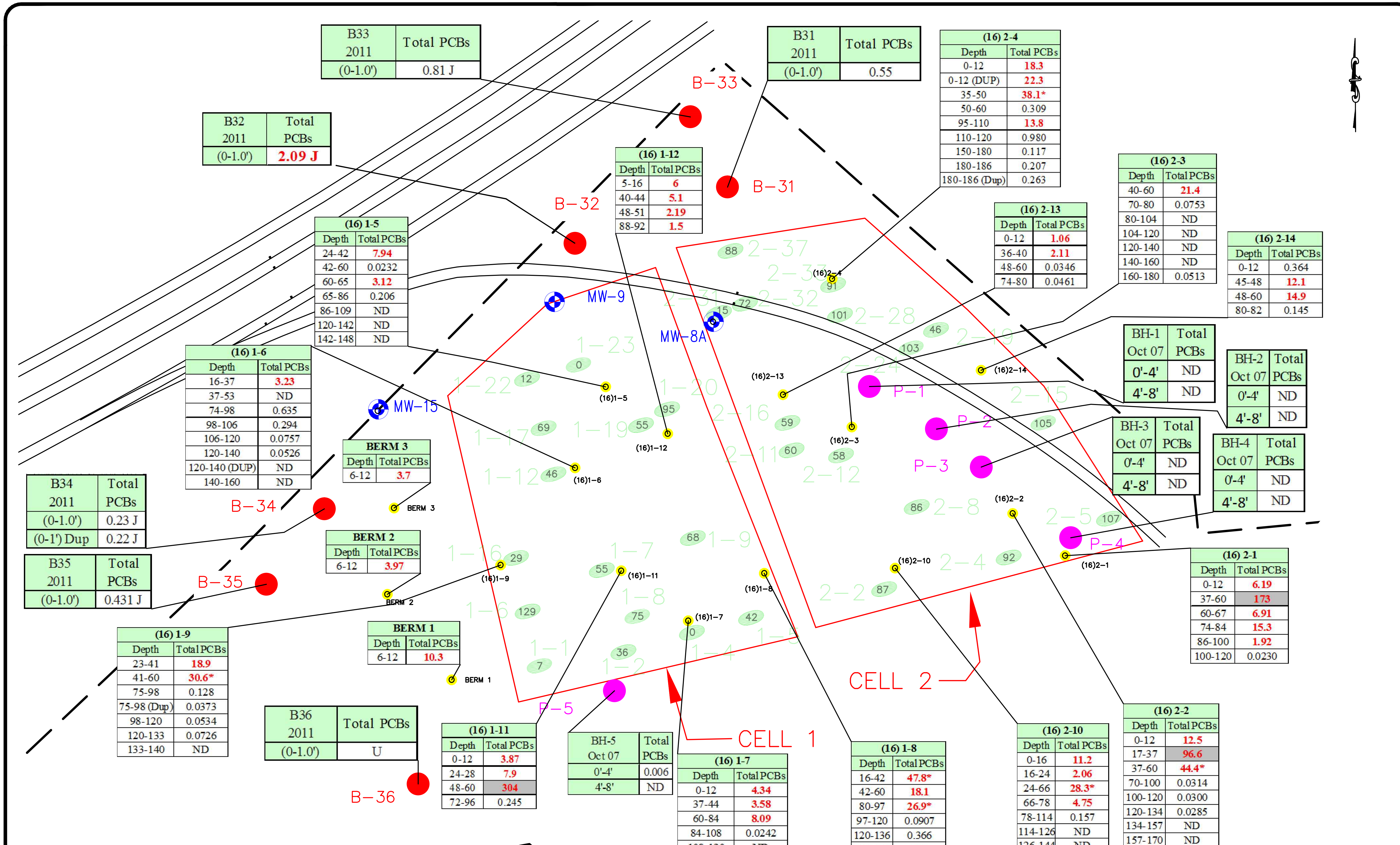
PROJ. No.: 16140	DATE: 10/10/17	SCALE: 1"=80'	DWG. NO. RRWP	FIGURE 4



B33 2011	Total PCBs
(0-1.0')	0.81 J

B31 2011	Total PCBs
(0-1.0')	0.55

B32 2011	Total PCBs
(0-1.0')	2.09 J

B34 2011	Total PCBs
(0-1.0')	0.23 J
(0-1') Dup	0.22 J

B35 2011	Total PCBs
(0-1.0')	0.431 J

B36 2011	Total PCBs
(0-1.0')	U

(16) 2-4

Depth	Total PCBs
0-12	18.3
0-12 (DUP)	22.3
35-50	38.1*
50-60	0.309
95-110	13.8
110-120	0.980
150-180	0.117
180-186	0.207
180-186 (Dup)	0.263

(16) 1-12

Depth	Total PCBs
5-16	6
40-44	5.1
48-51	2.19
88-92	1.5

(16) 2-13

Depth	Total PCBs
0-12	1.06
36-40	2.11
48-60	0.0346
74-80	0.0461

(16) 2-3

Depth	Total PCBs
40-60	21.4
70-80	0.0753
80-104	ND
104-120	ND
120-140	ND
140-160	ND
160-180	0.0513

(16) 2-14

Depth	Total PCBs
0-12	0.364
45-48	12.1
48-60	14.9
80-82	0.145

(16) 1-5

Depth	Total PCBs
24-42	7.94
42-60	0.0232
60-65	3.12
65-86	0.206
86-109	ND
120-142	ND
142-148	ND

(16) 1-6

Depth	Total PCBs
16-37	3.23
37-53	ND
74-98	0.635
98-106	0.294
106-120	0.0757
120-140	0.0526
120-140 (DUP)	ND
140-160	ND

BH-1 Oct 07	Total PCBs
0'-4'	ND
4'-8'	ND

BH-2 Oct 07	Total PCBs
0'-4'	ND
4'-8'	ND

BH-3 Oct 07	Total PCBs
0'-4'	ND
4'-8'	ND

BH-4 Oct 07	Total PCBs
0'-4'	ND
4'-8'	ND

BERM 3

Depth	Total PCBs
6-12	3.7

BERM 2

Depth	Total PCBs
6-12	3.97

BERM 1

Depth	Total PCBs
6-12	10.3

(16) 2-1

Depth	Total PCBs
0-12	6.19
37-60	173
60-67	6.91
74-84	15.3
86-100	1.92
100-120	0.0230

(16) 1-9

Depth	Total PCBs
23-41	18.9
41-60	30.6*
75-98	0.128
75-98 (Dup)	0.0373
98-120	0.0534
120-133	0.0726
133-140	ND

(16) 1-11

Depth	Total PCBs
0-12	3.87
24-28	7.9
48-60	304
72-96	0.245

BH-5 Oct 07	Total PCBs
0'-4'	0.006
4'-8'	ND

(16) 1-7

Depth	Total PCBs
0-12	4.34
37-44	3.58
60-84	8.09
84-108	0.0242
108-120	ND
120-144	0.190
144-168	ND
168-180	0.0250

(16) 1-8

Depth	Total PCBs
16-42	47.8*
42-60	18.1
80-97	26.9*
97-120	0.0907
120-136	0.366
136-140	ND
140-146	ND

(16) 2-10

Depth	Total PCBs
0-16	11.2
16-24	2.06
24-66	28.3*
66-78	4.75
78-114	0.157
114-126	ND
126-144	ND

(16) 2-2

Depth	Total PCBs
0-12	12.5
17-37	96.6
37-60	44.4*
70-100	0.0314
100-120	0.0300
120-134	0.0285
134-157	ND
157-170	ND

LEGEND

- APPROXIMATE WASTE CELL LOCATIONS
- 18 BAUMGARTNER WASTE CELL SAMPLE LOCATIONS (SCREENING LEVEL PCB CONCENTRATION, PPM)
- PASSERO SAMPLE LOCATIONS
- BROWN AND CALDWELL SAMPLE LOCATIONS
- AECOM SAMPLE LOCATIONS
- PROPERTY BOUNDARY
- MONITORING WELL – EXISTING
- WASTE CELL SAMPLE LOCATIONS (Spectra, May/June 2016)
- 12.2 CONCENTRATION EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVES (1 ppm)
- 28.0* CONCENTRATION EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVES (25 ppm)
- 85.0 CONCENTRATION EXCEEDS HAZARDOUS WASTE THRESHOLD (50 ppm)

NOTES:

1. Depths in inches unless otherwise indicated.
2. PCB concentrations in mg/kg (ppm).

0 25 50
1"=50'

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PROJ. No.: 16140	DATE: 9/21/16	SCALE: 1"=50'	DWG. NO. 16140C	FIGURE 5

LEGEND

- APPROXIMATE DISPOSAL CELL LOCATIONS
- BAUMGARTNER WASTE CELL SAMPLE LOCATIONS
- PASSERO SAMPLE LOCATIONS
- BROWN AND CALDWELL SAMPLE LOCATIONS
- AECOM SAMPLE LOCATIONS
- FATLYN SOIL TEST BORINGS
- O'BRIEN AND GERE SAMPLE LOCATIONS
- CLOUGH HARBOR and ASSOCIATES SAMPLE LOCATIONS (SB 1 – SB 13)
- PROPERTY BOUNDARY
- PROPOSED ELEVATED TRAIL
- PROPOSED GROUND-LEVEL TRAIL
- MONITORING WELL – WORKING CONDITION
- MONITORING WELL – DAMAGED OR MISSING
- 12.2 CONCENTRATION EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVES
- 28.0* CONCENTRATION EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVES
- METAL SAMPLES COLLECTED FROM SOIL DEEPER THAN 1FT BGS.
- METAL SAMPLES COLLECTED FROM SOIL LESS THAN 1FT BGS.

NOTES:
1. All sample locations are approximate.
2. Only Metal exceedance values are shown
3. Sample results are in mg/kg (ppm)

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PROJ. No.:	16140	DATE:	10/03/17	SCALE:	1"=80'	DWG. NO.	16140D	FIGURE	6

LEGEND

- APPROXIMATE DISPOSAL CELL LOCATIONS
- BAUMGARTNER WASTE CELL SAMPLE LOCATIONS
- PASSERO SAMPLE LOCATIONS
- BROWN AND CALDWELL SAMPLE LOCATIONS
- AECOM SAMPLE LOCATIONS
- FATLYN SOIL TEST BORINGS
- O'BRIEN AND GERE SAMPLE LOCATIONS
- CLOUGH HARBOR and ASSOCIATES SAMPLE LOCATIONS (SB 1 – SB 13)
- PROPERTY BOUNDARY
- MONITORING WELL – WORKING CONDITION
- MONITORING WELL – DAMAGED OR MISSING
- 12.2 CONCENTRATION EXCEEDS COMMERCIAL USE SOIL CLEANUP OBJECTIVES
- 28.0* CONCENTRATION EXCEEDS INDUSTRIAL USE SOIL CLEANUP OBJECTIVES
- SVOCs SAMPLES COLLECTED FROM SOIL DEEPER THAN 1FT BGS
- SVOCs SAMPLES COLLECTED FROM SOIL LESS THAN 1FT BGS
- VOCs SAMPLES COLLECTED FROM SOIL DEEPER THAN 1FT BGS
- VOCs SAMPLES COLLECTED FROM SOIL LESS THAN 1FT BGS
- PROPOSED ELEVATED TRAIL
- PROPOSED GROUND-LEVEL TRAIL

NOTES:
1. All sample locations are approximate.
2. Only SVOC exceedance values are shown
3. Sample results are in mg/kg (ppm)

0 40 80
1"=80'

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PROJ. No.: 16140	DATE: 10/03/17	SCALE: 1"=80'	DWG. NO. 16140D	FIGURE 7

LEGEND

APPROXIMATE DISPOSAL CELL LOCATIONS

PROPERTY BOUNDARY

GROUNDWATER CONTOUR (ft. above mean sea level, amsl)

EXISTING GROUNDWATER MONITORING WELL

GROUNDWATER MONITORING WELL– MISSING OR DAMAGED

368.38 GROUNDWATER ELEVATION (ft amsl, MEASURED 4/15/16)

RIWP PROPOSED ACTIVITIES

GROUNDWATER SAMPLING LOCATION

NEW/REPLACEMENT MONITORING WELL

Notes:
1. All sample locations are approximate.
2. MW–12 is damaged. Measurements collected May 2016.
3. Area of standing water is approximate. (Observed Spring 2016)
4. Well casing elevations based on historic data.

0 40 80
1"=80'

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PROJ. No.: 16140	DATE: 10/09/17	SCALE: 1"=80'	DWG. NO. RRIWP	FIGURE 8

LEGEND

- APPROXIMATE DISPOSAL CELL LOCATIONS
- BAUMGARTNER WASTE CELL SAMPLE LOCATIONS
- PASSERO SAMPLE LOCATIONS
- BROWN AND CALDWELL SAMPLE LOCATIONS
- AECOM SAMPLE LOCATIONS
- FATLYN SOIL TEST BORINGS
- O'BRIEN AND GERE SAMPLE LOCATIONS
- PROPERTY BOUNDARY
- RAILROAD
- MONITORING WELL – WORKING CONDITION
- MONITORING WELL – DAMAGED OR MISSING
- 12.2 CONCENTRATION EXCEEDS NYSDEC PART 703 WATER QUALITY STANDARDS FOR AMBIENT GROUNDWATER

NOTES:
1. All sample locations are approximate.
2. Sample results are in ug/L (ppb)
3. *The Draft Site Investigation Report (O'Brien & Gere, June 2013) lists several SVOC exceedances but the data are suspect.

0 40 80
1"=80'

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PROJ. No.: 16140	DATE: 10/09/17	SCALE: 1"=80'	DWG. NO. RRIWP	FIGURE 9

LEGEND

- APPROXIMATE DISPOSAL CELL LOCATIONS
- BAUMGARTNER WASTE CELL SAMPLE LOCATIONS
- PASSERO SAMPLE LOCATIONS
- BROWN AND CALDWELL SAMPLE LOCATIONS
- AECOM SAMPLE LOCATIONS
- FATLYN SOIL TEST BORINGS
- O'BRIEN AND GERE SAMPLE LOCATIONS
- PROPERTY BOUNDARY
- RAILROAD
- MONITORING WELL – WORKING CONDITION
- MONITORING WELL – DAMAGED OR MISSING
- 12.2 CONCENTRATION EXCEEDS NYSDEC PART 703 WATER QUALITY STANDARDS FOR AMBIENT GROUNDWATER

NOTES:
1. All sample locations are approximate.
2. Sample results are in ug/L (ppb)

0 40 80
1"=80'

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PROJ. No.: 16140	DATE: 10/09/17	SCALE: 1"=80'	DWG. NO. RRIWP	FIGURE 10

LEGEND

- APPROXIMATE DISPOSAL CELL LOCATIONS
- BAUMGARTNER WASTE CELL SAMPLE LOCATIONS
- PASSERO SAMPLE LOCATIONS
- BROWN AND CALDWELL SAMPLE LOCATIONS
- AECOM SAMPLE LOCATIONS
- FATLYN SOIL TEST BORINGS
- O'BRIEN AND GERE SAMPLE LOCATIONS
- PROPERTY BOUNDARY
- RAILROAD
- MONITORING WELL – WORKING CONDITION
- MONITORING WELL – DAMAGED OR MISSING
- 12.2 CONCENTRATION EXCEEDS NYSDEC PART 703 WATER QUALITY STANDARDS FOR AMBIENT GROUNDWATER

NOTES:

1. All sample locations are approximate.
2. Sample results are in mg/L (ppm)

0 40 80
1"=80'

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GROUNDWATER METALS EXCEEDANCES
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PROJ. No.: 16140	DATE: 10/09/17	SCALE: 1"=80'	DWG. NO. RRIWP	FIGURE 11

LEGEND

- APPROXIMATE DISPOSAL CELL LOCATIONS
- BAUMGARTNER WASTE CELL SAMPLE LOCATIONS
- PASSERO SAMPLE LOCATIONS
- BROWN AND CALDWELL SAMPLE LOCATIONS
- AECOM SAMPLE LOCATIONS
- O'BRIEN AND GERE SAMPLE LOCATIONS
- CLOUGH HARBOR and ASSOCIATES SAMPLE LOCATIONS (SB 1 – SB 13)
- PROPERTY BOUNDARY
- PROPOSED ELEVATED TRAIL
- PROPOSED GROUND-LEVEL TRAIL
- MONITORING WELL – WORKING CONDITION
- MONITORING WELL – DAMAGED OR MISSING
- 200' SAMPLING GRID
- 150' SAMPLING GRID
- 75' SAMPLING GRID

RIWP PROPOSED ACTIVITIES

- TP TEST PIT
- BORING LOCATION
- SURFACE SAMPLE LOCATIONS
- VAPOR POINT LOCATION
- NEW/REPLACEMENT MONITORING WELL

NOTES:
1. All sample locations are approximate.

0 40 80
1"=80'

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PROPOSED SAMPLING LOCATIONS
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PROJ. No.:	16140	DATE:	10/09/17	SCALE:	1"=80'	DWG. NO.	RRIWP	FIGURE	12

APPENDIX A

HISTORICAL ANALYTICAL DATA TABLES

CLOUGH HARBOR TRAILWAYS DATA

CHA/Trailways Samples

	Sample ID:		SB-1 (8-10')		SB-2 (12-14')		SB-3 (6-8')		SB-4 (10-12')		SB-5 (2-4')		SB-6 (0-2')		SB-7 (3-5')		SB-8 (3-5')		SB-9 (3-5')		SB-10 (3-5')		SB-11 (3-5')		SB-12 (3-5')		SB-13 (5-10')		SB-1 (0-2')		SB-2 (0-2')	
ANALYTE	**Soil Cleanup Objectives**		**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**
	Commercial	**Industrial**																														
VOLATILES																																
Tetrachloroethene	150	300	ND		ND		ND		ND		ND		0.00072	J	ND		ND		ND		ND		ND		ND		ND		-	-	-	-
Benzene	44	89	0.00021	J	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		-	-	-	-
Toluene	500	1000	ND		ND		ND		0.00034	J	ND		ND		ND		ND		ND		ND		ND		ND		ND		-	-	-	-
Methyl tert butyl ether	500	1000	0.00018	J	0.00018	J	ND		ND		0.00036	J	ND		ND		0.00027	J	ND		ND		0.00016	J	ND		0.0017	J	-	-	-	-
p/m-Xylene	NA	NA	ND		0.00069	J	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		-	-	-	-
Acetone	500	1000	0.044		0.018		0.059		0.019		0.0089	J	0.0022	J	ND		ND		ND		0.0049	J	ND		ND		0.057		-	-	-	-
Carbon disulfide	NA	NA	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		-	-	-	-
2-Butanone	500	1000	0.0087	J	0.00088	J	0.0054	J	ND		ND		ND		ND		ND		ND		ND		ND		ND		0.0061	J	-	-	-	-
Cyclohexane	NA	NA	0.0015	J	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		-	-	-	-
Methyl cyclohexane	NA	NA	0.0034	J	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		-	-	-	-
Total VOCs			0.05799	-	0.01975	-	0.0644	-	0.01934	-	0.0093	-	0.00292	-	-	-	0.0003	-	-	-	0.0049	-	0.00016	-	-	-	0.0648	-	-	-	-	-
SEMIVOLATILES																																
Fluoranthene	500	1000	0.25		ND		ND		0.044	J	ND		0.21		ND		2.7		ND		0.27		0.26		0.12	J	ND		-	-	-	-
Naphthalene	500	1000	0.07	J	ND		ND		0.087	J	ND		0.089	J	ND		0.14	J	ND		ND		ND		0.043	J	ND		-	-	-	-
Nitrobenzene	69	140	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		-	-	-	-
Butyl benzyl phthalate	NA	NA	ND		ND		ND		ND		ND		0.068	J	ND		ND		ND		ND		ND		ND		ND		-	-	-	-
Benzo(a)anthracene	5.6	11	0.13	J	ND		ND		0.039	J	ND		0.13		ND		2.2		ND		0.15		0.19		0.12	J	ND		-	-	-	-
Benzo(a)pyrene	1	1.1	0.12	J	ND		ND		ND		ND		0.14	J	ND		1.7		ND		0.14	J	0.21		0.13	J	ND		-	-	-	-
Benzo(b)fluoranthene	5.6	11	0.17		ND		ND		0.049	J	ND		0.21		ND		2.7		ND		0.21		0.3		0.21		ND		-	-	-	-
Benzo(k)fluoranthene	56	110	0.058	J	ND		ND		ND		ND		0.084	J	ND		1.1		ND		0.063	J	0.1	J	0.071	J	ND		-	-	-	-
Chrysene	56	110	0.14	J	ND		ND		0.043	J	ND		0.17		0.021	J	1.8		ND		0.15		0.23		0.14		ND		-	-	-	-
Acenaphthylene	500	1000	0.06	J	ND		ND		ND		ND		0.035	J	ND		0.19		ND		ND		ND		ND		ND		-	-	-	-
Anthracene	500	1000	ND		ND		ND		ND		ND		0.04	J	ND		0.34		ND		ND		ND		ND		ND		-	-	-	-
Benzo(ghi)perylene	500	1000	0.075	J	ND		ND		ND		ND		0.095	J	ND		0.87		ND		0.074	J	0.15	J	0.11	J	ND		-	-	-	-
Fluorene	500	1000	ND		ND		ND		ND		ND		ND		ND		0.024	J	ND		ND		ND		ND		ND		-	-	-	-
Phenanthrene	500	1000	0.13	J	ND		ND		ND		ND		0.1	J	ND		0.68		ND		0.18		0.14		0.053	J	ND		-	-	-	-
Dibenzo(a,h)anthracene	0.56	1.1	ND		ND		ND		ND		ND		0.027	J	ND		0.38		ND		ND		0.043	J	0.033	J	ND		-	-	-	-
Indeno(1,2,3-cd)pyrene	5.6	11	0.083	J	ND		ND		ND		ND		0.11	J	ND		1.1		ND		0.076	J	0.18		0.12	J	ND		-	-	-	-
Pyrene	500	1000	0.25		ND		ND		0.031	J	ND		0.19		ND		1.7		ND		0.22		0.2		0.098	J	ND		-	-	-	-
2-Methylnaphthalene	NA	NA	ND		ND		ND		ND		ND		0.026	J	ND		ND		ND		ND		ND		ND		ND		-	-	-	-
3/4-Methylphenol	500	1000	0.045	J	ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		-	-	-	-
Carbazole	NA	NA	ND		ND		ND		ND		ND		ND		ND		0.082	J	ND		ND		ND		ND		ND		-	-	-	-
Atrazine	NA	NA	ND		ND		ND		ND		ND		0.083	J	ND		ND		ND		ND		ND		ND		ND		-	-	-	-
Total SVOCs			1.581	-	-	-	-	-	0.293	-	-	-	1.807	-	0.021	-	17.706	-	-	-	1.533	-	2.003	-	1.248	-	-	-	-	-	-	-

	Sample ID:		SB-1 (8-10')		SB-2 (12-14')		SB-3 (6-8')		SB-4 (10-12')		SB-5 (2-4')		SB-6 (0-2')		SB-7 (3-5')		SB-8 (3-5')		SB-9 (3-5')		SB-10 (3-5')		SB-11 (3-5')		SB-12 (3-5')		SB-13 (5-10')		SB-1 (0-2')		SB-2 (0-2')	
ANALYTE	**Soil Cleanup Objectives**		**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**	**Conc**	**Q**
	Commercial	**Industrial**																														
POLYCHLORINATED BIPHENYLS																																
PCBs, Total	1	25	1.27		ND		ND		ND		ND		0.00866	J	0.0421	J	ND		ND		0.0816	J	ND		ND		ND		ND		ND	
TOTAL METALS																																
Arsenic, Total	16	16	18*		3.6		4.3		3.2		2.5		4.8		5.4		6.6		6.6		4.5		3.6		4.1		1.9		3.8		3.7	
Barium, Total	400	10000	440		100		210		76		64		85		62		70		120		67		75		40		1600		33		79	
Cadmium, Total	9.3	60	17		ND		ND		ND		ND		0.25	J	ND		0.276	J	ND		ND		ND		ND		ND		ND		ND	
Chromium, Total	NA	NA	170		9.5		14		7.4		7		6.3		5.7		8.3		12		6.5		6.3		5.1		10		9.8		11	
Lead, Total	1000	3900	3700		16		200		8.6		19		22		9.4		23		18		4.7		5.3		9.5		21		7.8		1.6	J
Mercury, Total	2.8	5.7	1.6		0.45		3.5		1.2		1.3		2.3		3.2		1.2		0.21		3.4		5.5		2.3		3.3		0.05	J	0.03	J
Selenium, Total	1500	6800	3.7		1.32		0.76	J	0.82	J	0.51	J	0.754	J	0.45	J	0.59	J	0.53	J	0.342	J	0.63	J	0.397	J	0.343	J	0.318	J	0.322	J
Silver, Total	1500	6800	2.1		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND		ND	

Notes:

All samples were collected by CHA on April 25, 2016; only constituents with detections are shown; results are shown in mg/kg.

Soil cleanup objectives are based on 6 NYCRR Part 375-6 or NYSDEC Guidance CP-51.

Q - Data qualifier

J - Data indicates the presence of a compound that meets the identification criteria. The result is less than the quantitation limit but greater than MDL.

ND - Non-detect

NA - Not available

Red - Value exceeds commercial cleanup objectives.

* - Value exceeds industrial cleanup objectives.

Chromium - The listed soil cleanup objectives are for trivalent chromium.

Phase II Environmental Site Assessment

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November 1, 2007 P.N 2007207.03

Roth Steel
Table 1 Soil September 28, 2007

VOCs												
Compound	**BH-1 0′-4′ (ppm)**	**BH-1 4′-8′ (ppm)**	**BH-2 0′-4′ (ppm)**	**BH-2 4′-8′ (ppm)**	**BH-3 0′-4′ (ppm)**	**BH-3 4′-8′ (ppm)**	**BH-4 0′-4′ (ppm)**	**BH-4 4′-8′ (ppm)**	**BH-5 0′-4′ (ppm)**	**BH-5 4′-8′ (ppm)**	**TAGM 4046 Table 1 Rec. SCO (ppm)**	**Table 375 Restricted Industrial SCOs (ppm)**
Trichloroethene	ND	ND	ND	0.028	ND	0.03	ND	ND	0.02	ND	0.7	400
Toulene	ND	ND	ND	0.027	ND	0.04	ND	ND	ND	ND	1.5	1,000
Acetone	ND	0.16	0.43	ND	0.48	0.13	0.12	0.23	ND	ND	0.2	1,000
Carbon disulfide	ND	ND	ND	ND	0.02	0.01	ND	0.04	ND	ND	2.7	NA

ppm: Parts per million.
SCOs: Soil clean up objectives.
ND: Non-detect.
NA: Not Available.

Roth Steel
Table 2 Soil September 28, 2007

PCBs												
Compound	**BH-1 0′-4′ (ppm)**	**BH-1 4′-8′ (ppm)**	**BH-2 0′-4′ (ppm)**	**BH-2 4′-8′ (ppm)**	**BH-3 0′-4′ (ppm)**	**BH-3 4′-8′ (ppm)**	**BH-4 0′-4′ (ppm)**	**BH-4 4′-8′ (ppm)**	**BH-5 0′-4′ (ppm)**	**BH-5 4′-8′ (ppm)**	**TAGM 4046 Table 3 Rec. SCO (ppm)**	**Table 375 Restricted Insustrial SCOs (ppm)**
Aroclor 1260	ND	ND	ND	ND	ND	ND	ND	ND	0.006	ND	1	25

ppm: Parts per million.
SCOs: Soil clean up objectives.
ND: Non-detect.
NA: Not Available.

Roth Steel
Table 3 Groundwater September 28, 2007

VOCs						
Compounds	**GW-1 ug/L**	**GW-2 ug/L**	**GW-3 ug/L**	**GW-4 ug/L**	**GW-5 ug/L**	**TOGS 1.1.1 ug/L**
Trichlorofluoromethane	ND	ND	ND	4.99	ND	5
Benzene	ND	ND	ND	**2.01**	ND	1
Acetone	15.9	ND	ND	23.3	ND	50

ND: Non-detect.
TOGS: Technical and Operational Guidance Series.

Roth Steel
Table 4 Groundwater September 28, 2007

PCBs						
Compounds	**GW-1 ug/L**	**GW-2 ug/L**	**GW-3 ug/L**	**GW-4 ug/L**	**GW-5 ug/L**	**TOGS 1.1.1 ug/L**
Aroclor 1254	ND	ND	ND	4.11	ND	0.09

ppm: Parts per million.
ND: Non-detect.
TOGS: Technical and Operational Guidance Series.

Roth Steel
Table 5 Soil October 11, 2007

VOCs											
Compound	**BH-6 0′-4′ (ppm)**	**BH-8 7′-8′ (ppm)**	**BH-9 0′-12′ (ppm)**	**BH-10 4′-8′ (ppm)**	**BH-11 0′-4′ (ppm)**	**BH-12 0′-8′ (ppm)**	**TP-13 4′ (ppm)**	**TP-14 4′ (ppm)**	**BH-15 7′-8′ (ppm)**	**TAGM 4046 Table 1 Rec. SCO (ppm)**	**Table 375 Restricted Industrial SCO (ppm)**
Tetrachloroethene	0.011	ND	ND	0.020	ND	ND	ND	ND	ND	1.4	300
Trichloroethene	ND	0.010	ND	ND	ND	ND	ND	ND	ND	0.7	400
Trichlorofluoromethane	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	NA
Benzene	0.021	0.013	ND	ND	ND	ND	ND	ND	ND	0.06	89
Ethylbenzene	0.065	0.139	ND	ND	0.017	ND	0.091	ND	ND	5.5	780
Toluene	0.11	0.026	ND	0.020	0.012	ND	0.012	ND	0.007	1.5	1,000
m,p-Xylene	0.087	0.463	ND	0.059	0.016	ND	0.018	ND	0.007	1.2	1,000
o-Xylene	0.054	0.219	ND	0.033	0.012	ND	0.014	0.010	ND	1.2	1,000
Styrene	0.055	ND	ND	ND	ND	ND	0.048	ND	ND	NA	NA
1,4-Dichlorobenzene	0.011	ND	ND	ND	ND	ND	ND	ND	ND	8.5	250
Acetone	1.730	0.357	0.069	ND	0.341	0.058	0.165	ND	0.058	0.2	1,000
2-Butanone	0.373	ND	ND	ND	0.086	ND	ND	ND	ND	0.3	NA
4-Methyl-2-pentanone	1.090	ND	ND	ND	0.030	ND	ND	ND	ND	1.0	NA
Carbon disulfide	0.084	0.058	0.025	0.031	0.017	0.061	ND	0.009	ND	2.7	NA
sec-Butylbenzene	ND	0.135	ND	ND	ND	ND	ND	ND	ND	NA	1,000
n-Propylbenzene	0.009	0.202	ND	ND	ND	ND	ND	ND	ND	NA	1,000
Isopropylbenzene	ND	0.149	ND	ND	ND	ND	ND	ND	ND	NA	NA
p-Isopropyltoluene	ND	0.234	ND	ND	ND	ND	ND	0.041	ND	NA	NA
Naphthalene	0.051	0.278	ND	ND	0.046	ND	ND	ND	ND	NA	NA
1,2,4- Trimethylbenzene	0.043	1.960	ND	0.068	0.018	ND	0.010	0.015	ND	NA	380
1,3,5- Trimethylbenzene	0.016	0.746	ND	0.031	ND	ND	ND	0.017	ND	NA	380
Methyl tert-butyl Ether	ND	ND	ND	ND	ND	ND	ND	ND	ND	NA	1,000

Roth Steel
Table 5 (Cont'd) Soil October 11, 2007

VOCs									
Compound	**TP-16 (ppm)**	**BH-17 4 (ppm)**	**BH 19 7′-8′ (ppm)**	**Lagoon 1 Center (ppm)**	**Lagoon 2 N Access (ppm)**	**Lagoon Surficial (ppm)**	**Lagoon N Access 5′ (ppm)**	**TAGM 4046 Table 1 (ppm)**	**Table 375 Restricted Industrial SCO (ppm)**
Tetrachloroethene	ND	ND	ND	ND	ND	0.018	ND	1.4	300
Trichloroethene	ND	ND	ND	ND	ND	0.017	0.0179	0.7	400
Trichlorofluoromethane	ND	ND	ND	ND	0.035	0.159	ND	NA	NA
Benzene	ND	0.065	ND	ND	ND	0.014	ND	0.06	89
Ethylbenzene	ND	ND	ND	0.018	0.055	0.148	0.0401	5.5	780
Toluene	ND	0.211	0.017	0.009	0.080	0.155	0.0572	1.5	1,000
m,p-Xylene	ND	0.295	0.016	0.014	0.132	0.214	0.0850	1.2	1,000
o-Xylene	ND	0.512	ND	0.019	0.100	0.236	0.0479	1.2	1,000
Styrene	ND	0.743	ND	ND	0.044	0.090	ND	NA	NA
1,4-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	8.5	250
Acetone	ND	0.321	0.195	0.047	ND	0.372	0.728	0.2	1,000
2-Butanone	ND	ND	0.074	ND	ND	ND	0.161	0.3	NA
4-Methyl-2-pentanone	ND	ND	ND	ND	ND	ND	0.226	1.0	NA
Carbon disulfide	ND	0.021	0.017	ND	ND	0.148	0.0959	2.7	NA
sec-Butylbenzene	ND	0.031	ND	ND	ND	ND	ND	NA	1,000
n-Propylbenzene	ND	0.126	ND	ND	0.020	0.035	ND	NA	1,000
Isopropylbenzene	ND	0.059	ND	ND	ND	ND	ND	NA	NA
p-Isopropyltoluene	ND	ND	ND	ND	ND	ND	ND	NA	NA
Naphthalene	ND	0.244	ND	ND	0.029	0.053	ND	NA	NA
1,2,4- Trimethylbenzene	ND	0.838	0.009	0.033	0.103	0.141	0.0599	NA	380
1,3,5- Trimethylbenzene	ND	0.807	ND	0.011	0.066	0.103	0.0251	NA	380
Methyl tert-butyl Ether	ND	ND	ND	ND	ND	ND	ND	NA	1,000

Roth Steel
Table 6 Soil October 11, 2007

SVOCs											
Compound	**BH-6 0′-4′ (ppm)**	**BH-8 7′-8′ (ppm)**	**BH-9 0′-12′ (ppm)**	**BH-10 4′-8′ (ppm)**	**BH-11 0′-4′ (ppm)**	**BH-12 0′-8′ (ppm)**	**TP-13 4′ (ppm)**	**TP-14 4′ (ppm)**	**BH-15 7′-8′ (ppm)**	**TAGM 4046 Table 2 Rec. SCO (ppm)**	**Table 375 Restricted Industrial SCO (ppm)**
Acenaphthene	ND	ND	ND	ND	ND	ND	ND	ND	ND	50.0	1000
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	41.0	1000
Anthracene	ND	ND	ND	ND	ND	ND	0.393	0.422	ND	50.0	1000
Benzo (a) anthracene	1.320	ND	ND	5.110	ND	ND	0.996	1.040	ND	0.224 or MDL	11
Benzo (a) pyrene	ND	ND	ND	**4.690**	ND	ND	0.575	0.705	ND	0.061 or MDL	1.1
Benzo (b) fluoranthene	0.882	ND	ND	4.560	ND	ND	0.797	0.579	ND	1.1	11
Benzo (g,h,I,) perylene	ND	ND	ND	3.430	ND	ND	ND	0.352	ND	50.0	1000
Benzo (k) fluoranthene	ND	ND	ND	2.450	ND	ND	0.620	0.561	ND	1.1	110
Chrysene	1.780	ND	ND	5.150	ND	ND	0.975	0.858	ND	0.4	110
Dibenz (a,h) anthracene	ND	ND	ND	**1.130**	ND	ND	ND	ND	ND	0.014 or MDL	1.1
Fluoranthene	3.300	ND	ND	6.510	ND	ND	2.380	1.950	ND	50.0	1000
Fluorene	ND	ND	ND	ND	ND	ND	ND	ND	ND	50.0	1000
Indeno (1,2,3-cd) pyrene	ND	ND	ND	3.450	ND	ND	0.397	0.354	ND	3.2	11
Naphthalene	ND	ND	ND	ND	ND	ND	ND	ND	ND	13.0	1000
Phenanthrene	1.670	0.873	ND	1.870	ND	ND	1.160	1.090	ND	50.0	1000
Pyrene	ND	ND	ND	4.640	1.150	ND	1.950	1.350	ND	50.0	1000

Roth Steel
Table 6 (Cont'd) Soil October 11, 2007

SVOCs									
Compound	**TP-16 (ppm)**	**BH-17 4 (ppm)**	**BH 19 7 ′-8 ′ (ppm)**	**Lagoon 1 Center (ppm)**	**Lagoon 2 N Access (ppm)**	**Lagoon Surficial (ppm)**	**Lagoon N Access 5 ′ (ppm)**	**TAGM 4046 Table 2 (ppm)**	**Table 375 Restricted Inustrial SCO (ppm)**
Acenaphthene	0.768	0.658	ND	ND	ND	ND	ND	50.0	1000
Acenaphthylene	0.395	ND	ND	ND	ND	ND	ND	41.0	1000
Anthracene	4.350	1.330	ND	ND	ND	ND	1.500	50.0	1000
Benzo (a) anthracene	7.750	2.990	ND	ND	ND	ND	4.180	0.224 or MDL	11
Benzo (a) pyrene	**5.190**	**1.430**	ND	ND	ND	ND	**3.310**	0.061 or MDL	1.1
Benzo (b) fluoranthene	4.670	1.910	ND	ND	ND	ND	3.350	1.1	11
Benzo (g,h,I,) perylene	2.660	1.070	ND	ND	ND	ND	1.870	50.0	1000
Benzo (k) fluoranthene	3.930	1.650	ND	ND	ND	ND	2.200	1.1	110
Chrysene	6.080	2.560	ND	ND	ND	ND	4.550	0.4	110
Dibenz (a,h) anthracene	0.638	ND	ND	ND	ND	ND	ND	0.014 or MDL	1.1
Fluoranthene	16.100	7.590	ND	ND	1.980	ND	8.360	50.0	1000
Fluorene	1.900	0.808	ND	ND	ND	ND	ND	50.0	1000
Indeno (1,2,3-cd) pyrene	2.360	1.070	ND	ND	ND	ND	1.840	3.2	11
Naphthalene	ND	0.515	ND	ND	ND	ND	ND	13.0	1000
Phenanthrene	10.600	5.990	ND	ND	1.670	ND	4.380	50.0	1000
Pyrene	11.500	5.910	ND	ND	1.720	ND	7.600	50.0	1000

Roth Steel
Table 7 Soil October 11, 2007

PCBs											
Compound	**BH-6 0′-4′ (ppm)**	**BH-8 7′-8′ (ppm)**	**BH-9 0′-12′ (ppm)**	**BH-10 4′-8′ (ppm)**	**BH-11 0′-4′ (ppm)**	**BH-12 0′-8′ (ppm)**	**TP-13 4′ (ppm)**	**TP-14 4′ (ppm)**	**BH-15 7′-8′ (ppm)**	**TAGM 4046 Table 3 Rec. SCO (ppm)**	**Table 375 Restricted Industrial SCO (ppm)**
Aroclor 1016	10.7	ND	ND	ND	ND	ND	3.23	1.09	ND	1 (Surface) 10 (Sub-surface)	25
Aroclor 1242	ND	ND	1.01	5.53	**94.3**	ND	ND	ND	ND	1 (Surface) 10 (Sub-surface	25
Aroclor 1260	20.8	ND	ND	ND	ND	ND	4.13	2.41	ND	1 (Surface) 10 (Sub-surface)	25

Roth Steel
Table 7 (Cont'd) Soil October 11, 2007

PCBs									
Compound	**TP-16 (ppm)**	**BH-17 4 (ppm)**	**BH 19 7 ′-8 ′ (ppm)**	**Lagoon 1 Center (ppm)**	**Lagoon 2 N Access (ppm)**	**Lagoon Surficial (ppm)**	**Lagoon N Access 5 ′ (ppm)**	**TAGM 4046 Table 3 Rec. SCO (ppm)**	**Table 375 Restricted Insustrial SCO (ppm)**
Aroclor 1016	ND	20.3	ND	ND	ND	ND	ND	1 (Surface) 10 (Sub-surface)	25
Aroclor 1242	ND	ND	ND	7.35	**46.1**	12.1	**41.3**	1 (Surface) 10 (Sub-surfac)e	25
Aroclor 1260	ND	9.17	ND	ND	ND	ND	ND	1 (Surface) 10 (Sub-surface)	25

Roth Steel
Table 8 Soil October 11, 2007

Metals											
Compound	**BH-6 0′-4′ (ppm)**	**BH-8 7′-8′ (ppm)**	**BH-9 0′-12′ (ppm)**	**BH-10 4′-8′ (ppm)**	**BH-11 0′-4′ (ppm)**	**BH-12 0′-8′ (ppm)**	**TP-13 4′ (ppm)**	**TP-14 4′ (ppm)**	**BH-15 7′-8′ (ppm)**	**TAGM 4046 Table 4 Rec. SCO (ppm)**	**Table 375 Restricted Industrial SCO (ppm)**
Arsenic	**53.4**	**20.4**	9.82	**35.9**	**27.7**	14.6	**28.4**	7.43	3.20	7.5 or SB	16
Barium	3360	759	364	270	2020	3080	357	148	112	300 or SB	10,000
Cadmium	**96.5**	4.52	23.7	9.92	**79.0**	<0.388	**22.5**	5.33	<0.416	1 or SB	60
Chromium	226	79.3	181	56.5	154	140	360	197	3.79	10 or SB	800
Lead	2850	19.30	595	864	1180	534	2440	347	14.4	SB	3,900
Mercury	0.894	0.385	0.683	0.137	3.46	0.126	3.68	0.271	<0.0081	0.1	5.7
Selenium	<0.593	9.12	<0.588	<0.419	6.75	<0.388	<0.536	<0.438	<0.416	2 or SB	6,800
Silver	<1.19	<1.17	<1.18	<0.383	1.44	<0.776	1.32	2.22	<0.830	SB	6,800

SB: site background

Roth Steel
Table 8 (Cont'd) Soil October 11, 2007

Metals									
Compound	**TP-16 (ppm)**	**BH-17 4 (ppm)**	**BH 19 7′-8′ (ppm)**	**Lagoon 1 Center (ppm)**	**Lagoon 2 N Access (ppm)**	**Lagoon Surficial (ppm)**	**Lagoon N Access 5′ (ppm)**	**TAGM 4046 Table 4 (ppm)**	**Table 375 Restricted Industrial SCO (ppm)**
Arsenic	4.60	8.28	8.29	**24.0**	**20.3**	13.4	**17.3**	7.5 or SB	16
Barium	62.0	225	140	75.4	341	461	849	300 or SB	10,000
Cadmium	<0.341	7.38	<0.340	5.98	22.5	18.4	9.03	1 or SB	60
Chromium	14.8	152	9.41	89.2	312	199	264	10 or SB	800
Lead	36.6	762	13.5	392	897	881	**11,300**	SB	3,900
Mercury	0.0995	1.01	0.0596	0.573	1.01	0.066	0.646	0.1	5.7
Selenium	<0.341	<0.483	<0.340	<0.507	<0.585	<0.546	1.49	2 or SB	6,800
Silver	<0.680	<0.967	<0.678	2.75	<1.17	3.36	15.1	SB	6,800

SB: site background

Roth Steel
Table 9 Groundwater October 11, 2007

VOCs											
Compound	**GW-6 ug/L**	**GW-7 ug/L**	**GW-8 ug/L**	**GW-9 ug/L**	**GW-10 ug/L**	**GW-11 ug/L**	**GW-12 ug/L**	**GW-15 ug/L**	**GW-19 ug/L**	**Retention Tank ug/L**	**TOGS 1.1.1 Groundwater standard ug/L**
Chloroethane	ND	ND	ND	ND	ND	**524**	ND	ND	ND	ND	5
Tetrachloroethene	ND	ND	ND	ND	ND	ND	ND	ND	ND	3.04	5
Trichlorofluoromethane	ND	ND	**19.6**	ND	4.99	ND	ND	ND	ND	**30.3**	5
Benzene	ND	ND	**4.98**	ND	ND	ND	ND	ND	**44.4**	**5.69**	1
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	**17.7**	**8.03**	5
Toluene	ND	ND	**8.32**	ND	ND	ND	ND	ND	**220**	**19.9**	5
m,p-Xylene	ND	ND	ND	ND	ND	ND	ND	ND	55.1	ND	NA
o-Xylene	ND	ND	ND	ND	ND	ND	ND	ND	32.9	19.8	NA
Acetone	**192**	ND	**316**	ND	ND	ND	**298**	ND	**172**	**181**	50
2-Butanone	ND	ND	ND	ND	ND	ND	51.9	ND	225	51.7	NA
2-Hexanone	ND	ND	ND	ND	ND	ND	ND	ND	13.2	ND	50
4-Methyl-2-pentanone	363	ND	267	ND	ND	ND	ND	ND	83.1	9.58	NA
Methyl tert-butyl Ether	ND	2.67	5.35	2.50	ND	ND	5.36	3.71	86.9	11.5	NA

Roth Steel
Table 10 Groundwater October 11, 2007

SVOCs											
Compound	**GW-6 ug/L**	**GW-7 ug/L**	**GW-8 ug/L**	**GW-9 ug/L**	**GW-10 ug/L**	**GW-11 ug/L**	**GW-12 ug/L**	**GW-15 ug/L**	**GW-19 ug/L**	**Retention Tank ug/L**	**TOGS 1.1.1 Groundwater standard ug/L**
Naphalene	ND	ND	ND	ND	ND	**24.2**	ND	ND	ND	ND	10

Roth Steel
Table 11 Groundwater October 11, 2007

PCBs									
Compound	**GW-6 ug/L**	**GW-7 ug/L**	**GW-8 ug/L**	**GW-9 ug/L**	**GW-10 ug/L**	**GW-11 ug/L**	**GW-15 ug/L**	**Retention Tank ug/L**	**TOGS 1.1.1 Groundwater standard ug/L**
Aroclor 1242	**78.0**	ND	**26.0**	ND	ND	**25,000**	ND	**36.0**	0.09

Roth Steel
Table 12 Groundwater October 11, 2007

Compound	GW-11 ug/L	TOGS 1.1.1 Groundwater standard ug/L
Medium Weight PHC as: Fuel Oil #6	**16,3000**	NA

PHC: Petroleum Hydrocarbon

September 20, 2013

Mr. Steven E. Perrigo, P.E.
Environmental Engineer 2
Division of Materials Management, Region 7
New York State Department of Environmental Conservation
615 Erie Boulevard West
Syracuse, New York 13204-2400

RE: Consent Order (Case No. R7-20121101-89)
Roth Steel Corporation

FILE: 10875.49565

Dear Steve:

This letter report presents the analytical results for samples that were collected at the Roth Steel Facility in Syracuse New York on August 8, 2013. As you know, on January 31, 2013 a Consent Order Number R7-20121101-89 (Consent Order) was executed between the Roth Steel Corporation (Roth Steel) and the New York State Department of Environmental Conservation (NYSDEC) in relation to a pile of materials located at the Roth Steel Facility on Hiawatha Boulevard in Syracuse, New York. Prior to execution of the Consent Order, Roth Steel was issued a Notice of Violation (NOV) on April 16, 2012 in relation to the material pile. As part of the NOV response, a portion of the pile was sampled to characterize approximately one-half of the material pile. The characterized half was then processed to remove recoverable metals and the resulting automobile shredder residue (ASR) material was disposed at permitted, off-site disposal facilities. The sampling was performed on June 27, 2012 by AECOM Technical Services and the results presented in a letter from K. Jaglal to S. Perrigo dated July 25, 2012.

Pursuant to Section 1 of Schedule A (Schedule For Compliance) of the January 31, 2013 Consent Order, Roth Steel characterized the remaining portion of the material pile by collecting representative composite samples and analyzing them for polychlorinated biphenyls (PCBs), total lead, and extractable metals using the Toxicity Characteristic Leaching Procedure (TCLP). This sampling of the remaining portion of the pile took place on May 6, 2013 and was performed by O' Brien & Gere Engineers in a manner consistent with the prior sampling of the pile. The samples were analyzed and the results were presented in a letter from K. Jaglal to S. Perrigo dated June 19, 2013.

Pursuant to Section 4 of Schedule A (Schedule For Compliance) of the Consent Order, Roth Steel also characterized the exposed surface following pile removal by sampling and analyzing the underlying samples for PCBs, total lead, and metals that were detected in the TCLP analyses conducted during the two previous phases of sampling. These metals included arsenic, barium, cadmium, lead and selenium. This letter report documents that sampling and presents the associated analytical data.

Management of the entire pile resulted in the removal and off-site disposal of a total of 2,179 tons of ASR-related material at Seneca Meadows Landfill in Waterloo, New York and Ontario County Landfill in Stanley, New York. Scale tickets for each of the loads were provided to the NYSDEC shortly after the material was disposed.

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Subsequently, on August 8, 2013 post- pile-removal sampling was performed at eight locations in the footprint of the former pile. The proposed sampling locations and approach were discussed with a NYSDEC representative and a figure was submitted for review. The NYSDEC reviewed and concurred with the proposed sampling locations by email on July 31, 2013. Three transects shown on Figure 1 were set up and one, three and four samples were collected from each transect, respectively. At each location, a layer of recently placed soil/fill was removed with a backhoe to expose the ground surface that was uncovered when the pile was addressed. The fill had been placed during removal of the pile material to prevent the adjacent pond from breaching its bank due to the pile removal. As indicated in Table 1, water was encountered in some of the excavations and was pumped out to facilitate sample collection.

A hand auger was used to collect the samples to the target depth of 16 inches below grade. The depth of penetration and material recoveries varied due to the characteristics of the underlying material. Each core was divided into two samples - one consisting of the top four (4) inches and the second consisting of the rest of the core. The individual samples were homogenized and submitted for laboratory analysis. A total of sixteen samples were collected for analysis for PCBs and total arsenic, barium, cadmium, lead and selenium. The results are presented in Table 2 and the laboratory data sheets are attached.

As always, the NYSDEC's assistance in matters relating to the facility is greatly appreciated. Please contact me with any questions.

Very truly yours,

O'BRIEN & GERE ENGINEERS, INC.

Kendrick Jaglal, P.E.
Senior Technical Director

Ec: Jim Hunihan, Roth Steel Corp.
Brenda D. Colella, Esq., Gilberti Stinziano Heintz & Smith, P.C.

Attachments

TABLE 1
ROTH STEEL – HIAWATHA BOULEVARD, SYRACUSE, NEW YORK
PILE POST-REMOVAL SAMPLING FIELD NOTES

Sample Location	Field Notes
PNOU-1	Debris encountered. 12 inches recovery.
PNOU-2	Debris encountered. 12 inches recovery.
PNOU-3	Sample collected through a shallow layer of water at the surface.
PNOU-4	Sample collected through a shallow layer of water at the surface. 15 inches recovery.
PNOU-5	Water pumped from sample location prior to sampling.
PNOU-6	Water pumped from sample location prior to sampling.
PNOU-7	Water pumped from sample location prior to sampling. 14 inches recovery
PNOU-8	Water pumped from sample location prior to sampling. Obstruction/debris encountered; 10 inches recovery.

NOTES:

Samples were collected on August 8, 2013.

Targeted sample depth of 16 inches was recovered unless otherwise noted.

TABLE 2
ROTH STEEL - HIAWATHA BOULEVARD, SYRACUSE, NEW YORK
PILE POST-REMOVAL SAMPLING DATA

Sample Interval	Analytes	PNOU-1		PNOU-2		PNOU-3		PNOU-4		PNOU-5		PNOU-6		PNOU-7		PNOU-8		PNOU-8 Dup	
	PCB-1242	10.0		13.0		6.5		4.8		6.2		11.0		11.0		9.4		6.4	
	PCB-1254	12.0		10.0		4.8		8.4		5.1		6.9		9.8		7.9		4.6	
	PCB-1260	3.1		2.7		0.9		1.9		0.9		1.4				1.8		1.0	
	Total PCBs	25.1		25.7		12.2		15.1		12.2		19.3		20.8		19.1		12.0	
0-4 in	Arsenic	19.0		26.3		13.6		9.2		46.5		12.0		22.3		44.4		10.5	
	Barium	1370	^	843	^	465		391	^	518	^	465	^	511		336		411	
	Cadmium	155.0		74.5		32.2		35.7		49.9		24.7		32.7		26.7		22.9	
	Lead	1640		1100		738		662		27700		700		1070		602		627	
	Selenium	15.9	B	4.1	J B	2.5	J B	3.6	JB	7.4	B	3.0	JB	2.9	JB	3.4	JB	3.3	JB
	PCB-1242	7.7		33.0		7.4		5.6		6.3		6.6		13.0		7.9		NA	
	PCB-1254	11.0		38.0		5.8		7.1		5.2		3.0		16.0		5.6		NA	
	PCB-1260	3.3		14.0		1.0	J	1.6		1.6				3.5		1.0	J	NA	
	Total PCBs	22.0		85.0		14.2		14.3		13.1		9.6		32.5		14.5		NA	
4-16 in*	Arsenic	16.8		26.5		11.0		14.1		20.1		9.9		13.5		11.1		NA	
	Barium	1700	^	1530		355	^	873	^	1330	^	488	^	836		626		NA	
	Cadmium	118.0		145.0		8.7		46.9		30.3		30.0		104.0		36.4		NA	
	Lead	1090		1410		344		776		1270		990		930		1060		NA	
	Selenium	24.7	B	7.4	B	2.6	JB	4.2	JB	3.6	JB	38.8	B	4.5	JB	2.3	JB	NA	

NOTES:

NA - Not analyzed

All data in mg/kg

* - Interval targeted was 4 to 6 inches but actual recoveries varied.

J - Result is less than the reporting limit but greater than or equal to the method detection limit

B- Analyte was detected in both the blank and the sample

^ - Instrument related quality control exceeded the control limits

DRAFT REPORT

Site Investigation Report
Roth Steel Facility
Syracuse, New York

June 2013

Table 4

Summary of Detected Constituents in Soil

Roth Steel Site - Syracuse, NY

DRAFT

	Soil Cleanup Objective Protection of Groundwater	Number of Samples Analyzed	Concentration Range Min	Max	Frequency of Detections	Frequency of Exceedances
PCBS (g/L)						
Total PCBs	3.2	48	0.036	38.3*	48	11
GLYCOLS (mg/kg)						
Diethylene glycol		35	0	0	0	
Ethylene Glycol		35	1.6	160	4	
Propylene glycol		35	0	0	0	
SEMIVOCs (mg/kg)						
2,6-Dinitrotoluene		42	0.51	0.51	1	
2-Methylnaphthalene		42	0.0091	5.55	27	
4-Chlorophenyl phenyl ether		42	0.15	0.15	1	
4-Methylphenol		42	3.1	3.1	1	
Acenaphthene	98	42	0.04	2.6	9	0
Acenaphthylene	107	42	0.075	2.4	13	0
Acetophenone		42	0.028	0.36	5	
Anthracene	1000	42	0.041	3	27	0
Benzaldehyde		42	0.4	1.1	2	
Benzo[a]anthracene	1	42	0.017	5	33	9
Benzo[a]pyrene	22	42	0.0099	3.8	35	0
Benzo[b]fluoranthene	1.7	42	0.085	5.3	30	6
Benzo[g,h,i]perylene	1000	42	0.0091	2.9	34	0
Benzo[k]fluoranthene	1.7	42	0.052	1.5	24	0
Bis(2-ethylhexyl) phthalate		42	0.38	460	29	
Butyl benzyl phthalate		42	0.28	8.1	17	
Caprolactam		42	0.95	0.95	1	
Carbazole		42	0.044	0.55	10	
Chrysene	1	42	0.016	5.5	34	11
Dibenz[a,h]anthracene	1000	42	0.026	0.59	15	0
Dibenzofuran		42	0.014	1.6	10	
Diethyl phthalate		42	0.29	1.4	2	
Dimethyl phthalate		42	0.028	16	20	
Di-n-butyl phthalate		42	0.84	2.3	3	
Di-n-octyl phthalate		42	0.066	10	24	
Fluoranthene	1000	42	0.031	9.6	34	0
Fluorene	386	42	0.018	4.4	19	0
Indeno[1,2,3-cd]pyrene	8.2	42	0.042	1.9	31	0
Naphthalene	12	42	0.02	2.65	24	0
N-Nitrosodiphenylamine		42	0.034	1.4	4	
Phenanthrene	1000	42	0.025	15	33	0
Phenol	0.33	42	0.37	0.37	1	1
Pyrene	1000	42	0.028	13	34	0

	Soil Cleanup Objective Protection of Groundwater	Number of Samples Analyzed	Concentration Range Min	Max	Frequency of Detections	Frequency of Exceedances
VOCs (mg/kg)						
1,1-Dichloroethene	0.33	35	0.002	0.2	5	0
1,2-Dibromoethane (EDB)		35	0.005	0.005	1	
1,2-Dichlorobenzene	1.1	35	0.014	0.23	2	0
1,4-Dichlorobenzene	1.8	35	0.22	0.22	1	0
2-Butanone (MEK)	0.12	35	0.003	0.17	15	2
2-Hexanone		35	0.002	0.022	4	
4-Methyl-2-pentanone (MIBK)		35	0.01	0.12	7	
Acetone	0.05	35	0.0069	0.79	27	11
Benzene	0.06	35	0.002	0.19	11	5
Carbon disulfide		35	0.001	0.016	13	
Chlorobenzene	1.1	35	1.9	1.9	1	1
cis-1,2-Dichloroethene	0.25	35	0.002	0.003	2	0
Cyclohexane		35	0.001	1.9	16	
Dichlorodifluoromethane		35	0.0043	0.046	4	
Ethylbenzene	1	35	0.001	2.3	17	3
Isopropylbenzene		35	0.002	0.41	11	
Methyl Acetate		35	0.051	0.051	1	
Methyl tert-Butyl Ether	0.93	35	0.0035	0.58	5	0
Methylcyclohexane		35	0.001	1.7	16	
Methylene Chloride	0.05	35	0.002	0.16	34	1
Styrene		35	0.0046	0.11	5	
Tetrachloroethene	1.3	35	0.001	0.052	10	0
Toluene	0.7	35	0.002	3.4	20	4
trans-1,2-Dichloroethene	0.19	35	0.025	0.025	1	0
trans-1,3-Dichloropropene		35	0.0051	0.0051	1	
Trichloroethene	0.47	35	0.03	0.03	1	0
Trichlorofluoromethane		35	0.001	0.57	8	
Vinyl chloride	0.02	35	0.001	0.057	4	2
Xylenes, total	1.6	35	0.0025	15	23	7
METALS (mg/kg)						
Aluminum		44	961	9760	44	
Antimony		44	0.6	605	43	
Arsenic	16	44	1.3	26.1	44	4
Barium	820	44	33.6	3010	44	3
Beryllium	47	44	0.023	0.93	44	0
Cadmium	7.5	44	0.217	2140	44	15
Calcium		44	12500	322000	44	
Chromium (1)	19	44	6.85	1092	44	37
Cobalt		44	1.92	20.7	44	
Copper	1720	44	10.2	5460	44	2
Iron		44	5420	116000	44	
Lead	450	44	15.5	4650	44	13
Manganese	2000	44	165	43500	44	15
Magnesium		44	140	56800	44	
Mercury	0.73	44	0.0348	11.7	43	18
Nickel	130	44	6.02	419	44	9
Potassim		44	251	1470	11	
Selenim	4	44	0.4	8.2	38	2
Silver	8.3	44	0.134	97.6	44	3

	Soil Cleanup Objective Protection of Groundwater	Number of Samples Analyzed	Concentration Range Min	Max	Frequency of Detections	Frequency of Exceedances
Sodium		44	158	3110	44	
Thallium		44	0.4	1.6	3	
Vanadium		44	4.4	1706	44	
Zinc	2480	44	41.5	32500	44	10

NOTES: *Numbers do not include duplicate analyses.*

** Two results collected in 2011 from TP-1 and TP-2 were significantly higher than the Maximum concentration presented as follows: TP-1 = 1187 mg/kg and TP-2 = 247 mg/kg*

TABLE 3
Roth Steel Site - Syracuse, NY
Site Investigation Report
Soil Analytical Data

Year	Soil Cleanup Objectives		2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2011	2011	2011
Location	Unrestricted	Protection of	B01	B06	B08	B09	B10	B12	B13	B15	B16	B18	B19	B22	B24	B27	B29	B31	B32	B33
Interval		Groundwater	(0-0.5)	(0.5-1.0)	(0-0.5)	(4.5-5.0)	(0.5-1.0)	(0-0.5)	(0.5-1.0)*	(0-0.5)	(0.5-1.0)	(0.5-1.0)	(0-0.5)	(0-0.5)	(1.5-2.0)	(0-0.5)	(0-0.5)	(0-1)	(0-1)	(0-1)
PCBS (mg/kg)																				
Aroclor 1016			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1221			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1232			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1242			0.2	0.29	0.23	0.073	0.29	0.27	0.155	0.21	U	U	0.24	U	U	U	0.076		U	U
Aroclor 1248			U	U	U	U	U	U	U	U	1.3	0.78	U	0.15	0.84	0.46	U	0.27	0.93	U
Aroclor 1254			0.14	0.2	0.26	U	0.21	0.016	0.084	0.077	0.91	0.41	0.18	0.11	0.72	0.24	0.04	0.28	0.94	0.61
Aroclor 1260			0.063	0.096	0.11	0.13	0.1	0.11	0.039	0.077	0.52	0.45	0.24	0.074	0.28	0.27	0.063	U	0.22 J	0.2 J
Aroclor 1262			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1268			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Total PCBs	0.1	3.2	**0.513**	**0.586**	**0.6**	**0.203**	**0.6**	**0.54**	**0.236**	**0.364**	**2.73**	**1.64**	**0.67**	**0.334**	**1.84**	**0.97**	**0.179**	**0.55**	**2.09** J	**0.81** J
GLYCOLS (mg/kg)																				
Diethylene glycol			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Ethylene Glycol			U	U	U	U	U	8.1	U	U	U	U	160	U	54	1.6	U			
Propylene glycol			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
SEMIVOCs (mg/kg)																				
2,4,5-Trichlorophenol			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
2,4,6-Trichlorophenol			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
2,4-Dichlorophenol			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
2,4-Dimethylphenol			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
2,4-Dinitrophenol			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
2,4-Dinitrotoluene			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
2,6-Dinitrotoluene			U	U	U	0.51 J	U	U	U	U	U	U	U	U	U	U	U			
2-Chloronaphthalene			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
2-Chlorophenol			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
2-Methylnaphthalene			1.2 J	0.23 J	U	1.7 J	0.18 J	U	5.55	0.2 J	0.33 J	U	1 J	U	0.28 J	0.21 J	1.5 J			
2-Methylphenol			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
2-Nitroaniline			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
2-Nitrophenol			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
3,3'-Dichlorobenzidine			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
3-Nitroaniline			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
4,6-Dinitro-2-methylphenol			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
4-Bromophenyl phenyl ether			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
4-Chloro-3-methylphenol			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
4-Chloroaniline			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
4-Chlorophenyl phenyl ether			U	U	U	U	U	U	0.15 J	U	U	U	U	U	U	U	U			
4-Methylphenol			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
4-Nitroaniline			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
4-Nitrophenol			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Acenaphthene	20	98	0.35 J	U	U	U	U	U	U	U	0.17 J	U	U	U	U	U	U			
Acenaphthylene	100	107	U	U	U	1.5 J	0.097 J	U	0.075 J	U	0.16 J	U	0.084 J	U	U	U	U			
Acetophenone			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Anthracene	100	1000	1.1 J	0.11 J	U	U	0.24 J	0.081 J	0.405 J	U	0.33 J	U	0.14 J	U	0.1 J	0.21 J	0.13 J			
Atrazine			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Benzaldehyde			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Benzo[a]anthracene	1	1	**3** J	0.41 J	0.21 J	U	0.64 J	0.33 J	0.795 J	0.14 J	0.83 J	0.2 J	0.33 J	U	0.2 J	0.42 J	0.3 J			
Benzo[a]pyrene	1	22	**3.4** J	0.35 J	0.24 J	**1.4** J	0.52 J	0.45 J	0.665 J	0.092 J	0.9 J	0.24 J	0.3 J	U	0.2 J	0.42 J	0.18 J			
Benzo[b]fluoranthene	1	1.7	**5.3**	0.69 J	0.32 J	U	**1.1** J	0.92 J	**1.3** J	0.14 J	**1.1** J	0.32 J	0.42 J	U	0.3 J	0.51 J	0.25 J			
Benzo[g,h,i]perylene	100	1000	2.9 J	0.22 J	0.18 J	0.4 J	0.27 J	0.25 J	0.31 J	0.099 J	0.7 J	0.29 J	0.29 J	U	0.17 J	0.29 J	0.11 J			

TABLE 3
Roth Steel Site - Syracuse, NY
Site Investigation Report
Soil Analytical Data

Year	Soil Cleanup Objectives		2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2011	2011	2011
Location	Unrestricted	Protection of	B01	B06	B08	B09	B10	B12	B13	B15	B16	B18	B19	B22	B24	B27	B29	B31	B32	B33
Interval		Groundwater	(0-0.5)	(0.5-1.0)	(0-0.5)	(4.5-5.0)	(0.5-1.0)	(0-0.5)	(0.5-1.0)*	(0-0.5)	(0.5-1.0)	(0.5-1.0)	(0-0.5)	(0-0.5)	(1.5-2.0)	(0-0.5)	(0-0.5)	(0-1)	(0-1)	(0-1)
Benzo[k]fluoranthene	0.8	1.7	U	U	0.23 BJ	U	U	U	U	0.18 J	0.43 J`	0.26 J	0.29 J	U	0.23 J	0.32 J	0.24 J			
Biphenyl			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Bis(2-chloroethoxy)methane			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Bis(2-chloroethyl)ether			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Bis(2-chloroisopropyl) ether			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Bis(2-ethylhexyl) phthalate			20	U	U	1.4 J	U	10	13	5.4	6.4	4.2	14	2.1	9.7	9.9	5.5			
Butyl benzyl phthalate			1.4 J	U	U	U	0.56 J	U	U	U	1.1 J	0.83 J	0.99 J	U	0.98 J	1.4 J	3.1			
Caprolactam			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Carbazole			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Chrysene	1	1	**3.3** BJ	0.66 BJ	0.42 BJ	**3.5** B	0.92 BJ	0.51 BJ	0.965 BJ	0.33 BJ	**1.1** BJ	0.42 BJ	0.51 BJ	0.26 BJ	0.37 BJ	0.74 BJ	0.51 BJ			
Dibenz[a,h]anthracene	0.33	1000	0.16 J	0.089 J	U	0.15 J	U	0.078 J	U	U	U	U	0.083 J	U	U	U	U			
Dibenzofuran			0.019 J	U	U	1.6 J	U	U	0.101 J	U	0.17 J	U	U	U	U	U	U			
Diethyl phthalate			U	U	U	U	U	U	U	U	U	U	U	0.29 J	U	U	1.4 J			
Dimethyl phthalate			16 `	0.19 J	0.089 J	U	0.57 J	0.42 J	0.315 J	0.096 J	0.9 J	0.9 J	0.16 J	U	U	4.9	0.37 J			
Di-n-butyl phthalate			U	U	U	U	U	U	U	U	U	U	U	U	U	U	0.99 J			
Di-n-octyl phthalate			5.4	U	U	U	U	2	3.6	2.3	2.2	2.1	3.2	1.8	1.8	3.6	2.6			
Fluoranthene	100	1000	7.1	0.41 J	0.23 J	U	1.4 J	0.42 J	2.1 J	0.24 J	2	0.35 J	0.75 J	0.086 J	0.42 J	0.79 J	0.62 J			
Fluorene	30	386	0.5 J	0.076 J	U	U	0.17 J	U	0.11 J	U	0.26 J	U	0.083 J	U	U	0.11 J	0.12 J			
Hexachlorobenzene			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Hexachlorobutadiene			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Hexachlorocyclopentadiene			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Hexachloroethane			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Indeno[1,2,3-cd]pyrene	0.5	8.2	**1.8** J	0.21 J	0.14 J	**0.53** J	0.24 J	0.24 J	0.27 J	U	0.47 J	0.212 J	0.23	U	0.16 J	0.24 J	0.086 J			
Isophorone			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Naphthalene	12	12	0.72 J	0.17 J	U	0.45 J	0.11 J	U	2.65	0.093 J	0.16 J	U	0.63 J	U	0.18 J	0.13 J	1.1 J			
Nitrobenzene			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
N-Nitrosodi-n-propylamine			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
N-Nitrosodiphenylamine			U	U	U	1.4 J	U	U	U	U	U	U	U	U	U	U	U			
Pentachlorophenol	0.8	0.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Phenanthrene	100	1000	4	0.41 J	0.15 J	U	1 J	0.19 J	0.7 J	0.18 J	2	0.21 J	0.64 J	U	0.35 J	1 J	0.71 J			
Phenol	0.33	0.33	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Pyrene	100	1000	5.6	0.98 J	0.37 J	U	1.4 J	0.48 J	1.6 J	0.22 J	1.9	0.35 J	0.69 J	0.087 J	0.36 J	1.7 J	0.68 J			
VOCs (mg/kg)																				
1,1,1-Trichloroethane	0.68	0.68	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
1,1,2,2-Tetrachloroethane			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
1,1,2-Trichloroethane			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
1,1,2-Trichlorotrifluoroethane			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
1,1-Dichloroethane	0.27	0.27	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
1,1-Dichloroethene	0.33	0.33	U	U	U	U	U	U	U	0.002 J	U	U	U	U	U	U	U			
1,2,4-Trichlorobenzene			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
1,2-Dibromo-3-chloropropane			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
1,2-Dibromoethane (EDB)			0.005 J	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
1,2-Dichlorobenzene	1.1	1.1	U	U	U	U	U	U	0.014 J	U	U	U	U	U	U	U	U			
1,2-Dichloroethane	0.02	0.02	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
1,2-Dichloroethene, Total			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
1,2-Dichloropropane			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
1,3-Dichlorobenzene	2.4	2.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
1,4-Dichlorobenzene	1.8	1.8	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
2-Butanone (MEK)	0.12	0.12	**0.15**	U	U	0.01 J	U	U	U	U	U	U	0.04	0.038	0.086	U	0.1			

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Year	Soil Cleanup Objectives		2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2011	2011	2011
Location	Unrestricted	Protection of	B01	B06	B08	B09	B10	B12	B13	B15	B16	B18	B19	B22	B24	B27	B29	B31	B32	B33
Interval		Groundwater	(0-0.5)	(0.5-1.0)	(0-0.5)	(4.5-5.0)	(0.5-1.0)	(0-0.5)	(0.5-1.0)*	(0-0.5)	(0.5-1.0)	(0.5-1.0)	(0-0.5)	(0-0.5)	(1.5-2.0)	(0-0.5)	(0-0.5)	(0-1)	(0-1)	(0-1)
2-Hexanone			0.002 J	U	U	U	U	U	U	U	U	U	U	U	0.009 J	U	0.022 J			
4-Methyl-2-pentanone (MIBK)			0.093	U	U	U	U	U	U	0.021 J	U	U	0.018 J	0.056	0.01 J	U	0.02 J			
Acetone	0.05	0.05	0.31	0.034	U	0.059	U	0.018 J	0.19	0.019 BJ	U	0.007 J	0.14 B	0.48 B	0.31 B	0.008 BJ	0.25 B			
Benzene	0.06	0.06	U	U	U	0.002 J	0.12	U	U	0.002 J	U	U	0.015	0.066 J	0.19	U	0.031			
Bromodichloromethane			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Bromoform			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Bromomethane			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Carbon disulfide			0.001 J	0.001 J	U	0.006	0.002 J	U	0.006 J	0.002 J	0.001 J	0.001 J	0.002 J	0.003 J	0.016	U	0.002 J			
Carbon Tetrachloride	0.76	0.76	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Chlorobenzene	1.1	1.1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Chlorodibromomethane			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Chloroethane			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Chloroform	0.37	0.37	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Chloromethane			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
cis-1,2-Dichloroethene	0.25	0.25	U	U	U	U	U	U	U	U	0.003 J	U	U	0.002 J	U	U	U			
cis-1,3-Dichloropropene			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Cyclohexane			0.002	U	U	0.005 J	0.15	U	U	0.003 J	0.001 J	0.002 J	0.004 J	0.049	0.023	U	0.011			
Dichlorodifluoromethane			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Ethylbenzene	1	1	U	U	U	0.003	0.021	U	0.112	0.018	0.001 J	U	0.13	2.3	0.16	U	1.1			
Isopropylbenzene			U	U	U	U	U	U	0.051	0.002 J	U	U	0.012	0.028	0.009	U	0.026			
Methyl Acetate			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Methyl tert-Butyl Ether	0.93	0.93	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Methylcyclohexane			0.001 J	U	U	0.022	0.057	U	U	0.002 J	U	0.002 J	0.003 J	0.026	0.013	0.01	0.014			
Methylene Chloride	0.05	0.05	0.013	0.015	0.006	0.004 J	U	0.007	0.028 J	0.008	0.002 J	0.007	0.008	0.015	0.015	0.01	0.019			
Styrene			0.005	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Tetrachloroethene	1.3	1.3	0.002 J	U	U	U	0.004 J	U	0.052	U	0.008	0.002 J	0.002 J	0.005	0.001 J	0.001 J	U			
Toluene	0.7	0.7	0.06	U	U	U	0.14 J	0.002 J	0.097	0.3 B	0.002 B	U	0.25	3.4	3.1	0.002 BJ	0.97			
trans-1,2-Dichloroethene	0.19	0.19	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
trans-1,3-Dichloropropene			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Trichloroethene	0.47	0.47	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U			
Trichlorofluoromethane			0.001 J	U	U	U	U	U	U	0.009	U	U	U	U	U	U	U			
Vinyl chloride	0.02	0.02	U	U	U	U	U	U	U	U	0.001 J	U	U	U	U	U	U			
Xylenes, total	0.26	1.6	0.14	U	U	U	1.8	0.004 J	15	0.094	0.007 J	U	1.9	1.7	3.6	0.004 J	7.5			
METALS (mg/kg)																				
Aluminum			2140	3200	2620	2830	2520	1840	5835	1180	3080	2370	2190	1510	4340	961	1680	5360	7330	8510
Antimony			1.8	2.4	1.2	6.3	1.9	2.1	605	1	1.7	1.9	126	2	3.7	2	2	0.88 J	4.1 J	0.92 J
Arsenic	13	16	2.9	3.2	3	26.1	5	3.7	7.15	1.9	8.3	3.1	5.4	3	3.9	1.3	2.7	6.6	8.7	9.8
Barium	350	820	112	76.2	112	3010	176	105	86	95.7	210	90	57.4	107	81.1	33.6	79.9	101	101	159
Beryllium	7.2	47	0.23	0.33	0.32	0.23	0.28	0.24	0.3	0.22	0.28	0.26	0.12	0.22	0.23	0.11	0.19	0.54	0.37	0.93
Cadmium	2.5	7.5	2140	1.5	1.6	23.6	2.1	2.4	2.05	1.1	11	2.2	2	2.3	3.1	1.5	3.5	3.1	3.8	22.3
Calcium			187000	237000	222000	109000	233000	261000	166500	260000	194000	226000	53600	217000	270000	82000	144000	195000 B	107000 B	111000 B
Chromium (1)	1	19	30.9	34.7	25.6	208	32.3	27.7	185	13.7	62.6	60.7	35.6	36.3	32.3	17.8	33.7	26.1	94.7	94.6
Cobalt			3.8	3.6	3.9	11.6	5.3	3.2	8.6	2.2	6.2	4.3	4.1	3.8	5	7.2	4.6	6.8	10.1	6.5
Copper	50	1720	98.1	89.2	52.1	241	219	108	111	52.2	5460	241	77.9	78.2	150	48	96.8	84.3	472	138
Iron			30400	15400	13800	82300	21800	29300	40700	17500	40700	43900	38000	46200	25300	22300	55000	13400 B	50200 B	9160 B
Lead	63	450	169	119	72.6	1690	330	151	374	58.9	300	124	830	151	191	389	141	171	216	328
Manganese	1600	2000	29000	43500	42200	10200	33000	26100	24000	33900	33200	27000	6780	25400	9030	11800	29000	341 B	643 B	267 B
Magnesium			234	219	218	3600	253	257	525	173	343	344	222	338	229	140	308	9100 B	11300 B	5930 B
Mercury	0.18	0.73	0.476	0.105	0.164	6.4	0.351	0.331	2.38	0.089	2.2	0.38	0.186	0.121	0.416	0.412	0.2	0.58	U	2.9

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Year	Soil Cleanup Objectives		2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2008	2011	2011	2011
Location	Unrestricted	Protection of	B01	B06	B08	B09	B10	B12	B13	B15	B16	B18	B19	B22	B24	B27	B29	B31	B32	B33
Interval		Groundwater	(0-0.5)	(0.5-1.0)	(0-0.5)	(4.5-5.0)	(0.5-1.0)	(0-0.5)	(0.5-1.0)*	(0-0.5)	(0.5-1.0)	(0.5-1.0)	(0-0.5)	(0-0.5)	(1.5-2.0)	(0-0.5)	(0-0.5)	(0-1)	(0-1)	(0-1)
Nickel	30	130	24.8	21.9	20.4	**171**	**43.1**	26.5	**101**	11.4	**51.7**	**33.2**	29.2	25.8	**31.7**	22.1	26.4	28.9	**84.6**	27.8
Potassium			647	947	1120	1310	829	558	700	486	673	621	336	533	474	347	498	838	536	1470
Selenium	3.9	4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Silver	2	8.3	0.49 B	0.35	0.25	0.92	0.41	0.54	0.725	0.74	1	0.75	0.86	**6.4**	1.2	0.33	1.1	U	U	**11.3**
Sodium			500	348	279	2120	402	332	495	298	413	286	275	345	386	184	382	290	316	694
Thallium			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Vanadium			8.5	47.1	11.9	19.1	9.1	8.3	25.5	6.4	36.6	44.8	11.8	9.4	10.9	4.4	8	37.1	27.6	27.5
Zinc	109	2480	**1030**	**367**	**298**	**21400**	**469**	**636**	**466**	**586**	**1520**	**611**	**642**	**699**	**709**	**367**	**1260**	**572** B	**944** B	**330** B

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Year	Soil Cleanup Objectives		2011	2011	2011	2011	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010
Location	Unrestricted	Protection of	B34	B34 Dup	B35	B36	B37	B37	B37	B38	B39	B40	B41	B42	B43	B44	B45	B46	B46 Dup	B47	B48
Interval		Groundwater	(0-1)	(0-1)	(0-1)	(0-1)	(0 - 2)	(2 - 4)	(5 - 7)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)
PCBS (mg/kg)																					
Aroclor 1016			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1221			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1232			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1242			U	U	U	U	0.42	U	0.071	1	10	0.042	31	0.22	0.31	5.2	0.12	17	23	2.1	1.8
Aroclor 1248			U	U	0.091 J	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1254			0.23 J	0.22 J	0.34	U	0.1	U	U	0.34	3.4	0.017 J	7.3	0.15	0.12	1.2	0.049	5.9	8.1	U	1.4
Aroclor 1260			U	U	U	U	U	3.4	U	0.25	1.8	U	U	0.14	U	U	U	2.5	3.7	U	U
Aroclor 1262			U	U	U	U	U	U	0.2	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1268			U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Total PCBs	0.1	3.2	**0.23** J	**0.22** J	**0.431** J	U	**0.52**	**3.4**	**0.271**	**1.9**	**15.2**	0.042 J	**38.3**	**0.51**	**0.43**	**6.4**	**0.169**	**25.4**	**35.11**	**2.1**	**3.2**
GLYCOLS (mg/kg)																					
Diethylene glycol							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Ethylene Glycol							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Propylene glycol							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
SEMIVOCs (mg/kg)																					
2,4,5-Trichlorophenol							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2,4,6-Trichlorophenol							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2,4-Dichlorophenol							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2,4-Dimethylphenol							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2,4-Dinitrophenol							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2,4-Dinitrotoluene							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2,6-Dinitrotoluene							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Chloronaphthalene							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Chlorophenol							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Methylnaphthalene							2.3 J	0.26 J	0.17 J	0.15 J	0.18 J	0.024 J	0.74 J	U	U	U	0.099 J	0.69 J	0.8 J	0.12 J	0.32 J
2-Methylphenol							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Nitroaniline							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Nitrophenol							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
3,3'-Dichlorobenzidine							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
3-Nitroaniline							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4,6-Dinitro-2-methylphenol							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Bromophenyl phenyl ether							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Chloro-3-methylphenol							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Chloroaniline							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Chlorophenyl phenyl ether							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Methylphenol							U	U	U	U	U	U	3.1 J	U	U	U	U	U	U	U	U
4-Nitroaniline							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Nitrophenol							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Acenaphthene	20	98					U	0.3 J	U	U	U	U	0.18 J	U	U	U	U	U	0.3 J	U	0.33 J
Acenaphthylene	100	107					U	1.4 J	0.2 J	U	U	U	0.14 J	U	U	U	U	U	0.29 J	U	0.18 J
Acetophenone							U	U	U	U	0.16 J	0.028 J	0.35 J	U	U	U	U	U	0.36 J	0.046 J	U
Anthracene	100	1000					0.22 J	2	0.38 J	U	0.24 J	U	0.39 J	U	0.046 J	U	0.13 J	0.74 J	0.67 J	0.044 J	0.84 J
Atrazine							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzaldehyde							U	U	U	0.4	U	U	U	1.1	U	U	U	U	U	U	U
Benzo[a]anthracene	1	1					0.57 J	**4.7**	**1.3** J	0.51 J	0.71 J	0.017 J	**1.2** J	0.59 J	0.26 J	0.11 J	0.3 J	**2.3** J	**2.2** J	0.17 J	**2.6**
Benzo[a]pyrene	1	22					0.41 J	**3.7**	**1.2** J	0.41 J	0.69 J	0.0099 J	0.93 J	0.38 J	0.25 J	0.079 J	0.22 J	**1.9** J	**2** J	0.13 J	**2.3**
Benzo[b]fluoranthene	1	1.7					0.48 J	**3.5**	**1.2** J	0.49 J	0.71 J	U	**1.1** J	U	0.3 J	0.085 J	0.22 J	**2.2** J	**1.8** J	U	**2.7**
Benzo[g,h,i]perylene	100	1000					0.25 J	2.5	0.74 J	0.24 J	0.51 J	0.0091 J	0.77 J	U	0.26 J	0.05 J	0.13 J	1.5 J	1.7 J	0.12 J	1.4 J

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Location	Unrestricted	Protection of	B34	B34 Dup	B35	B36	B37	B37	B37	B38	B39	B40	B41	B42	B43	B44	B45	B46	B46 Dup	B47	B48
Interval		Groundwater	(0-1)	(0-1)	(0-1)	(0-1)	(0 - 2)	(2 - 4)	(5 - 7)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)
Benzo[k]fluoranthene	0.8	1.7					0.17 J	**1.5** J	0.47 J	0.17 J	0.31 J	U	0.43 J	U	0.13 J	0.052 J	0.14 J	**0.81** J	**1** J	U	**0.84** J
Biphenyl							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Bis(2-chloroethoxy)methane							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Bis(2-chloroethyl)ether							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Bis(2-chloroisopropyl) ether							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Bis(2-ethylhexyl) phthalate							2.9	1.3	U	3.2 J	11	0.83	52	U	0.79 J	1.4	2.8	57	74	5.5	13
Butyl benzyl phthalate							U	U	U	U	5.9	U	2.5 J	U	0.43 J	U	0.28 J	7.6 J	8.1	1.3	1.2 J
Caprolactam							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Carbazole							U	0.55 J	0.093 J	U	0.11 J	U	0.21 J	U	0.044 J	U	0.048 J	U	0.37 J	U	0.33 J
Chrysene	1	1					0.52 J	**4.3**	**1.2** J	0.47 J	0.74 J	0.016 J	**1.2** J	U	0.31 J	0.1 J	0.28 J	**2** J	**2.2** J	0.18 J	**2.8**
Dibenz[a,h]anthracene	0.33	1000					U	**0.6** J	0.21 J	U	0.14 J	U	U	U	0.11 J	U	0.048 J	U	U	U	**0.41** J
Dibenzofuran							U	0.45 J	U	U	U	U	0.14 J	U	U	U	U	U	U	U	0.19 J
Diethyl phthalate							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Dimethyl phthalate							0.23 J	U	U	U	U	0.028 J	0.78 J	U	0.87 J	U	0.074 J	U	0.61 J	U	0.89 J
Di-n-butyl phthalate							U	U	U	U	0.84 J	U	U	U	U	U	U	U	U	U	2.3
Di-n-octyl phthalate							0.42 J	U	U	0.6 J	0.74 J	0.082 J	10	U	U	0.2 J	0.066 J	2.5 J	3.7 J	0.51 J	1.2 J
Fluoranthene	100	1000					1 J	8.4	2 J	0.88 J	1.3 J	0.031 J	2.3 J	0.65 J	0.52 J	0.2 J	0.67 J	4 J	4.3 J	0.32 J	5.3
Fluorene	30	386					0.16 J	0.97 J	0.15 J	U	U	U	0.36 J	U	U	U	0.041 J	U	0.46 J	0.043 J	0.43 J
Hexachlorobenzene							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachlorobutadiene							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachlorocyclopentadiene							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachloroethane							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Indeno[1,2,3-cd]pyrene	0.5	8.2					0.2 J	2	**0.62** J	0.23 J	0.47 J	U	**0.55** J	U	0.2 J	0.042 J	0.12 J	**1.2** J	**1.1**	0.092 J	**1.2** J
Isophorone							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Naphthalene	12	12					1.9 J	0.43 J	0.16 J	U	0.14 J	0.021 J	0.39 J	U	U	U	0.048 J	U	0.52 J	0.046 J	0.28 J
Nitrobenzene							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
N-Nitrosodi-n-propylamine							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
N-Nitrosodiphenylamine							U	U	U	U	U	U	0.33 J	U	U	U	U	U	U	U	U
Pentachlorophenol	0.8	0.8					U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Phenanthrene	100	1000					0.83 J	6.1	1.2 J	0.56 J	0.82 J	0.025	1.8 J	0.52 J	0.32 J	0.12 J	0.44 J	2.7 J	3 J	0.25 J	3
Phenol	0.33	0.33					U	U	U	U	U	U U	**0.37** J	U	U	U	U	U	U	U	U
Pyrene	100	1000					0.95 J	7.7	1.7 J	0.77 J	1.2 J	0.028	2.1 J	0.55 J	0.43 J	0.17 J	0.58 J	3.6 J	3.8 J	0.34 J	5.2
VOCs (mg/kg)																					
1,1,1-Trichloroethane	0.68	0.68					U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1,2,2-Tetrachloroethane							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1,2-Trichloroethane							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1,2-Trichlorotrifluoroethane							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-Dichloroethane	0.27	0.27					U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-Dichloroethene	0.33	0.33					U	U	U	0.0091	0.016	0.012	0.2	U	U	U	U	U	U	U	U
1,2,4-Trichlorobenzene							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dibromo-3-chloropropane							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dibromoethane (EDB)							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichlorobenzene	1.1	1.1					U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichloroethane	0.02	0.02					U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichloroethene, Total							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichloropropane							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,3-Dichlorobenzene	2.4	2.4					U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,4-Dichlorobenzene	1.8	1.8					U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Butanone (MEK)	0.12	0.12					U	U	U	U	0.0036 J	U	**0.17** J	U	0.0061 J	0.003 J	U	0.0073 J	0.015 J	U	0.008 J

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Location	Unrestricted	Protection of	B34	B34 Dup	B35	B36	B37	B37	B37	B38	B39	B40	B41	B42	B43	B44	B45	B46	B46 Dup	B47	B48
Interval		Groundwater	(0-1)	(0-1)	(0-1)	(0-1)	(0 - 2)	(2 - 4)	(5 - 7)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)
2-Hexanone							U	U	U	U	U	U	0.022	U	U	U	U	U	U	U	U
4-Methyl-2-pentanone (MIBK)							U	U	U	U	U	U	0.12 J	U	U	U	U	U	U	U	U
Acetone	0.05	0.05					U	U	0.018 J	0.0069 J	0.034	0.011 J	0.79	U	0.05	0.03	U	0.039	0.073	0.0095 J	0.06
Benzene	0.06	0.06					0.1 J	U	U	U	U	U	0.033 J	U	U	U	U	0.0026 J	0.0049 J	U	U
Bromodichloromethane							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Bromoform							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Bromomethane							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Carbon disulfide							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Carbon Tetrachloride	0.76	0.76					U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Chlorobenzene	1.1	1.1					U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Chlorodibromomethane							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Chloroethane							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Chloroform	0.37	0.37					U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Chloromethane							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,2-Dichloroethene	0.25	0.25					U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,3-Dichloropropene							U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Cyclohexane							1.9	U	0.0037 J	U	0.032	U	0.023 J	U	U	U	U	0.0065	U	U	U
Dichlorodifluoromethane							0.046	U	U	U	0.0069	0.0043	0.045	U	U	U	U	U	U	U	U
Ethylbenzene	1	1					1.2	U	U	U	0.019	0.0035	0.077	U	U	U	U	0.019	0.029	U	U
Isopropylbenzene							0.41	U	U	U	0.0036 J	U	U	U	U	U	U	0.0034 J	0.0062 J	U	U
Methyl Acetate							0.051	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Methyl tert-Butyl Ether	0.93	0.93					0.04	0.45	0.067	U	U	U	U	U	U	U	U	U	U	U	U
Methylcyclohexane							1.7	U	0.0029 J	U	0.023	U	U	U	U	U	U	0.0051 J	0.0087 J	U	U
Methylene Chloride	0.05	0.05					0.021	U	0.009	0.018	0.012	0.023	0.16	0.018	0.016	0.012	0.014	0.024	0.035	0.019	0.018
Styrene							0.026	U	U	U	U	0.011	0.11	U	U	U	U	U	U	U	U
Tetrachloroethene	1.3	1.3					0.014	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Toluene	0.7	0.7					1.1	U	U	0.0026	0.033	0.011	0.25	U	U	U	0.0024 J	0.0093	0.017	U	0.0035
trans-1,2-Dichloroethene	0.19	0.19					0.025	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trans-1,3-Dichloropropene							0.0051	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Trichloroethene	0.47	0.47					0.03	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Trichlorofluoromethane							0.57	U	U	0.0038 J	0.11	0.028	0.035 J	U	U	U	0.0025 J	U	U	U	U
Vinyl chloride	0.02	0.02					0.036	U	U	U	U	U	0.02 J	U	U	U	U	U	U	U	U
Xylenes, total	0.26	1.6					9.8	U	U	0.0053 J	0.099	0.013	0.43	U	U	U	0.0025 J	0.065	0.11	0.0026 J	0.0075 J
METALS (mg/kg)																					
Aluminum			5660	5600	5170	5200	2020	5730	5910	3080	4930	3590	9760	3590	6900	3810	2050	9080	6700	2630	4910
Antimony			1.1 J		0.75 J		2.9 J	4.8 J	12.8 J	19.1	9.3 J	1.0 J	21.1 J	1.4 J	2.5 J	7.9 J	0.6	13.0 J	15.8 J	1.3 J	6.8 J
Arsenic	13	16	12.5	9.1	9.8	5.2	3.0	10.9	16.1	4.8	8.9	2.7	8.2	3.8	6.0	4.7	3.2	8.6	9.5	3.4	6.1
Barium	350	820	116	107	173	70.7	86.8	481	564	148	406	114	660	154	211	194	53.7	417	466	140	430
Beryllium	7.2	47	0.64	0.52	0.58	0.39	0.287	0.309	0.468	0.282	0.198 J	0.396	0.306 J	0.311	0.358	0.285	0.343	0.193 J	0.233 J	0.310	0.210 J
Cadmium	2.5	7.5	14.8	14.7	26.1	0.51	1.91	4.34	3.64	4.94	22.9	0.789	27.4	2.66	3.49	3.83	0.492	32.2	32.7	1.90	7.80
Calcium			135000 B	113000 B	79800 B	189000 B	246000	46800	111000	206000	127000	322000	171000	206000	176000	188000	293000	84700	123000	257000	105000
Chromium (1)	1	19	60.6	59.5	1092	13.2	35.2	52.1	44.3	43.2	98.8	16.7	120	22.6	34.6	78.0	23.6	87.5	102	69.8	101
Cobalt			4.5	4.7	5.1	4.4	4.39	8.11	8.39	5.72	17.3	3.25	18.1	4.93	5.77	6.00	3.04	14.6	20.7	4.21	8.58
Copper	50	1720	133	726	127	47.6	131	506	473	194	513	26.8	819	99.6	1230	554	24.0	1070	735	141	1290
Iron			8600 B	7800 B	9110 B	13400 B	46400	23900	38100	34700	94900	10300	57600	18600	20300	32900	7330	83600	71200	17300	81100
Lead	63	450	167	172	284	111	212	639	650	873	1130	42.0	1370	275	120	357	28.5	1050	1050	167	645
Manganese	1600	2000	259 B	246 B	218 B	481 B	386	330	553	399	663	201	665	362	333	371	222	586	584	246	785
Magnesium			11200 B	10200 B	6380 B	13600 B	33500	10800	39100	30900	24600	56800	21500	26600	22600	21300	19400	9530	11300	27700	8660
Mercury	0.18	0.73	1.5	1.4	1.9	0.23	0.229	0.6	0.395	0.913	2.39	0.0613	6.77	0.255	0.0469	0.144	0.0348	2.64	3.77	0.314	1.33

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Location	Unrestricted	Protection of	B34	B34 Dup	B35	B36	B37	B37	B37	B38	B39	B40	B41	B42	B43	B44	B45	B46	B46 Dup	B47	B48
Interval		Groundwater	(0-1)	(0-1)	(0-1)	(0-1)	(0 - 2)	(2 - 4)	(5 - 7)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)	(0-1)
Nickel	30	130	19.3	18.9	22.4	13.2	**31.1**	**119**	**320**	**41.8**	**163**	13.1	**116**	**40.9**	**30.4**	**49.8**	12.1	**163**	**163**	20.4	**81.8**
Potassium			699	787	826	779	580	986	1120	764	580	1030	929	874	800	505	765	597	777	749	632
Selenium	3.9	4	U		U	U	U	0.6	1.2	0.4	U	U	U	U	0.9 J	U	0.4	0.6	U	0.4	U
Silver	2	8.3	**6.3**	**6.4**	**12.8**	U	0.779	1.43	1.36	0.797	1.53	0.188 J	**4.40**	0.648	0.733	0.774	0.134 J	**97.6**	**3.01**	1.28	1.57
Sodium			738	767	691	590	336	946	838	440	733	305	1860	342	299	603	158 J	1110	1180	623	898
Thallium			1.6 J	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	0.8	U	U
Vanadium			28.7	27	24.7	1706	9.19	18.7	12.3	13.1	23.8	13.0	24.6	20.3	98.6	11.2	30.1	23.2	20.7	14.0	16.3
Zinc	109	2480	**253** B	**251** B	**353** B	75.3 B	**979**	**891**	**1470**	**1440**	**4270**	**235**	**12800**	**837**	**1110**	**2420**	**185**	**8910**	**7060** B	**6920**	**2290**

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Year	Soil Cleanup Objectives		2010	2010	2010	2010	2010	2010	2010	2013	2013	2013	2013	2011	2011
Location	Unrestricted	Protection of	MW-10	MW-10	MW-11	MW-11	MW-12	MW-12	MW-13	MW-16	MW-16	MW-17	MW-17	TP-1	TP-2
Interval		Groundwater	(0-2)	(6-8)	0-2)	(10-12)	(4-6)	(8-10)	(2-4)	(0-2)	(4-6)	(0-2)	(6-8)	(0-4)	(4-8)
PCBS (mg/kg)															
Aroclor 1016			U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1221			U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1232			U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1242			4.9	0.19	0.4	U	0.41 J	0.05	0.56	18	6.8	0.28	U	1100	190
Aroclor 1248			U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1254			0.88	0.11	0.14	U	0.86	U	0.051	10	4	0.18 J	1.1	87 J	57
Aroclor 1260			U	0.12	0.51	U	2.9	0.18	U	2.8	1.2	U	0.59	U	U
Aroclor 1262			U	U	U	0.036	U	U	U	U	U	U	U	U	U
Aroclor 1268			U	U	U	U	U	U	U	U	U	U	U	U	U
Total PCBs	0.1	3.2	**5.78**	**0.42**	**1.05**	0.036	**3.76** J	**0.23**	**0.611**	**30.8**	**12**	**0.46** J	**1.69**	**1187** J	**247**
GLYCOLS (mg/kg)															
Diethylene glycol			U	U	8.8	U	180	U	U						
Ethylene Glycol			U	U	U	U	U	U	U						
Propylene glycol			U	U	U	U	U	U	U						
SEMIVOCs (mg/kg)															
2,4,5-Trichlorophenol			U	U	U	U	U	U	U						
2,4,6-Trichlorophenol			U	U	U	U	U	U	U						
2,4-Dichlorophenol			U	U	U	U	U	U	U						
2,4-Dimethylphenol			U	U	U	U	U	U	U						
2,4-Dinitrophenol			U	U	U	U	U	U	U						
2,4-Dinitrotoluene			U	U	U	U	U	U	U						
2,6-Dinitrotoluene			U	U	U	U	U	U	U						
2-Chloronaphthalene			U	U	U	U	U	U	U						
2-Chlorophenol			U	U	U	U	U	U	U						
2-Methylnaphthalene			1.8 J	0.15 J	U	0.06 J	0.1 J	0.0091 J	U						
2-Methylphenol			U	U	U	U	U	U	U						
2-Nitroaniline			U	U	U	U	U	U	U						
2-Nitrophenol			U	U	U	U	U	U	U						
3,3'-Dichlorobenzidine			U	U	U	U	U	U	U						
3-Nitroaniline			U	U	U	U	U	U	U						
4,6-Dinitro-2-methylphenol			U	U	U	U	U	U	U						
4-Bromophenyl phenyl ether			U	U	U	U	U	U	U						
4-Chloro-3-methylphenol			U	U	U	U	U	U	U						
4-Chloroaniline			U	U	U	U	U	U	U						
4-Chlorophenyl phenyl ether			U	U	U	U	U	U	U						
4-Methylphenol			U	U	U	U	U	U	U						
4-Nitroaniline			U	U	U	U	U	U	U						
4-Nitrophenol			U	U	U	U	U	U	U						
Acenaphthene	20	98	U	0.13 J	2.6	0.24 J	U	0.04 J	U						
Acenaphthylene	100	107	U	0.13 J	2.4	0.11 J	U	U	0.077 J						
Acetophenone			0.33 J	U	U	U	U	U	U						
Anthracene	100	1000	0.18 J	0.64 J	3	0.55	0.099 J	0.041 J	0.066 J						
Atrazine			U	U	U	U	U	U	U						
Benzaldehyde			U	U	U	U	U	U	U						
Benzo[a]anthracene	1	1	U	**3.5**	**5**	**1.2**	0.4 J	0.2 J	0.75 J						
Benzo[a]pyrene	1	22	0.49 J	**3.1**	**3.8**	0.91	0.29 J	0.12 J	0.7 J						
Benzo[b]fluoranthene	1	1.7	U	**3.7**	**4.5**	0.97	0.4 J	0.16 J	**1.1** J						
Benzo[g,h,i]perylene	100	1000	0.63 J	1.8 J	2.5	0.65	0.22 J	0.15 J	0.59 J						

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Year	Soil Cleanup Objectives		2010	2010	2010	2010	2010	2010	2010	2013	2013	2013	2013	2011	2011
Location	Unrestricted	Protection of	MW-10	MW-10	MW-11	MW-11	MW-12	MW-12	MW-13	MW-16	MW-16	MW-17	MW-17	TP-1	TP-2
Interval		Groundwater	(0-2)	(6-8)	0-2)	(10-12)	(4-6)	(8-10)	(2-4)	(0-2)	(4-6)	(0-2)	(6-8)	(0-4)	(4-8)
Benzo[k]fluoranthene	0.8	1.7	U	**1.4** J	U	0.26 J	0.18 J	0.054 J	0.43 J						
Biphenyl			U	U	U	U	U	U	U						
Bis(2-chloroethoxy)methane			U	U	U	U	U	U	U						
Bis(2-chloroethyl)ether			U	U	U	U	U	U	U						
Bis(2-chloroisopropyl) ether			U	U	U	U	U	U	U						
Bis(2-ethylhexyl) phthalate			460	5.1	3.5	0.38	18	U	U						
Butyl benzyl phthalate			U	0.59	U	U	1.2	U	U						
Caprolactam			U	0.95	U	U	U	U	U						
Carbazole			U	0.23 J	0.15 J	0.16 J	U	U	U						
Chrysene	1	1	U	**3.5**	**5.5**	**1.2**	0.42 J	0.27	0.81 J						
Dibenz[a,h]anthracene	0.33	1000	U	**0.59** J	**0.58** J	0.11 J	U	0.026 J	0.27 J						
Dibenzofuran			U	0.13 J	1.2 J	0.18 J	U	0.014 J	U						
Diethyl phthalate			U	U	U	U	U	U	U						
Dimethyl phthalate			0.8 J	U	U	0.073 J	U	U	U						
Di-n-butyl phthalate			U	U	U	U	U	U	U						
Di-n-octyl phthalate			3.6	0.16 J	U	U	4.8	U	U						
Fluoranthene	100	1000	0.99 J	5.1	9.6	2.5	0.84 J	0.71	0.55 J						
Fluorene	30	386	0.23 J	0.27 J	4.4	0.33	U	0.018 J	U						
Hexachlorobenzene			U	U	U	U	U	U	U						
Hexachlorobutadiene			U	U	U	U	U	U	U						
Hexachlorocyclopentadiene			U	U	U	U	U	U	U						
Hexachloroethane			U	U	U	U	U	U	U						
Indeno[1,2,3-cd]pyrene	0.5	8.2	0.32 J	**1.7** J	**1.9**	0.45 0	0.2 J	0.095 J	**0.55** J						
Isophorone			U	U	U	U	U	U	U						
Naphthalene	12	12	0.68 J	0.14 J	U	0.15 J	U	0.02 J	0.11 J						
Nitrobenzene			U	U	U	U	U	U	U						
N-Nitrosodi-n-propylamine			U	U	U	U	U	U	U						
N-Nitrosodiphenylamine			0.4 J	U	U	U	U	0.034 J	U						
Pentachlorophenol	0.8	0.8	U	U	U	U	U	U	U						
Phenanthrene	100	1000	0.92 J	2.3	15	2.6 0	0.62 J	0.11 J	0.2 J						
Phenol	0.33	0.33	U	U	U	U	U	U	U						
Pyrene	100	1000	1.9 J	4.1	13	2.5 0	0.74 J	0.65	0.4 J						
VOCs (mg/kg)															
1,1,1-Trichloroethane	0.68	0.68	U	U	U	U	U	U	U	U			U		
1,1,2,2-Tetrachloroethane			U	U	U	U	U	U	U	U			U		
1,1,2-Trichloroethane			U	U	U	U	U	U	U	U			U		
1,1,2-Trichlorotrifluoroethane			U	U	U	U	U	U	U	U			U		
1,1-Dichloroethane	0.27	0.27	U	U	U	U	U	U	U	U			U		
1,1-Dichloroethene	0.33	0.33	U	U	U	U	U	U	U	U			U		
1,2,4-Trichlorobenzene			U	U	U	U	U	U	U	U			U		
1,2-Dibromo-3-chloropropane			U	U	U	U	U	U	U	U			U		
1,2-Dibromoethane (EDB)			U	U	U	U	U	U	U	U			U		
1,2-Dichlorobenzene	1.1	1.1	U	U	U	U	U	U	U	U			**0.23**		
1,2-Dichloroethane	0.02	0.02	U	U	U	U	U	U	U	U			U		
1,2-Dichloroethene, Total			U	U	U	U	U	U	U	U			U		
1,2-Dichloropropane			U	U	U	U	U	U	U	U			U		
1,3-Dichlorobenzene	2.4	2.4	U	U	U	U	U	U	U	U			U		
1,4-Dichlorobenzene	1.8	1.8	U	U	U	U	U	U	U	U			0.22		
2-Butanone (MEK)	0.12	0.12	U	0.0036 J	U	0.025 J	U	0.0076 J	U	U			U		

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TABLE 3
Roth Steel Site - Syracuse, NY
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Soil Analytical Data

Year	Soil Cleanup Objectives		2010	2010	2010	2010	2010	2010	2010	2013	2013	2013	2013	2011	2011
Location	Unrestricted	Protection of	MW-10	MW-10	MW-11	MW-11	MW-12	MW-12	MW-13	MW-16	MW-16	MW-17	MW-17	TP-1	TP-2
Interval		Groundwater	(0-2)	(6-8)	0-2)	(10-12)	(4-6)	(8-10)	(2-4)	(0-2)	(4-6)	(0-2)	(6-8)	(0-4)	(4-8)
2-Hexanone			U	U U	U	U	U	U	U	U			U		
4-Methyl-2-pentanone (MIBK)			U	U U	U	U	U	U	U	U			U		
Acetone	0.05	0.05	0.0085 J	0.024 J	U	**0.16**	0.019 J	**0.053**	U	U			U		
Benzene	0.06	0.06	U	U	U	U	U	U	U	U			**0.15**		
Bromodichloromethane			U	U	U	U	U	U	U	U			U		
Bromoform			U	U	U	U	U	U	U	U			U		
Bromomethane			U	U	U	U	U	U	U	U			U		
Carbon disulfide			U	U	U	U	U	0.0034 J	U	U			U		
Carbon Tetrachloride	0.76	0.76	U	U	U	U	U	U	U	U			U		
Chlorobenzene	1.1	1.1	U	U	U	U	U	U	U	U			**1.9**		
Chlorodibromomethane			U	U	U	U	U	U	U	U			U		
Chloroethane			U	U	U	U	U	U	U	U			U		
Chloroform	0.37	0.37	U	U	U	U	U	U	U	U			U		
Chloromethane			U	U	U	U	U	U	U	U			U		
cis-1,2-Dichloroethene	0.25	0.25	U	U	U	U	U	U	U	U			U		
cis-1,3-Dichloropropene			U	U	U	U	U	U	U	U			U		
Cyclohexane			U	U	U	U	U	U	U	U			0.11 J		
Dichlorodifluoromethane			U	U	U	U	U	U	U	U			U		
Ethylbenzene	1	1	0.0071	U	U	U	U	U	U	0.001 J			0.045 J		
Isopropylbenzene			U	U	U	U	U	U	U	0.01			0.16		
Methyl Acetate			U	U	U	U	U	U	U	U			U		
Methyl tert-Butyl Ether	0.93	0.93	U	0.0035 J	U	U	0.0074	U	U	U			0.58		
Methylcyclohexane			U	U	U	U	0.011	0.0036 J	U	U			U		
Methylene Chloride	0.05	0.05	0.014	0.0068	0.01	0.012	0.015	0.013	0.017	U			U		
Styrene			0.0046 J	U	U	U	U	U	U	U			U		
Tetrachloroethene	1.3	1.3	U	U	U	U	U	U	U	U			U		
Toluene	0.7	0.7	U	U	U	U	U	U	U	U			0.11 J		
trans-1,2-Dichloroethene	0.19	0.19	U	U	U	U	U	U	U	U			U		
trans-1,3-Dichloropropene			U	U	U	U	U	U	U	U			U		
Trichloroethene	0.47	0.47	U	U	U	U	U	U	U	U			U		
Trichlorofluoromethane			U	U	U	U	U	U	U	U			U		
Vinyl chloride	0.02	0.02	U	U	U	U	U	U	U	U			**0.057** J		
Xylenes, total	0.26	1.6	U	U	U	U	0.015	U	U	0.018			0.043 J		
METALS (mg/kg)															
Aluminum			4850	6460	3080	5040	8120	2590	6810	8360				5440	4300
Antimony			4.2 J	33.7	0.9 J	0.9	3.0 J	1.8 J	0.7	10.1 J				12.9 J	13.8 J
Arsenic	13	16	5.9	8.4	3.2	3.2 J	11.4	6.0	5.2	10.8				**19.5**	**22.2**
Barium	350	820	201	272	43.6	37.3	315	**765**	87.4	**552**				**1440**	**1860**
Beryllium	7.2	47	0.302	0.235 J	0.365	0.411	0.484	0.154 J	0.642	0.14 J				0.23 J	0.28
Cadmium	2.5	7.5	**10.1**	**4.07**	0.587	0.217 J	**10.6**	1.34	0.740	**24.4**				**125**	**104**
Calcium			198000	49400	238000	264000	12500	91100	135000	114000 B				31000 B	29600 B
Chromium (1)	1	19	**47.1**	**104**	**11.9**	**7.18**	**56.9**	**28.8**	**6.85**	**148**				**98.2**	**133**
Cobalt			9.03	7.31	4.40	2.44	12.7	1.92	5.45	16.6				17.4	18.5
Copper	50	1720	**363**	**4840**	29.6	10.2	**278**	**51.0**	41.0	**632**				**1350**	**1090**
Iron			68600	32100	9220	5420	55600	13300	6780	111000				109000 B	116000 B
Lead	63	450	**335**	**4650**	**64.5**	15.5	**662**	**165**	41.4	**931**				**1720**	**1880**
Manganese	1600	2000	427	251	282	180	347	165	231	780 B				834	606
Magnesium			20500	3530	37700	28000	2490	6150	7660	14600				6140	11800
Mercury	0.18	0.73	**1.06**	**5.74**	0.111	0.178	**0.280**	**11.7**	**3.88**	**1.3**				**2.5**	**2.9**

TABLE 3
Roth Steel Site - Syracuse, NY
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Soil Analytical Data

Year	Soil Cleanup Objectives		2010	2010	2010	2010	2010	2010	2010	2013	2013	2013	2013	2011	2011
Location	Unrestricted	Protection of	MW-10	MW-10	MW-11	MW-11	MW-12	MW-12	MW-13	MW-16	MW-16	MW-17	MW-17	TP-1	TP-2
Interval		Groundwater	(0-2)	(6-8)	0-2)	(10-12)	(4-6)	(8-10)	(2-4)	(0-2)	(4-6)	(0-2)	(6-8)	(0-4)	(4-8)
Nickel	30	130	**52.4**	**255**	13.7	6.02 J	**228**	17.2	12.2	**170**				**351**	**419**
Potassium			719	593	1440	251	1080	474	959	468				491	346
Selenium	3.9	4	**5.9**	0.5 J	U	U	0.8 J	U	U	U				3.1 J	**8.2**
Silver	2	8.3	1.64	1.40	U	U	1.01	0.456 J	U	**4.4**				**2.2**	**3.9**
Sodium			592	1130	230	1160	1510	929	567	542				859	3110
Thallium			U	U	0.4 J	U	U	U	1.1 J	U				U	U
Vanadium			12.1	15.8	9.45	8.24	29.6	4.52	19.9	16.6				12.2	11.3
Zinc	109	2480	**3010**	**3230**	**165**	41.5	**900**	**889**	49.1	**4900** B				**10400**	**32500**

Notes:
U - Not detected
B - Analyte found in associated blank
J - Below quantitation limit
(1) - SCOs are for hexavalent chromium
Bold indicates concentration exceeds unrestricted SCO
Red indicates concentration exceeds both unrestricted and protection of groundwater SCOs.
Blank cell indicates chemical analysis not performed.

Data Source:
Aug 2008 "Draft Petroleum Investigation Report." Brown and Caldwell, Liverpool, New York. October 2008.
Sept 2008 "Draft Solid Waste Investigation Report." Brown and Caldwell, Liverpool, New York. March 2009.
July 2010 to July 2012 "Roth Steel Consent Order D7-015-11-04, Revised Interim Data Submittal." AECOM, East Syracuse, New York. April 2011

TABLE 5
Roth Steel Site - Syracuse, NY
Site Investigation Report
Groundwater Analytical Data

Analyte	Groundwater Standard (TOGS 1.1.1)	MW-1		MW-2			MW-3				MW-4			MW-5		MW-6			
		Aug 2008	Jul 2010	Aug 2008	Jul 2010	Feb 2013	Aug 2008	Jul 2010	Jul 2012	Feb 2013	Aug 2008	Jul 2010	Jul 2010 D	Aug 2008	Sep 2008 D	Aug 2008	Jul 2010	Jul 2012	Feb 2013
PCBS (ug/L)																			
Aroclor 1016		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1221		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1232		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1242		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1248		U	U	U	U	U	U	U	0.21 J	U	0.0003 J	U	U	U	U	U	U	U	U
Aroclor 1254		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1260		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1262		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1268		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Total PCBs	0.09	U	U	U	U	U	U	U	**0.21** J	U	0.0003 J	U	U	U	U	U	U	U	U
GLYCOLS (mg/L)																			
Diethylene glycol		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Ethylene Glycol	0.05 (G)	U	U	U	U	U	U	U	U	U	**2.6** J	U	U	U	**1.2** J	U	U	U	U
Propylene glycol		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
SVOCs (ug/L)																			
2,2'-Oxybis(1-Chloropropane)		U	U	U	U	U	U	U	U	U	U	U	U	5	U	U	U	U	U
2,4,5-Trichlorophenol		U	U	U	U	U	U	U	U	U	U	U	U	5	U	U	U	U	U
2,4,6-Trichlorophenol		U	U	U	U	U	U	U	U	U	U	U	U	5	U	U	U	U	U
2,4-Dichlorophenol	5	U	UJ	U	UJ	U	U	U	U	U	U	UJ	UJ	**5**	U	U	UJ	U	U
2,4-Dimethylphenol	50 (G)	1 J	UJ	U	UJ	U	37	5.6	U	U	8	0.78 J	1.0 J	6	6	13	3.6 J	U	U
2,4-Dinitrophenol	10 (G)	U	U	U	U	U	U	UJ	U	U	U	U	U	**10**	U	U	U	U	U
2,4-Dinitrotoluene	5	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U
2,6-Dinitrotoluene	5	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U
2-Chloronaphthalene	10 (G)	U	U	U	U	U	U	U	U	U	U	U	U	5	U	U	U	U	U
2-Chlorophenol		U	UJ	U	UJ	U	U	U	U	U	U	UJ	UJ	5	U	U	UJ	U	U
2-Methylnaphthalene		1 J	U	U	U	U	3 J	0.63 J	U	U	U	U	U	4 j	4 J	1 J	U	U	U
2-Methylphenol		0.9 J	U	U	U	U	27	9.7	U	U	4 J	0.62 J	0.68 J	3 J	3 J	11	5.4	U	U
2-Nitroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	**10**	U	U	U	U	U
2-Nitrophenol		U	UJ	U	UJ	U	U	U	U	U	U	UJ	UJ	5	U	U	UJ	U	U
3,3'-Dichlorobenzidine	5	U	U	U	U	U	U	UJ	U	U	U	U	U	**5**	U	U	U	U	U
3-Nitroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	**10**	U	U	U	U	U
4,6-Dinitro-2-methylphenol		U	U	U	U	U	U	UJ	U	U	U	U	U	10	U	U	U	U	U
4-Bromophenyl phenyl ether		U	U	U	U	U	U	U	U	U	U	U	U	5	U	U	U	U	U
4-Chloro-3-methylphenol		U	U	U	U	U	U	U	U	U	U	U	U	5	U	U	U	U	U
4-Chloroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U
4-Chlorophenyl phenyl ether		U	U	U	U	U	U	U	U	U	U	U	U	5	U	U	U	U	U
4-Methylphenol		6	U	0.6 J	U	U	60	23	U	U	53	5.0 J	4.7 J	28	30.5	22	10	U	U
4-Nitroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	**10**	U	U	U	U	U
4-Nitrophenol		U	U	U	U	U	U	U	U	U	U	U	U	10	U	U	U	U	U
Acenaphthene	20 (G)	1 J	U	U	U	U	1 J	1.2 J	U	U	1 J	U	U	2 J	2 J	0.5 J	U	U	U
Acenaphthylene		U	U	U	U	U	0.2 J	5.2	U	U	0.2 J	U	U	5	U	0.4 J	U	U	U
Acetophenone		U	U	U	U	U	U	3.2 J	U	U	2 J	0.72 J	0.82 J	5	U	U	U	U	U
Anthracene	50 (G)	0.7 J	U	0.2 J	U	U	1 J	0.56 J	U	U	1 J	0.72 J	0.59 J	0.8 J	0.9 J	0.3 J	U	U	U
Atrazine	7.5	U	U	U	U	U	U	U	U	U	U	U	U	5	U	U	U	U	U
Benzaldehyde		0.4 J	U	U	U	U	U	U	U	U	U	U	U	5	U	U	U	U	U
Benzo[a]anthracene	0.002 (G)	U	U	U	U	U	**0.2** J	U	U	U	**0.2** J	U	U	**0.6** J	**0.55** J	**0.2** J	U	U	U
Benzo[a]pyrene	ND	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U
Benzo[b]fluoranthene	0.002 (G)	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U
Benzo[g,h,i]perylene		U	U	U	U	U	U	U	U	U	U	U	U	5	U	U	U	U	U
Benzo[k]fluoranthene	0.002 (G)	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U
Biphenyl		0.3 J	U	U	U	U	0.4 J	U	U	U	0.4 J	U	U	0.4 J	0.45 J	0.3 J	U	U	U
Bis(2-chloroethoxy)methane	5	U	UJ	U	UJ	U	U	U	U	U	U	UJ	UJ	**5**	U	U	UJ	U	U
Bis(2-chloroethyl)ether	1	U	UJ	U	UJ	U	U	U	U	U	U	UJ	UJ	**5**	U	U	UJ	U	U
Bis(2-ethylhexyl) phthalate	5	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U
Butyl benzyl phthalate	50 (G)	U	U	U	U	U	U	U	U	U	U	U	U	5	U	U	U	U	U
Caprolactam		U	U	U	U	U	U	UJ	U	U	U	U	U	5	U	U	U	U	U
Carbazole		1 J	U	0.2 J	U	U	2 J	1.2 J	U	U	2 J	U J	0.73 J	2 J	2 J	U J	0.44 J	U	U
Chrysene	0.002 (G)	**0.6** BJ	U	U	U	U	**0.7** BJ	U	U	U	**0.6** BJ	U	U	**0.6** BJ	**0.65** BJ	**0.6** BJ	U	U	U
Dibenz[a,h]anthracene		U	U	U	U	U	U	U	U	U	U	U	U	5	U	U	U	U	U

TABLE 5
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Analyte	Groundwater Standard (TOGS 1.1.1)	MW-1		MW-2			MW-3				MW-4			MW-5		MW-6			
		Aug 2008	Jul 2010	Aug 2008	Jul 2010	Feb 2013	Aug 2008	Jul 2010	Jul 2012	Feb 2013	Aug 2008	Jul 2010	Jul 2010 D	Aug 2008	Sep 2008 D	Aug 2008	Jul 2010	Jul 2012	Feb 2013
Dibenzofuran		0.7 J	U	U	U	U	1 J	U	U	U	1 J	U	U	1 J	1 J	0.3 J	U	U	U
Diethyl phthalate	50 (G)	U	U	U	U	U	U	U	U	U	U	U	U	0.7 J	U	U	U	U	U
Dimethyl phthalate	50 (G)	U	U	U	U	U	U	U	U	U	U	U	U	5	U	U	5.0	U	U
Di-n-butyl phthalate	50	0.5 J	U	U	U	U	0.4 J	U	U	U	0.7 J	U	U	0.7 J	U	0.3 J	U	U	U
Di-n-octyl phthalate		U	U	U	U	U	U	U	U	U	U	U	U	5	U	U	U	U	U
Fluoranthene	50 (G)	0.4 J	U	0.3 J	U	U	1 J	0.77 J	U	U	0.6 J	0.53 J	0.61 J	0.7 J	0.7 J	0.6 J	0.46 J	U	U
Fluorene	50 (G)	U	U	U	U	U	2 J	1.3 J	U	U	2 J	0.59 J	U	3 J	3 J	0.4 J	U	U	U
Hexachlorobenzene	0.04	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U
Hexachlorobutadiene	0.5	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U
Hexachlorocyclopentadiene	5	U	U	U	U	U	U	UJ	U	U	U	U	U	**5**	U	U	U	U	U
Hexachloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U
Indeno[1,2,3-cd]pyrene	0.002 (G)	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U
Isophorone	50 (G)	U	UJ	U	UJ	U	U	U	U	U	U	UJ	UJ	5	U	U	UJ	U	U
Naphthalene	10 (G)	8	0.83 J	0.2 J	U	U	**18**	2.7 J	U	U	5	1.0 J	1.1 J	8	8	**12**	5.3	U	U
Nitrobenzene	0.4	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U
N-Nitrosodi-n-propylamine		U	U	U	U	U	U	U	U	U	U	U	U	5	U	U	U	U	U
N-Nitrosodiphenylamine	50 (G)	U	U	U	U	U	U	U	U	U	U	U	U	**5**	U	U	U	U	U
Pentachlorophenol	1***	U	U	U	U	U	U	U	U	U	U	U	U	**10**	U	U	U	U	U
Phenanthrene	50 (G)	2 J	0.46 J	0.5 J	0.45 J	U	4 J	2.5 J	U	U	3 J	2.3 J	2.0 J	4 J	4 J	2 J	1.4 J	U	U
Phenol	1***	**4** J	U	**2** J	U	U	**25**	**8.3**	U	U	**14**	**8.9**	**9.3**	**9**	**9.5**	**8**	**4.0** J	U	U
Pyrene	50 (G)	0.3 J	U	U	U	U	0.8 J	0.55 J	U	U	0.6 J	0.42 J	0.46 J	0.4 J	0.4 J	0.2 J	U	U	U
VOCs (ug/L)																			
1,1,1-Trichloroethane	5	U	U	U	U	U	U	UJ	U	U	U	U	U	1	U	U	U	U	U
1,1,2,2-Tetrachloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
1,1,2-Trichloroethane	1	U	U	U	U	U	U	U	U	U	U	U	U	**1**	U	U	U	U	U
1,1,2-Trichlorotrifluoroethane		U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
1,1-Dichloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
1,1-Dichloroethene	5	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
1,2,4-Trichlorobenzene	5	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
1,2-Dibromo-3-chloropropane	0.04	U	UJ	U	UJ	U	U	UJ	U	U	U	UJ	UJ	**1**	U	U	UJ	U	U
1,2-Dibromoethane (EDB)		U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
1,2-Dichlorobenzene	3	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
1,2-Dichloroethane	0.6	U	U	U	U	U	**0.94** J	U	U	U	U	U	U	**1**	U	U	U	U	U
1,2-Dichloroethene, Total		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichloropropane	1	U	U	U	U	U	U	U	U	U	U	U	U	**1**	U	U	U	U	U
1,3-Dichlorobenzene	3	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
1,4-Dichlorobenzene	3	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
2-Butanone (MEK)	50	8	U	3.3 J	U	U	16	42	U	**160**	28	13	13	4 J	3.65 J	4.6 J	U	U	U
2-Hexanone	50	U	U	U	U	U	U	U	U	U	U	U U	U	5	U	U	U	U	U
4-Methyl-2-pentanone (MIBK)		U	U	U	U	U	U	12	U	47 J	U	U U	U	5	U	U	U	U	U
Acetone	50	47	7.0 J	20	16	U	**80**	**96**	**150**	**560**	**160**	42	44	21	19.5	25	16	**120**	34 J
Benzene	1	**3.9**	0.85 J	**1.7**	0.58 J	U	**12**	**90**	**130**	**570**	**2.6** J	**2.0**	**1.9**	0.7 J	0.68 J	U	**2.3**	**8.1** J	**7.8**
Bromodichloromethane	50	U	U	U	U	U	U	UJ	U	U	U	U	U	1	U	U	U	U	U
Bromoform	50	U	U	U	U	U	U	UJ	U	U	U	U	U	1	U	U	U	U	U
Bromomethane	5	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
Carbon disulfide		U	UJ	U	UJ	U	U	UJ	U	U	U	UJ	UJ	1	U	U	UJ	U	U
Carbon Tetrachloride	5	U	U	U	U	U	U	UJ	U	U	U	U	U	1	U	U	U	U	U
Chlorobenzene	5	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
Chlorodibromomethane		U	U	U	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U	U
Chloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
Chloroform	7	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
Chloromethane		U	U	U	U	U	U	UJ	U	U	U	U	U	1	U	U	U	U	U
cis-1,2-Dichloroethene	5	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
cis-1,3-Dichloropropene	0.4**	U	U	U	U	U	U	U	U	U	U	U	U	**1**	U	U	U	U	U
Cyclohexane		1	U	2.8	3.2	2.6 J	2.3	1.9	3.2 J	10	U	1.1	1.0	1.2	1.25	3.7	1.4	U	4 J
Dichlorodifluoromethane	5	U	U	U	U	U	U	UJ	U	U	U	U	U	1	U	U	U	U	U
Ethylbenzene	5	0.92 J	0.98 J	U	U	U	**12**	5.0	**150**	**250**	**6**	2.6	2.6	0.59 J	0.57 J	1.8	U	U	U
Isopropylbenzene	5	U	U	U	U	U	U	U	U	**12**	U	0.85 J	0.86 J	1	U	U	U	U	U
Methyl Acetate		U	UJ	U	UJ	U	U	U	U	U	U	UJ	UJ	1	U	U	UJ	U	U
Methyl tert-Butyl Ether	10	**110**	1.7	**24**	**17**	**14**	**80**	**13**	**67**	**93**	**24**	**26**	**27**	**25**	**25**	**32**	9.5	**21**	**23**
Methylcyclohexane		0.56 J	U	1	1.3	1.1 J	1.1	0.60 J	U	9.1 J	U	1.6	1.6	2.3	2.3	U	U	U	U
Methylene Chloride	5	U	U	U	U	U	U	**52**	U	U	U	U	U	1	U	U	U	U	U
Styrene	5	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U

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Analyte	Groundwater Standard (TOGS 1.1.1)	MW-1		MW-2			MW-3				MW-4			MW-5		MW-6			
		Aug 2008	Jul 2010	Aug 2008	Jul 2010	Feb 2013	Aug 2008	Jul 2010	Jul 2012	Feb 2013	Aug 2008	Jul 2010	Jul 2010 D	Aug 2008	Sep 2008 D	Aug 2008	Jul 2010	Jul 2012	Feb 2013
Tetrachloroethene	5	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
Toluene	5	1.2	U	U	U	U	**7.3**	**71**	**500**	**610**	**16**	**11**	**11**	1.1	0.1 J	4.7	1.4	U	4.9 J
trans-1,2-Dichloroethene	5	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
trans-1,3-Dichloropropene	0.4**	U	U	U	U	U	U	UJ	U	U	U	U	U	**1**	U	U	U	U	U
Trichloroethene	5	U	U	U	U	U	U	U	U	U	U	0.55 J	U	1	U	U	U	U	U
Trichlorofluoromethane	5	U	U	U	U	U	U	U	U	U	U	U	U	1	U	U	U	U	U
Vinyl chloride	2	1.1	U	U	U	U	**2.7**	1.4	U	**18**	**10**	**9.5**	**10**	1	U	0.98 j	U	U	U
Xylenes, total	5	4.9	U	U	U	U	**56**	**29**	**680**	**930**	**33**	**15**	**15**	3.9	3.7	**7.4**	2.7	U	**5.6** J
Metals (mg/L)																			
Aluminum	0.1	**0.218**	**0.2**	**0.826**	**0.222** J	0.06 J	**0.214**	U	**1.2**	**0.13** J	**0.284**	**0.137** J	0.08 J	**0.115**	**0.127** B	**0.29**	**0.2**	**0.19** J	U
Antimony	0.003	U	U	U	U	U	U	U	U	U	U	U	U	**0.0055**	**0.0055**	U	**0.02**	U	U
Arsenic	0.025	0.008	U	U	U	U	0.0041 B	U	**0.026**	0.0084 J	0.0049 B	U	U	0.0037	0.0037	U	0.01	U	U
Barium	1	**1.98**	**1.09**	0.616	**1.67**	**1.9**	**2.39**	**1.94**	0.94 B	0.64	**1.29**	0.223	0.231	**1.7**	**1.7**	0.169	0.245	0.18 B	0.22
Beryllium	0.003 (G)	U	0.0004 J	U	U	U	**0.0047** B	U	U	U	**0.0038**	0.0003 J	0.0004 J	0.0027	0.0027	U	0.0003 J	U	U
Cadmium	0.005	U	U	U	U	U	U	U	U	U	U	U	U	0.0027	0.0027	U	U	U	U
Calcium		307	351	111.00	59.8	56.8	112	191	372 B	165	941	740	780	118	120	615	567	626 B	613
Chromium	0.05	U	U	0.002 B	0.0016 J	U	0.0012 B	U	0.002 J	U	0.0015 B	U	U	0.0088	0.0088	U	0.0021 J	0.002 J	0.0015 J
Cobalt		U	U	U	0.0015 J	0.0009 J	U	U	0.0007 J	U	U	U	0.0006 J	0.0011	0.0017	U	U	0.013	U
Copper	0.2	0.0018	0.0023 J	0.005 B	0.0056 J	0.0021 J	0.0079 B	U	0.0026 J	0.0034 J	0.0136	0.0023 J	0.0023 J	0.0035	0.0037 B	0.002 B	0.0044 J	U	0.0069 J
Iron	0.3	**1.19**	**1.99** J	**1.64**	**9.22** J	**8.6**	**0.333**	**1.13** J	0.12 B	0.074	**0.355**	0.035 J	0.023 J	**16.4**	**16.6**	0.19	U	0.21 B	0.022 J
Lead	0.025	0.0052	U	0.0084	0.0056	U	0.018	U	0.0055	U	0.0051	U	U	0.0067	0.0081	U	U	0.0065	U
Magnesium	35 (G)	9.91	**555**	6.67	19.6	18.2	0.455	**122**	0.9	2	0.607	0.552	0.27	28.4	28.6	0.632	U	0.21	0.14 J
Manganese	0.3	0.0262	**0.315**	0.0204	0.0501	0.033	0.0076	0.0775	0.0026 J	0.0047	0.0086	0.0003 J	0.0002 J	0.138	0.139	0.0115	0.0008 J	0.0028	0.0004 J
Mercury	0.0007	U	0.0001 J	U	0.0001 J	U	**0.0017**	0.0002	U	U	U	U	U	0.00012	0.00012	**0.001**	0.0003	**0.00085**	**0.00081**
Nickel	0.1	0.0296	0.0104	0.0064 B	0.0061 J	0.0043 J	0.0102	0.0045 J	0.0087 J	0.025	0.0296	0.0141	0.0143	0.0102	0.0116	0.0017 B	0.0013 J	0.0051	0.033 J
Potassium		64.8	59.2	44.4 0	53.6	48.2	45.3	51.6	60.6	114	32.6	35.1	36.7	63.9	66	34	30.6	32.4	34.2
Selenium	0.01	U	U	U	U	U	U	U	U	U	U	U	U	0.0061	0.0061	U	U	U	U
Silver	0.05	U	U	U	U	U	U	U	U	U		U	U	0.0013	0.0013	U	U		U
Sodium	20	**432**	**180** J	**189**	**228** J	**208**	**328**	**229** J	**353** B	**564**	**174**	**225** J	**234** J	**300**	**312**	**262**	**214** J	**312**	**310**
Thallium	0.0005 (G)	U	U	U	U	U	U	U	U	U	U	U	U	**0.0059**	**0.0059**	U	U	U	U
Vanadium		U	U	0.004 B	0.0024 J	U	U	U	U	0.0015 J	U	U	U	0.0098	1	U	0.0028 J	0.0016	U
Zinc	2 (G)	0.136	0.0189 J	0.0198	0.0141 J	0.002 J	0.0307	0.0062 J	0.0015 JB	0.003 J	0.04	0.0062 J	0.0045 J	0.0187	0.0197	U	U	0.017	0.0042 J

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Analyte	Groundwater Standard (TOGS 1.1.1)	MW-7					MW-8					MW-9				MW-10		
		Sep 2008	Jul 2010	Jul 2012	Jul 2012 D	Feb 2013	Sep 2008	Sep 2008 D	Jul 2010	Jul 2012	Feb 2013	Sep 2008	Jul 2010	Jul 2012	Feb 2013	Jul 2010	Jul 2012	Feb 2013
PCBS (ug/L)																		
Aroclor 1016		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1221		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1232		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1242		0.00062	0.73	1.4	0.72	U	U	U	U	4.8	U	U	U	U	U	U	U	U
Aroclor 1248		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1254		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1260		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1262		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1268		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Total PCBs	0.09	0.0006	**0.73**	**1.4**	**0.72**	U	U	U	U	**4.8**	U	U	U	U	U	U	U	U
GLYCOLS (mg/L)																		
Diethylene glycol		U	UJ	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Ethylene Glycol	0.05 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Propylene glycol		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
SVOCs (ug/L)																		
2,2'-Oxybis(1-Chloropropane)		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2,4,5-Trichlorophenol		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2,4,6-Trichlorophenol		U	U	U	U	U	U	U	U	U	U		U	U	U	U	U	U
2,4-Dichlorophenol	5	U	UJ	U	U	U	U	U	UJ	U	U	U	UJ	U	U	U	U	U
2,4-Dimethylphenol	50 (G)	U	UJ	U	U	U	U	U	UJ	U	U	U	UJ	U	U	27	U	U
2,4-Dinitrophenol	10 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	UJ	U	U
2,4-Dinitrotoluene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2,6-Dinitrotoluene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Chloronaphthalene	10 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Chlorophenol		U	UJ	U	U	U	U	U	UJ	U	U	U	UJ	U	U	U	U	U
2-Methylnaphthalene		U	U	U	U	U	U	U	U	U	U	U J	1.2	U	U	2.6 J	U	U
2-Methylphenol		U	U	U	U	U	U	U	U	U	U	U	U	U	U	16	U	U
2-Nitroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Nitrophenol		U	UJ	U	U	U	U	U	UJ	U	U	U	UJ	U	U	U	U	U
3,3'-Dichlorobenzidine	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
3-Nitroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4,6-Dinitro-2-methylphenol		U	U	U	U	U	U	U	U	U	U	U	U	U	U	UJ	U	U
4-Bromophenyl phenyl ether		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Chloro-3-methylphenol		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Chloroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Chlorophenyl phenyl ether		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Methylphenol		U	U	U	U	U	U	U	U	U	U	1 J	1.6 J	U	U	34	U	U
4-Nitroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Nitrophenol		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Acenaphthene	20 (G)	U	U	U	U	U	0.2 J	0.1 J	U	U	U	1 J	1.0 J	U	U	1.2 J	U	U
Acenaphthylene		U	U	U	U	U	U	U	U	U	U	0.3 J	U	U	U	U	U	U
Acetophenone		U	U	U	U	U	U	U	U	U	U	U	U	U	U	5.1	U	U
Anthracene	50 (G)	U	U	U	U	U	0.3 J	0.15 J	U	U	U	0.5 J	0.72 J	U	U	0.55 J	U	U
Atrazine	7.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzaldehyde		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzo[a]anthracene	0.002 (G)	**0.4** J	U	U	U	U	**0.3** J	U J	U	U	U	U	U	U	U	U	U	U
Benzo[a]pyrene	ND	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzo[b]fluoranthene	0.002 (G)	**0.2** J	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzo[g,h,i]perylene		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzo[k]fluoranthene	0.002 (G)	**0.2** J	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Biphenyl		U	U	U	U	U	U	U	U	U	U	0.2 J	U	U	U	U	U	U
Bis(2-chloroethoxy)methane	5	U	UJ	U	U	U	U	U	UJ	U	U	U	UJ	U	U	U	U	U
Bis(2-chloroethyl)ether	1	U	UJ	U	U	U	U	U	UJ	U	U	U	UJ	U	U	U	U	U
Bis(2-ethylhexyl) phthalate	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Butyl benzyl phthalate	50 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Caprolactam		U	U	U	U	U	5	U	U	U	U	U	U	U	U	U	U	U
Carbazole		U	U	U	U	U	0.6 J	0.3 J	U	U	U	2 J	3.2 J	U	U	1.2 J	U	U
Chrysene	0.002 (G)	**0.3** J	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Dibenz[a,h]anthracene		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U

Analyte	Groundwater Standard (TOGS 1.1.1)	MW-7 Sep 2008	MW-7 Jul 2010	MW-7 Jul 2012	MW-7 Jul 2012 D	MW-7 Feb 2013	MW-8 Sep 2008	MW-8 Sep 2008 D	MW-8 Jul 2010	MW-8 Jul 2012	MW-8 Feb 2013	MW-9 Sep 2008	MW-9 Jul 2010	MW-9 Jul 2012	MW-9 Feb 2013	MW-10 Jul 2010	MW-10 Jul 2012	MW-10 Feb 2013
Dibenzofuran		U	U	U	U	U	U	U	U	U	U	1 J	1.3 J	U	U	0.58 J	U	U
Diethyl phthalate	50 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	0.93 J	U	U
Dimethyl phthalate	50 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Di-n-butyl phthalate	50	0.3 J	U	U	U	U	0.5 J	0.3 J	U	U	U	U	U	U	U	U	U	U
Di-n-octyl phthalate		U	U	U	U	U	0.3 J	U	U	U	U	U	U	U	U	U	U	U
Fluoranthene	50 (G)	0.2 J	0.44 J	U	U	U	0.2 J	0.1 J	U	U	U	U	U	U	U	0.45 J	U	U
Fluorene	50 (G)	U	U	U	U	U	U	U	U	U	U	2 J	2.8 J	U	U	1.0 J	U	U
Hexachlorobenzene	0.04	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachlorobutadiene	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachlorocyclopentadiene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Indeno[1,2,3-cd]pyrene	0.002 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Isophorone	50 (G)	U	UJ	U	U	U	UJ	U	UJ	U	U	U	UJ	U	U	U	U	U
Naphthalene	10 (G)	U	U	U	U	U	U	U	U	U	U	2 J	2.4 J	U	U	5.2	U	U
Nitrobenzene	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
N-Nitrosodi-n-propylamine		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
N-Nitrosodiphenylamine	50 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Pentachlorophenol	1***	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Phenanthrene	50 (G)	U	U	U	U	U	0.3 J	0.15 J	U	U	U	9 J	13	U	U	1.6 J	U	U
Phenol	1***	U	U	U	U	U	0.8 J	0.4 J	U	U	U	**3** J	U	U	U	**14**	U	U
Pyrene	50 (G)	0.3 J	U	U	U	U	U	U	U	U	U	U	U	U	U	U		U
VOCs (ug/L)																		
1,1,1-Trichloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	UJ	U	U
1,1,2,2-Tetrachloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1,2-Trichloroethane	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1,2-Trichlorotrifluoroethane		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-Dichloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-Dichloroethene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-Trichlorobenzene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dibromo-3-chloropropane	0.04	U	UJ	U	U	U	U	U	UJ	U	U	U	UJ	U	U	UJ	U	U
1,2-Dibromoethane (EDB)		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichlorobenzene	3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichloroethane	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichloroethene, Total		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichloropropane	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,3-Dichlorobenzene	3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,4-Dichlorobenzene	3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Butanone (MEK)	50	U	U	U	U	U	U	U	U	U	U	U	4.5 J	U	4.7 J	**170**	U	U
2-Hexanone	50	U	U	U	U	U	U	U	U	U	U	U	U	U	U	3.1 J	U	U
4-Methyl-2-pentanone (MIBK)		U	U	U	U	U	U	U	U	U		U	U	U	U	57		U
Acetone	50	U	6.7 J	U	43 J	U	16	U	U	4.3 J	U	16	18	**51**	25	**220**	4.9 J	U
Benzene	1	U	0.79 J	U	U	U	U	U	U	U	U	U	U	U	U	**7.5**	**2.9** J	U
Bromodichloromethane	50	U	U	U	U	U	U	U	U	U	U	U	U	U	U	UJ	U	U
Bromoform	50	U	U	U	U	U	U	U	U	U	U	U	U	U	U	UJ	U	U
Bromomethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Carbon disulfide		U	UJ	U	U	0.47 J	U	U	UJ	U	U	U	0.82 J	U	U	UJ	U	U
Carbon Tetrachloride	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	UJ	U	U
Chlorobenzene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Chlorodibromomethane		U	U	U	U	U	U	U	U	U	U	U	U	U	U	UJ	U	U
Chloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Chloroform	7	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Chloromethane		U	0.66 J	U	U	U	U	U	U	U	U	U	U	U	U	UJ	U	U
cis-1,2-Dichloroethene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
cis-1,3-Dichloropropene	0.4**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Cyclohexane		1.8 J	2.2	U	U	0.33 J	U	U	U	U	U	U	U	U	U	0.55 J	U	U
Dichlorodifluoromethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	UJ	U	U
Ethylbenzene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	**6.4**	U	U
Isopropylbenzene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Methyl Acetate		U	UJ	U	U	U	U	U	UJ	U	U	U	UJ	U	U	U	U	U
Methyl tert-Butyl Ether	10	U	0.58 J	U	U	0.33 J	1.8 J	1.8 J	2.6	2.1 J	2.5	1.2 J	2.5	1.7 J	2.8	**38**	**24**	**18** J
Methylcyclohexane		7.6	1.8	U	U	U	U	U	U	U	U	U	U	U		U	U	U
Methylene Chloride	5	**8.2** B	U	U	U	U	**5.4**	**9.1** B	U	U	U	**5.4** B	U	U	U	U	U	U
Styrene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	2.9	U	U

TABLE 5
Roth Steel Site - Syracuse, NY
Site Investigation Report
Groundwater Analytical Data

Analyte	Groundwater Standard (TOGS 1.1.1)	MW-7					MW-8					MW-9				MW-10		
		Sep 2008	Jul 2010	Jul 2012	Jul 2012 D	Feb 2013	Sep 2008	Sep 2008 D	Jul 2010	Jul 2012	Feb 2013	Sep 2008	Jul 2010	Jul 2012	Feb 2013	Jul 2010	Jul 2012	Feb 2013
Tetrachloroethene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Toluene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	**12**	3.4 J	U
trans-1,2-Dichloroethene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trans-1,3-Dichloropropene	0.4**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	UJ	U	U
Trichloroethene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Trichlorofluoromethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Vinyl chloride	2	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Xylenes, total	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	**20**	4.1 J	U
Metals (mg/L)																		
Aluminum	0.1	**2.2**	**2.2** J	**1.8**	**2** B	**0.26**	0.0812	0.0838	U	U	U	**0.118** B	U	0.065 J	U	0.0970 J	U	0.07 J
Antimony	0.003	U	U	U	U	U	**0.0055**	**0.0055**	U	U	U	U	U	U	U	**0.0076** J	U	U
Arsenic	0.025	U	U	U	0.0056 J	U	0.0087	0.0081	0.0079 J	0.006 J	U	U	U	U	U	0.0154	U	U
Barium	1	**1.29**	**3.15**	0.063 B	0.62	0.7	0.0646	0.0657	0.0408	0.038 B	0.058	0.0936	0.108	0.088 B	0.087	**1.7600**	0.89 B	**1.3**
Beryllium	0.003 (G)	U	0.0003 J	U	U	U	0.00033	0.00033	U	U	U	0.00057 B	0.0003 J	**397** B	U	0.0003 J	U	U
Cadmium	0.005	0.0012	**0.0064**	0.0047	0.0044	0.00	0.00033	0.00033	U	U	U	U	U	U	U	U	0.0006 J	U
Calcium		172 E	166	71 B	68.2 B	65.4	88.4	89.6	65.3	66.5 B	91.6	374 E	668	U	495	532.00	93.1 B	48.1
Chromium	0.05	0.0059	0.0154	0.012	0.012	0.0011 J	0.0013	0.0013	U	0.0019 J	U	U	U	U J	U	0.0040	0.0023 J	0.0011 J
Cobalt		0.0014 B	0.003 J	0.0021	0.0021 J	U	0.0011	0.0011	U	U	U	U	U	U	U	0.0040	0.0008 J	U
Copper	0.2	0.0791	**0.243**	**0.24**	**0.21**	0.027	0.0013	0.0013	0.0029 J	U	0.0046 J	U	0.0024 J	U	0.0035 J	0.0032 J	0.0018 J	0.0056 J
Iron	0.3	**9.8**	**16.9** J	**6.3** B	**6.4**	**2.5**	**1.69**	**1.63**	0.096 J	0.06 B	**0.71**	0.0736	0.042 J	0.071 B	0.044 J	0.0700 J	**2.1** B	**3**
Lead	0.025	**0.0479**	**0.239**	**0.15**	**0.14**	0.022	0.0029	0.0029	U	U	U	U	U	U	U	0.0072	U	0.0086
Magnesium	35 (G)	**76**	**112**	22.6	21.5	28.2	5.5	5.66	**55.1**	**40.9**	**49.4**	0.563	0.098 J	1.8	0.086 J	**68.50**	**58.7**	30.4
Manganese	0.3	0.211	0.239	0.086	0.085	0.065	0.188	0.183	0.0264	0.016 B	0.22	0.0036 B	0.0004 J	0.00094 JB	U	0.0035	0.053 B	0.041
Mercury	0.0007	**0.00148** B	**0.0007**	0.00015 J	0.00014 J	U	0.00012	0.00012	0.0001 J	U	U	**0.00467**	**0.0009**	0.00036	0.0006	0.0001 J	U	U
Nickel	0.1	0.0136	0.0422	0.033	0.03	0.0086 J	0.0052	0.0064	0.0039 J	0.0037 J	0.0056 J	0.0028	0.0018 J	0.0041 JB	0.002 J	0.0241	0.008 J	0.0068 J
Potassium		41.1	40.8	24.3	25 B	18.5	29.5	30.7	30.3	29.3	28.2	30.3	33.3	26.7	28,3	90.90	66	52.3
Selenium	0.01	U	U	U	U	U	0.0061	0.0061	U	U	U	U	U	U	U	U	U	U
Silver	0.05	U	U	U	U	U	0.0013	0.0013	U	U	U	U	U	U	U	U	U	U
Sodium	20	**126**	**209** J	**124**	**127**	**96.7**	**182**	**190**	**203** J	**201** B	**204**	**246**	**264** J	**214** B	**287**	**696** J	**480** B	**474**
Thallium	0.0005 (G)	U	U	U	U	U	**0.0059**	**0.0059**	U	U	U	U	U	U	U	U	U	U
Vanadium		0.0042 B	0.006	0.004	0.0053	U	0.002	0.0023	U	U	0.0016 J	0.0064	U	U	U	U	U	U
Zinc	2 (G)	0.203	1.3 J	0.75	0.77	0.13	0.0036	0.0036	0.0024 J	0.0019 JB	0.0037 J	U	0.0044 J	U	0.0017 J	0.0076 J	0.0039 JB	0.038

Analyte	Groundwater Standard (TOGS 1.1.1)	MW-11			MW-12	MW-13			MW-14			MW-15		MW-16	MW-17	PW-1 (PW)
		Jul 2010	Jul 2012	Feb 2013	Jul 2010	Jul 2010	Jul 2012	Feb 2013	Jul 2012	Feb 2013	Feb 2013 D	Jul 2012	Feb 2013	Feb 2013	Feb 2013	JUL 2010
PCBS (ug/L)																
Aroclor 1016		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1221		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1232		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1242		U	U	U	0.57	U	U	U	0.49	U	U	U	U	U	U	0.17 J
Aroclor 1248		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1254		U	U	U	4.4	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1260		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1262		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Aroclor 1268		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Total PCBs	0.09	U	U	U	**4.97**	U	U	U	**0.49**	U	U	U	U	U	U	**0.17** J
GLYCOLS (mg/L)																
Diethylene glycol		U	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U
Ethylene Glycol	0.05 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Propylene glycol		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
SVOCs (ug/L)																
2,2'-Oxybis(1-Chloropropane)		U	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U
2,4,5-Trichlorophenol		U	U	U	2.3 J	U	U	U	U	U	U	U	U	U	U	U
2,4,6-Trichlorophenol		U	U	U	1.3 J	U	U	U	U	U	U	U	U	U	U	U
2,4-Dichlorophenol	5	U	U	U	4.4 J	UJ	U	U	U	U	U	U	U	U	U	UJ
2,4-Dimethylphenol	50 (G)	4.4 J	U	U	26	UJ	U	U	U	U	U	U	U	U	U	U
2,4-Dinitrophenol	10 (G)	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U	U
2,4-Dinitrotoluene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2,6-Dinitrotoluene	5	U	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U
2-Chloronaphthalene	10 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Chlorophenol		U	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U
2-Methylnaphthalene		4.4 J	U	U	3.6 J	U	U	U	U	U	U	U	U	U	U	U
2-Methylphenol		3.5 J	U	U	15	U	U	U	U	U	U	U	U	U	U	U
2-Nitroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Nitrophenol		U	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U
3,3'-Dichlorobenzidine	5	U	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U
3-Nitroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4,6-Dinitro-2-methylphenol		U	U	U	UJ	U	U	U	U	U	U	U	U	U	U	UJ
4-Bromophenyl phenyl ether		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Chloro-3-methylphenol		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Chloroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Chlorophenyl phenyl ether		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Methylphenol		9.3 J	U	U	56	U	U	U	U	U	U	U	U	U	U	U
4-Nitroaniline	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Nitrophenol		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Acenaphthene	20 (G)	4.9 J	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Acenaphthylene		0.87 J	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U
Acetophenone		U	U	U	3.9 J	U	U	U	U	U	U	U	U	U	U	5.4
Anthracene	50 (G)	1.9 J	U	U	0.48 J	U	U	U	U	U	U	U	U	U	U	U
Atrazine	7.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzaldehyde		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzo[a]anthracene	0.002 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzo[a]pyrene	ND	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzo[b]fluoranthene	0.002 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzo[g,h,i]perylene		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Benzo[k]fluoranthene	0.002 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Biphenyl		0.88 J	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Bis(2-chloroethoxy)methane	5	U	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U
Bis(2-chloroethyl)ether	1	U	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U
Bis(2-ethylhexyl) phthalate	5	U	U	U	4.5 J	U	U	U	U	U	U	U	U	U	U	2.3 J
Butyl benzyl phthalate	50 (G)	U	U	U	2.7 J	U	U	U	U	U	U	U	U	U	U	U
Caprolactam		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Carbazole		11	U	U	U	U J	U	U	U	U	U	U	U	U	U	U
Chrysene	0.002 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Dibenz[a,h]anthracene		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U

TABLE 5
Roth Steel Site - Syracuse, NY
Site Investigation Report
Groundwater Analytical Data

Analyte	Groundwater Standard (TOGS 1.1.1)	MW-11			MW-12	MW-13			MW-14			MW-15		MW-16	MW-17	PW-1 (PW)
		Jul 2010	Jul 2012	Feb 2013	Jul 2010	Jul 2010	Jul 2012	Feb 2013	Jul 2012	Feb 2013	Feb 2013 D	Jul 2012	Feb 2013	Feb 2013	Feb 2013	JUL 2010
Dibenzofuran		3.4 J	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U
Diethyl phthalate	50 (G)	U	U	U	1.8 J	UJ	U	U	U	U	U	U	U	U	U	1.8 J
Dimethyl phthalate	50 (G)	U	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U
Di-n-butyl phthalate	50	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Di-n-octyl phthalate		U	U	U	U	1.3 J	U	U	U	U	U	U	U	U	U	U
Fluoranthene	50 (G)	1.7 J	U	U	0.82 J	0.50 J	U	U	U	U	U	U	U	U	U	U
Fluorene	50 (G)	4.6 J	U	U	0.69 J	0.38 J	U	U	U	U	U	U	U	U	U	U
Hexachlorobenzene	0.04	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachlorobutadiene	0.5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachlorocyclopentadiene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Hexachloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Indeno[1,2,3-cd]pyrene	0.002 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Isophorone	50 (G)	U	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U
Naphthalene	10 (G)	**30**	U	U	7.5	1.2 J	U	U	U	U	U	U	U	U	U	U
Nitrobenzene	0.4	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
N-Nitrosodi-n-propylamine		U	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U
N-Nitrosodiphenylamine	50 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Pentachlorophenol	1***	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Phenanthrene	50 (G)	9.2	U	U	0.94 J	1.2 J	U	U	U	U	U	U	U	U	U	U
Phenol	1***	**4.0** J	U	U	**3.6** J	U	U	U	U	U	U	U	U	U	U	U
Pyrene	50 (G)	1.2 J	U	U	0.37 J	U	U	U	U	U	U	U	U	U	U	U
VOCs (ug/L)																
1,1,1-Trichloroethane	5	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U	UJ
1,1,2,2-Tetrachloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1,2-Trichloroethane	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1,2-Trichlorotrifluoroethane		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-Dichloroethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,1-Dichloroethene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2,4-Trichlorobenzene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dibromo-3-chloropropane	0.04	UJ	U	U	UJ	UJ	U	U	U	U	U	U	U	U	U	UJ
1,2-Dibromoethane (EDB)		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichlorobenzene	3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichloroethane	0.6	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichloroethene, Total		U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,2-Dichloropropane	1	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,3-Dichlorobenzene	3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
1,4-Dichlorobenzene	3	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
2-Butanone (MEK)	50	3.6 J	U	U	U	U	U	U	U	U	U	U	U	U	12	14
2-Hexanone	50	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
4-Methyl-2-pentanone (MIBK)		U	U	U	55	U	U	U	U	U	U	U	U	U	7.2	3.2
Acetone	50	19	**66**	U	17	4.5 J	45 J	U	46	4.6J	4.5 J	**69**	U	U	**66**	**120**
Benzene	1	0.96 J	U	U	**13**	0.61 J	U	U	U	**1.2**	**1.2**	U	U	U	0.72 J	U
Bromodichloromethane	50	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U	UJ
Bromoform	50	UJ	U	U	UJ	U	U	U	U	U	U	U	U	U	U	UJ
Bromomethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Carbon disulfide		U	U	U	2.6 J	UJ	U	U	U	U	U	U	U	U	U	1.5
Carbon Tetrachloride	5	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U	UJ
Chlorobenzene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	1.2	U
Chlorodibromomethane		U	U	U	UJ	U	U	U	U	U	U	U	U	U	U	UJ
Chloroethane	5	U	U	U	U	0.61 J	U	U	U	U	U	U	U	U	U	U
Chloroform	7	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Chloromethane		U	U	U	UJ	U	U	U	U	U	U	U	U	U	U	UJ
cis-1,2-Dichloroethene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	2	U
cis-1,3-Dichloropropene	0.4**	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Cyclohexane		0.58 J	U	U	U	U	U	U	U	U	U	U	U	U	0.45 J	U
Dichlorodifluoromethane	5	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U	UJ
Ethylbenzene	5	U	U	U	**13**	U	U	U	U	U	U	U	U	U	U	U
Isopropylbenzene	5	U	U	U	1.0	U	U	U	U	U	U	U	U	U	U	U
Methyl Acetate		UJ	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U
Methyl tert-Butyl Ether	10	3.8	**11**	2.7 J	**22**	9.6	4.3 J	4.3	**12**	**13**	**13**	U	U	**64**	0.62 J	U
Methylcyclohexane		U	U	U	0.85 J	U	U	U	U	U	U	U	U	U	3.1	U
Methylene Chloride	5	U	U	U	0.99 J	U	U	U	U	U	U	U	U	U	U	U
Styrene	5	U	U	U	**9.0**	U	U	U	U	U	U	U	U	U	U	U

O'BRIEN & GERE

TABLE 5
Roth Steel Site - Syracuse, NY
Site Investigation Report
Groundwater Analytical Data

Analyte	Groundwater Standard (TOGS 1.1.1)	MW-11			MW-12	MW-13			MW-14			MW-15		MW-16	MW-17	PW-1 (PW)
		Jul 2010	Jul 2012	Feb 2013	Jul 2010	Jul 2010	Jul 2012	Feb 2013	Jul 2012	Feb 2013	Feb 2013 D	Jul 2012	Feb 2013	Feb 2013	Feb 2013	JUL 2010
Tetrachloroethene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	0.46 J	U
Toluene	5	U	U	U	**46**	U	U	U	U	U	U	U	U	U	U	0.95 J
trans-1,2-Dichloroethene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
trans-1,3-Dichloropropene	0.4**	U	U	U	UJ	U	U	U	U	U	U	U	U	U	U	UJ
Trichloroethene	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Trichlorofluoromethane	5	U	U	U	U	U	U	U	U	U	U	U	U	U	U	1.4
Vinyl chloride	2	U	U	U	**4.9**	U	U	U	U	1.4	1.4	U	U	U	U	U
Xylenes, total	5	U	U	U	**59**	U	U	U	U	U	U	U	U	U	2.1	U
Metals (mg/L)																
Aluminum	0.1	**0.227** J	**17** J	U	**1.23** J	**0.456** J	U	U	U	**0.29**	**0.28**	**0.11** J	0.077 J	**0.11** J	**0.12** J	**0.17** J
Antimony	0.003	U	U	U	U	U	U	U	U	U	U	U	U	U	U	**0.01** J
Arsenic	0.025	U	U	U	0.01 J	U	U	U	U	U	U	U	U	0.018	U	U
Barium	1	0.576	0.07 B	0.61	**1.23**	0.0496	U	0.063	U	0.05	0.05	0.15 B	0.083	**2.6**	0.11	0.54
Beryllium	0.003 (G)	U	U	U	U	U	U	U	U	U	U		U	U	U	U
Cadmium	0.005	U	U	U	0.0016	U	U	U	U	U	U	U	U	0.0013	0.0005 J	0.0006 J
Calcium		110	32.9 B	100	16.20	39.5	U	52	U	103	103	824 B	108	102	67.7	64.7
Chromium	0.05	U	0.0018 J		0.0065	U	U	U	U	U	U	0.0016 J	U	0.0022 J	U	0.0013 J
Cobalt		U	0.001 J	U	0.0011 J	U	U	U	U	U	U	U	U	U	0.0055	0.0008 J
Copper	0.2	0.0047 J	U	0.0025 J	0.0354	0.0045 J	U	0.0028 J	U	0.0049 J	0.0032 J	U	0.0098 J	0.012	0.0097 J	0.018
Iron	0.3	**2.03** J	0.24 B	**1.7**	**2.5000** J	0.246 J	U	0.14	U	U	U	U	0.07	**5.6**	**1.3**	**1.32** J
Lead	0.025	0.0115	0.0039 J	U	**0.1020**	0.0049 J	U	U	U	U	U	U	U	**0.041**	0.0087	**0.0342**
Magnesium	35 (G)	19.4	11.4	24.5	9.1800	13.3	U	17.9	U	U	U	0.064 J	31.5	33.8	34	**45.7**
Manganese	0.3	0.0707	0.02 B	0.11	0.0258	0.0209	U	0.038	U	U	U	0.00087 JB	0.03	0.17	**0.47**	0.08
Mercury	0.0007	U	U	U	0.0002	0.0006	U	U	U	U	U	0.00067	U	U	U	U
Nickel	0.1	0.0062 J	0.0061 JU	0.0033 J	0.0169	0.0062 J	U	0.0052 J	U	0.0023 J	0.0025 J	0.0034 J	0.0058 J	0.011	0.011	0.02
Potassium		49.1	27.8	37.9	79.10	30.1	U	24.2	U	29,4	30.4	21.8	17,4	40.4	25.7	67.2
Selenium	0.01	U	U	U	U	U	U	U	U	U	**0.01** J	U	U	U	U	U
Silver	0.05	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Sodium	20	**287** J	**288** B	**243**	**549** J	**251** J	U	**200**	U	**217**	**222**	**430** B	**187**	**380**	**232**	**392** J
Thallium	0.0005 (G)	U	U	U	U	U	U	U	U	U	U	U	U	U	U	U
Vanadium		0.0012 J	U	U	0.0029 J	0.002 J	U	U	U	0.089	0.088	U	0.0049 J	0.0058	U	U
Zinc	2 (G)	0.0113 J	0.011 B	U	0.3000 J	0.0178 J	U	0.034	U	0.0024 J	0.0016 J	0.0015 JB	0.0084 J	0.035	0.034	0.241 J

Notes:

U - Not detected
B - Analyte found in associated blank
J - Below quantitiation limit
* - Average of duplicate samples
Bold indicates concentration exceeds TOGS 1.1.1 GA
ND - a non-detectable concentration by the approved analytical methods referenced in 6 NYCRR Section 700.3
PW - Pond Water

(G) indicates TOGS 1.1.1 guidance value
** - Applies to the sum of cis-and trans-1.3-dichloropropene
*** - Applies to the sum of phenolic compounds
NYSDEC, Division of Water, TOGS (1.1.1) [NYSDEC, 1998, with addenda through 2004].

Data Source:

Aug 2008	"Draft Petroleum Investigation Report." Brown and Caldwell, Liverpool, New York. October 2008.
Sept 2008	"Draft Solid Waste Investigation Report." Brown and Caldwell, Liverpool, New York. March 2009.
July 2010 to July 2012	"Roth Steel Consent Order D7-015-11-04, Revised Interim Data Submittal." AECOM, East Syracuse, New York. April 2011

APPENDIX B

SOIL BORING AND MONITORING WELL LOGS

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OIL CONTAMINATION STUDY
HIAWATHA BOULEVARD SITE
SYRACUSE, NEW YORK

FOR

ROTH STEEL CORP.

SYRACUSE, NEW YORK

BY

Norbert E. Faltyn

NORBERT E. FALTYN
CONSULTING GEOLOGIST

OCTOBER 1968

DATE		EMPIRE SOILS INVESTIGATIONS, INC. OF GROTON, N. Y.	HOLE NO.	B-1
START	9-20-68		GRD. ELEV.	
FINISH	9-20-68		G. W. ELEV.	
SHEET	1 OF 1	BORING LOG	G. W. DEPTH	See Note

PROJECT Roth Steel Compacny LOCATION Syracuse, New York

DEPTH BELOW GND. SURF.	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	CROSS SECTION	SOIL CLASSIFICATION	TEST DATA
										No Topsoil	
0	1	13	52	20	72	20				FILL Very compact to firm SILT, SAND & GRAVEL, trace ashes tar & oil	Water Readings: encountered water @ 3.0' @ completion 9-20 10:45 AM water @ 3.5'
						27	Dmp	Br			
	2	8	6	12	18	12					
	3	5	3	2	5	10					
						5	Wet	blk		FILL Loose SAND & ASHES, little silt, trace organics & oil	
5	4	1	1	1	2	2					
	5	1	2	5	7	3	Wet	wht			
						3					Note: Slight petroleum odor in Sample #1
	6	3	5	5	10					Loose WASTE trace fiber in Sample #4 trace glass in Sample #5	
										Bottom of Hole 9.0'	

NOTATION:
- M.A. = Mechanical Analysis
- w = Water content, dry weight basis
- L.L. = Liquid Limit
- P.I. = Plasticity index.
- qu. = Unconfined compressive strength, tons per sq. ft.
- N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 " per blow.
- C = No. blows to drive 2 1/2" casing 12 " with 300 lb. weight falling 18 " per blow.

SOIL CLASSIFICATIONS Visual by laboratory technician
GROUND WATER READINGS As noted

DATE		EMPIRE SOILS INVESTIGATIONS, INC. OF GROTON, N. Y.	HOLE NO.	B-2
START	9-20-68	BORING LOG	GRD. ELEV.	
FINISH	9-20-68		G. W. ELEV.	
SHEET	1 OF 1		G. W. DEPTH	See Note

PROJECT Roth Steel Company LOCATION Syracuse, New York

DEPTH BELOW GND. SURF.	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	CROSS SECTION	SOIL CLASSIFICATION	TEST DATA
0										No Topsoil	
	1	14	46	22	68	25	Dmp	Br		FILL very compact SAND & ROCK FRAGMENTS, some Tar & Oil	Water Readings: @ completion 9-20 12:00 Noon water @ 2.5' casing out 12:10 PM water @ 2.5'
						18		Blk			
	2	9	6	4	10	12	Dmp	Br		FILL Loose SAND & ASHES, trace glass, tar & oil, little silt in sample #3	
	3	2	2	1	3	4	Wet	Wht			
5						4					
	4	No Recovery				5					
	5	1	1		2	3	Wet	Wht		Loose WASTE, trace organics	Note: Strong Petroleum odor in Sample #1
										Bottom of Hole 7.0'	

NOTATION: M.A. = Mechanical Analysis
w = Water content, dry weight basis
L.L. = Liquid Limit
P.I. = Plasticity index.
qu. = Unconfined compressive strength, tons per sq. ft.
N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30" per blow.
C = No. blows to drive 2 1/2 casing 12 " with 300 lb. weight falling 24" per blow.

SOIL CLASSIFICATIONS Visual by laboratory technician

GROUND WATER READINGS As noted

DATE	
START	9-20-68
FINISH	9-20-68
SHEET	1 OF 1

EMPIRE SOILS INVESTIGATIONS, INC.
OF
GROTON, N. Y.

BORING LOG

HOLE NO.	B-3
GRD. ELEV.	
G. W. ELEV.	
G. W. DEPTH	See Note

PROJECT Roth Steel Company   LOCATION Syracuse, New York

DEPTH BELOW GND. SURF.	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	CROSS SECTION	SOIL CLASSIFICATION	TEST DATA
										No Topsoil	
0	1	22	50	27	77	26	Mst	Br Blk		FILL very compact to compact SAND & GRAVEL, trace to little ashes, tar & coal, trace wire & wood	Water Readings: encountered water @ 3.0' @ completion 9-20 1:15 PM water @ 3.0' casing out 1:25 PM water @ 3.0'
						20					
	2	14	17	15	32	18					
	3	4	1	1	2	4	Wet	Blk		FILL Loose CINDERS, trace ashes, wood & gravel	
						5					
5	4	1	1	1	2	2					
	5	1	1	1	2	3					
						4					
	6	1	1	2	3		Wet	Wht Gr		Loose WASTE, little organics	
										Bottom of Hole 9.0'	

NOTATION:
- M.A. = Mechanical Analysis
- w = Water content, dry weight basis
- L.L. = Liquid Limit
- P.I. = Plasticity index.
- qu. = Unconfined compressive strength, tons per sq. ft.
- N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 " per blow.
- C = No. blows to drive 2 1/2" casing 12 " with 300 lb. weight falling 18 " per blow.

SOIL CLASSIFICATIONS Visual by laboratory technician

GROUND WATER READINGS Asnoted

DATE	
START	9-20-68
FINISH	9-20-68
SHEET	1 OF 1

EMPIRE SOILS INVESTIGATIONS, INC.
OF
GROTON, N. Y.

BORING LOG

HOLE NO.	B-5
GRD. ELEV.	
G. W. ELEV.	
G. W. DEPTH	See Note

PROJECT Roth Steel Company LOCATION Syracuse, New York

DEPTH BELOW GND. SURF.	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	CROSS SECTION	SOIL CLASSIFICATION	TEST DATA
0										N. Topsoil	
	1	6	25	12	37	26	Mst	Br		FILL compact to firm	Water Readings:
						18		Blk		SAND & GRAVEL w/ Slt	encountered water
	2	14	19	8	27	22		Red		Brick, Cinders, Ashes &	@ 3.0'
	3	6	8	6	14	14				Wood	@ completion
5						15					9-20 4:00 PM
	4	8	10	7	17	18					water @ 3.0'
	5	7	6		13						casing out
	6	5	4		9		Wet	Wht		Loose WASTE	4:10 PM water
											@ 3.0'
										Bottom of Hole 8.0'	

NOTATION:
- M.A. = Mechanical Analysis
- w = Water content, dry weight basis
- L.L. = Liquid Limit
- P.I. = Plasticity index.
- qu. = Unconfined compressive strength, tons per sq. ft.
- N = No. blows to drive 2 " spoon 12 " with 140 lb. pin.wt. falling 30" per blow.
- C = No. blows to drive 2 1/2 casing 12 " with 300 lb. weight falling 18" per blow.

SOIL CLASSIFICATIONS Visual by laboratory technician

GROUND WATER READINGS As noted

DATE START 9-23-68 FINISH 9-23-68 SHEET 1 OF 1	**EMPIRE SOILS INVESTIGATIONS, INC.** OF GROTON, N. Y. **BORING LOG**	HOLE NO. B-6 GRD. ELEV. G. W. ELEV. G. W. DEPTH See Note

PROJECT Roth Steel Company LOCATION Syracuse, New York

DEPTH BELOW GND. SURF.	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	CROSS SECTION	SOIL CLASSIFICATION	TEST DATA
0										No Topsoil	
	1	8	15	12	27	16					
						12	Mst	Br		FILL firm to very compact	Water Readings:
	2	12	17	10	27	14		Blk		to compact SAND, GRAVEL	encountered water
	3	26	52	74	126	17		Red		BRICK, WOOD & GLASS	@ 2.5
5						62					@ completion
	4	58	46	25	71	97					9-23 5:00 PM
	5	18	26		44						water @ 2.5'
											casing out 5:1 PM
										Bottom of Hole 7.0	water @ 2.
											Note: Slight petroleum odor in Sample #1

NOTATION:
- M.A. = Mechanical Analysis
- w = Water content, dry weight basis
- L.L. = Liquid Limit
- P.I. = Plasticity index.
- qu = Unconfined compressive strength, tons per sq. ft.
- N = No. blows to drive 2" spoon 12" with 140 lb. pin wt. falling 30" per blow.
- C = No. blows to drive 2 1/2" casing 12" with 300 lb. weight falling 18" per blow.

SOIL CLASSIFICATIONS Visual by laboratory technician

GROUND WATER READINGS As noted

DATE	
START	9-23-68
FINISH	9-23-68
SHEET	1 OF 1

EMPIRE SOILS INVESTIGATIONS, INC.
OF
GROTON, N. Y.

BORING LOG

HOLE NO.	B-7
GRD. ELEV.	
G. W. ELEV.	
G. W. DEPTH	See Note

PROJECT: Roth Steel Company
LOCATION: Syracuse, New York

DEPTH BELOW GND. SURF.	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	CROSS SECTION	SOIL CLASSIFICATION	TEST DATA
0										No Topsoi:	
	1	12	32	20	52	25					Water Readings:
						32	Mst	Br		FILL very compact to	encountered water
	2	42	36	18	54	36		Blk		loose SAND, GRAVEL &	@ 2.0' @ comple-
	3	25	10	8	18	27				CINDERS w/ Wood & Oil	tion 9-23 3:00 PM
5						15					water @ 2.0'
	4	2	3	3	6	8					casing out 3:15 PM
	5	2	2		4						water @ 2.0'
										Bottom of Hole 7.0'	Note: Sligh petroleum odor in Sample #1
											Note: Strong odor in Sample#3

NOTATION:
- M.A. = Mechanical Analysis
- w = Water content, dry weight basis
- L.L. = Liquid Limit
- P.I. = Plasticity index.
- qu. = Unconfined compressive strength, tons per sq. ft.
- N = No. blows to drive 2" spoon 12" with 140 lb. pin wt. falling 30" per blow.
- C = No. blows to drive 2 1/2" casing 12" with 300 lb. weight falling 18" per blow.

SOIL CLASSIFICATIONS: Visual by laboratory technician
GROUND WATER READINGS: As noted

DATE	
START	9-24-68
FINISH	9-24-68
SHEET	1 OF 1

EMPIRE SOILS INVESTIGATIONS, INC.
OF
GROTON, N. Y.

BORING LOG

HOLE NO.	B-8
GRD. ELEV.	
G. W. ELEV.	
G. W. DEPTH	See Note

PROJECT Roth Steel Company LOCATION Syracuse, New York

DEPTH BELOW GND. SURF.	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	CROSS SECTION	SOIL CLASSIFICATION	TEST DATA
0										No Topsoil	
	1	10	15	26	41	15					
						17	Mst	Br		FILL compact to firm	Water Readings:
	2	14	19	22	41	21		Blk		SAND & CINDERS w/	@ completion
	3	5	8	10	18	18		Red		Ashes, Brick, Glass,	water @ 3.6'
5						18				Wood & Tar	casing out
	4	11	9	12	21	12					water @ 3.6'
	5	8	9		17						
										Bottom of Hole 7.0'	

NOTATION:
- M.A. = Mechanical Analysis
- w = Water content, dry weight basis
- L.L. = Liquid Limit
- P.I. = Plasticity index.
- qu. = Unconfined compressive strength, tons per sq. ft.
- N = No. blows to drive 2" spoon 12" with 140 lb. pin wt. falling 30" per blow.
- C = No. blows to drive 2 1/2 casing 12" with 300 lb. weight falling 18" per blow.

SOIL CLASSIFICATIONS Visual by laboratory technician

GROUND WATER READINGS As noted

DATE		
START	9-23-68	
FINISH	9-23-68	
SHEET	1	OF 1

EMPIRE SOILS INVESTIGATIONS, INC.

OF

GROTON, N. Y.

BORING LOG

HOLE NO.	B-2
GRD. ELEV.	
G. W. ELEV.	
G. W. DEPTH	See Note

PROJECT Roth Steel Company LOCATION Syracuse, New York

DEPTH BELOW GND. SURF.	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	CROSS SECTION	SOIL CLASSIFICATION	TEST DATA
0										N : Topsoil	
	1	8	9	7	16	14					
						10	Mst	Br Blk Red		FILL Firm to loose SAND & CINDERS w/ Brick, Gravel, Glass, Tar & Oil	Water Readings: encountered water @ 2.0' @ completion 9-28 2:00 PM water @ 2.0' casing out
	2	5	5	6	11	9					
	3	6	5	8	13	8					
5						12					
	4	6	7	9	16	10					
	5	1	1		2	12					
	6	2	6		8		Wet	Wht		Loose WASTE	
										Bottom of Hole 8.0'	2:15 PM water @ 2.0' Note: Sample #5 no recovery

NOTATION:
- M.A. = Mechanical Analysis
- w = Water content, dry weight basis
- L.L. = Liquid Limit
- P.I. = Plasticity index.
- qu. = Unconfined compressive strength, tons per sq. ft.
- N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 " per blow.
- C = No. blows to drive 2 1/2 casing 12 " with 300 lb. weight falling 18 " per blow.

SOIL CLASSIFICATIONS Visual by laboratory technician

GROUND WATER READINGS As noted

DATE	
START	9-24-68
FINISH	9-24-68
SHEET	1 OF 1

EMPIRE SOILS INVESTIGATIONS, INC.
OF
GROTON, N. Y.

BORING LOG

HOLE NO.	B-10
GRD. ELEV.	
G. W. ELEV.	
G. W. DEPTH	See Note

PROJECT Roth Steel Company LOCATION Syracuse, New York

DEPTH BELOW GND. SURF.	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	CROSS SECTION	SOIL CLASSIFICATION	TEST DATA
0										No Topsoil	
	1	9	25	15	40	17					
						20	Mst	Br		FILL compact to firm	Water Readings:
	2	9	6	10	16	18		Blk		SAND & CINDERS w/ Ashes	encountered
	3	12	17	20	37	17				Wood, Nails, Tar & Oil	water @ 3.0'
5						24				some Silt in Sample #2	@ completion
	4	12	10	9	19	27					9-24 3:45 PM
	5	2	5	5	10		Wet	Wht		Loose WASTE	water @ 3.0'
											casing out
											4:00 PM
										Bottom of Hole 7.5'	water @ 3.0'
											Note: Slight
											pertoleum odor
											in Sample #2

NOTATION:
M.A. = Mechanical Analysis
w = Water content, dry weight basis
L.L. = Liquid Limit
P.I. = Plasticity index.
qu. = Unconfined compressive strength, tons per sq. ft.
N = No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 " per blow.
C = No. blows to drive 2 1/2 casing 12 " with 300 lb. weight falling 18 " per blow.

SOIL CLASSIFICATIONS Visual by laboratory technician
GROUND WATER READINGS As noted

DATE	
START	9-23-68
FINISH	9-23-68
SHEET	1 OF 1

EMPIRE SOILS INVESTIGATIONS, INC.
OF
GROTON, N. Y.

BORING LOG

HOLE NO.	B-11
GRD. ELEV.	
G. W. ELEV.	
G. W. DEPTH	See Note

PROJECT Roth Steel Company LOCATION Syracuse, New York

DEPTH BELOW GND. SURF.	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	CROSS SECTION	SOIL CLASSIFICATION	TEST DATA
0										No Topsoil	
	1	2	4	4	8	8					Water Readings:
						6	Mst	Br		FILL loose SAND &	emcountered
	2	2	2	2	4	5		Blk		CINDERS w/ Wood,	water @ 1.5'
	3	3	4	4	8	5				Leather, Ashes, & Oil	@ completion
5						6				Petroleum odor	9-23 12:30 PM
	4	3	4	5	9	4					water @ 1.4'
	5	4	7		11			Wht		Firm WASTE @ 6.5'	casing out
											water @ 1.5'
										Bottom of Hole 7.0'	

NOTATION:
- M.A. = Mechanical Analysis
- w = Water content, dry weight basis
- L.L. = Liquid Limit
- P.I. = Plasticity index.
- qu. = Unconfined compressive strength, tons per sq. ft.
- N = No. blows to drive 2" spoon 12" with 140 lb. pin wt. falling 30" per blow.
- C = No. blows to drive 2 1/2" casing 12" with 300 lb. weight falling 18" per blow.

SOIL CLASSIFICATIONS Visual by laboratory technician

GROUND WATER READINGS As noted

DATE	
START	9-24-68
FINISH	9-24-68
SHEET	1 OF 1

EMPIRE SOILS INVESTIGATIONS, INC.
OF
GROTON, N. Y.

BORING LOG

HOLE NO.	B-12
GRD. ELEV.	
G. W. ELEV.	
G. W. DEPTH	See Note

PROJECT Roth Steel Company LOCATION Syracuse, New York

DEPTH BELOW GND. SURF.	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	CROSS SECTION	SOIL CLASSIFICATION	TEST DATA
0										N: Topsoil	
	1	6	7	9	16	10	Mst	Br Blk		FILL firm to loose SAND & CINDERS w/ Ashes, Wood, & Leather	Water Readings: encountered water @ 3.0' @ completion 9-24 10:00 AM water @ 3.0' casing out water @ 3.0'
						8					
	2	5	6	5	11	6					
	3	1	1	1	2	1	Wet				
5						1					
	4	1	1	1	2	1	Wet	Wht		Loose WASTE	
	5	1	1		2						
										Bottom of Hole 7.0'	

NOTATION:
- M.A. = Mechanical Analysis
- w = Water content, dry weight basis
- L.L. = Liquid Limit
- P.I. = Plasticity index.
- qu. = Unconfined compressive strength, tons per sq. ft.
- N = No. blows to drive 2" spoon 12" with 140 lb. pin wt. falling 30" per blow.
- C = No. blows to drive 2 1/2" casing 12" with 300 lb. weight falling 18" per blow.

SOIL CLASSIFICATIONS Visual by laboratory technician

GROUND WATER READINGS as noted

EMPIRE SOILS INVESTIGATIONS, INC.
OF
GROTON, N. Y.

BORING LOG

DATE:
START 9-23-68
FINISH 9-23-68
SHEET 1 OF 1

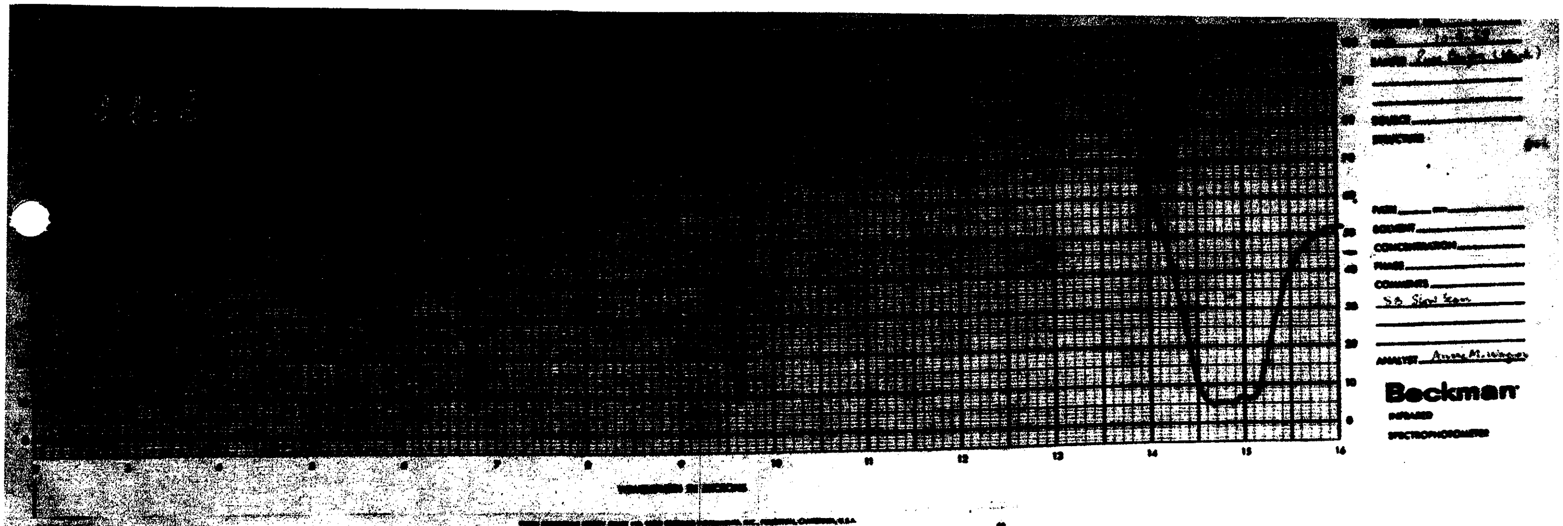
HOLE NO. B-13
GRD. ELEV.
G. W. ELEV.
G. W. DEPTH See Note

PROJECT Roth Steel Company
LOCATION Syracuse, New York

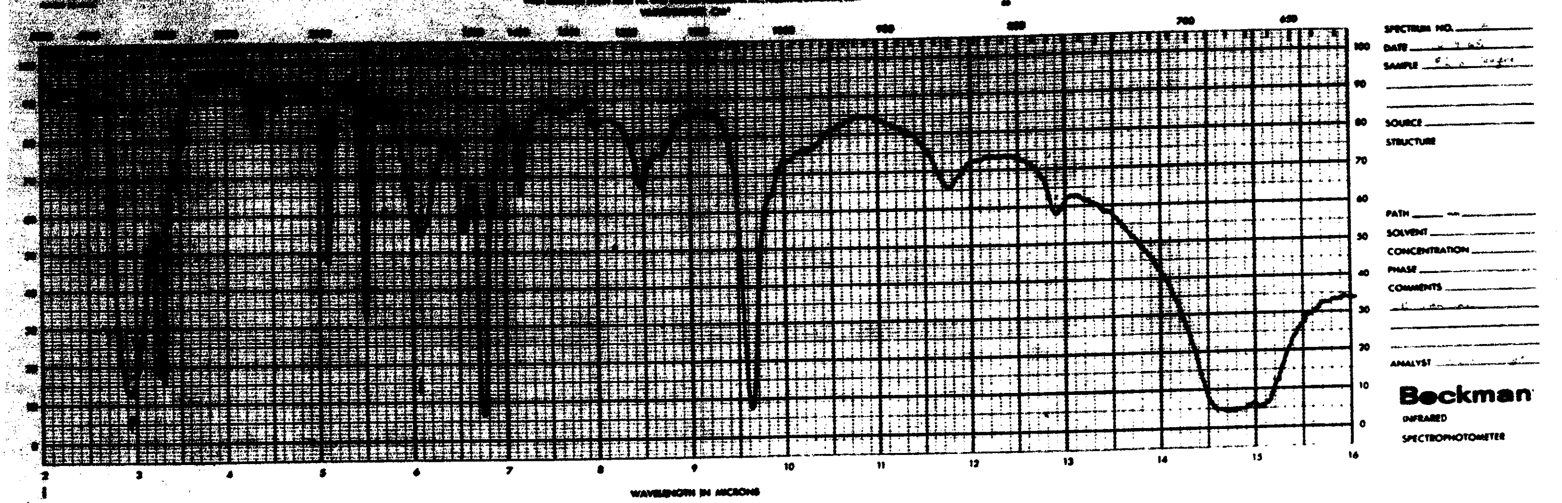
DEPTH BELOW GND. SURF.	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	CROSS SECTION	SOIL CLASSIFICATION	TEST DATA
										No Topsoil	
0	1	5	12	4	16	12	Mst	Br		FILL firm to loose to firm	Water Readings:
						10		Blk		SAND & CINDERS w/	encountered
	2	4	3	6	9	8				Brick, Wood, Leather &	water @ 3.0'
	3	7	6	4	10	9				Metal, Tar & Oil	@ completion
5						9				Petroleum Odor	9-23 10:00 AM
	4	8	9	9	18	12					water @ 2.5'
	5	5	6	8	14	10	Wet				casing out
											10:15 AM water
	6	4	6	6	12		Wet	Wht		Firm WASTE	@ 2.8'
										Bottom of Hole 9.0'	

NOTATION:
M.A. = Mechanical Analysis
w = Water content, dry weight basis
L.L. = Liquid Limit
P.I. = Plasticity index.
qu. = Unconfined compressive strength, tons per sq. ft.
N = No. blows to drive 2" spoon 12' with 140 lb. pin wt. falling 30' per blow.
C = No. blows to drive 2 1/2 casing 12 with 300 lb. weight falling 18' per blow.

SOIL CLASSIFICATIONS Visual by laboratory technician
GROUND WATER READINGS As noted



SOURCE
STRUCTURE
PATH
SOLVENT
CONCENTRATION
PHASE
COMMENTS
ANALYST
Beckman
INFRARED
SPECTROPHOTOMETER



WAVENUMBER CM⁻¹
SPECTRUM NO.
DATE
SAMPLE
SOURCE
STRUCTURE
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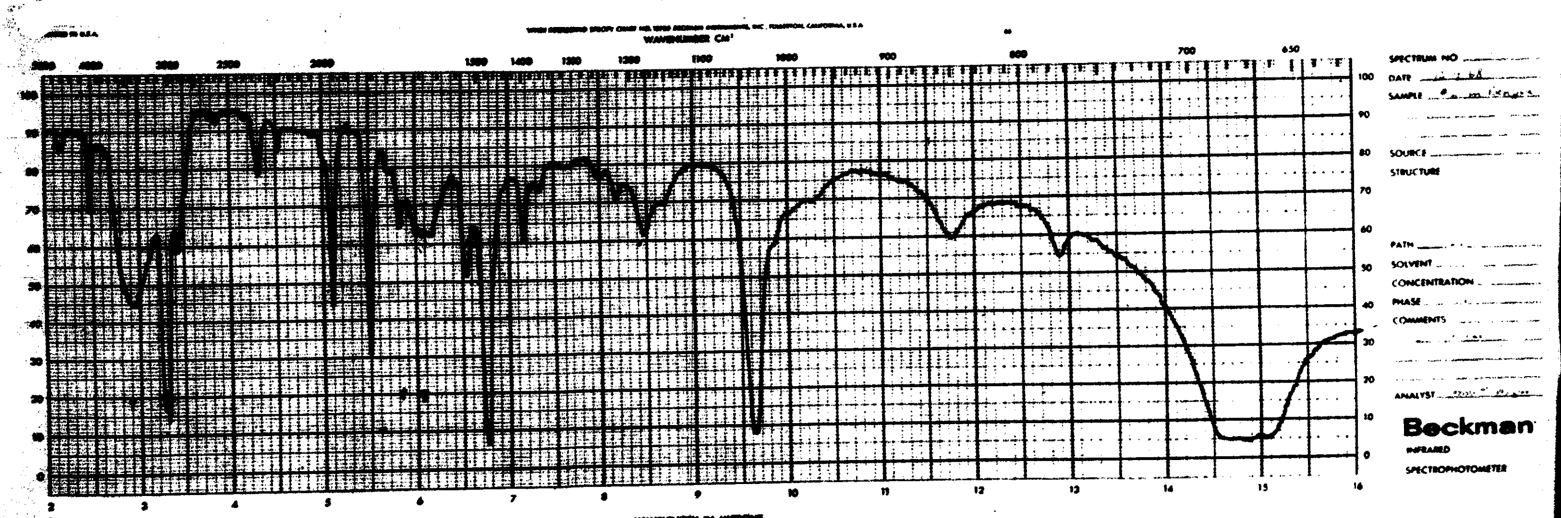
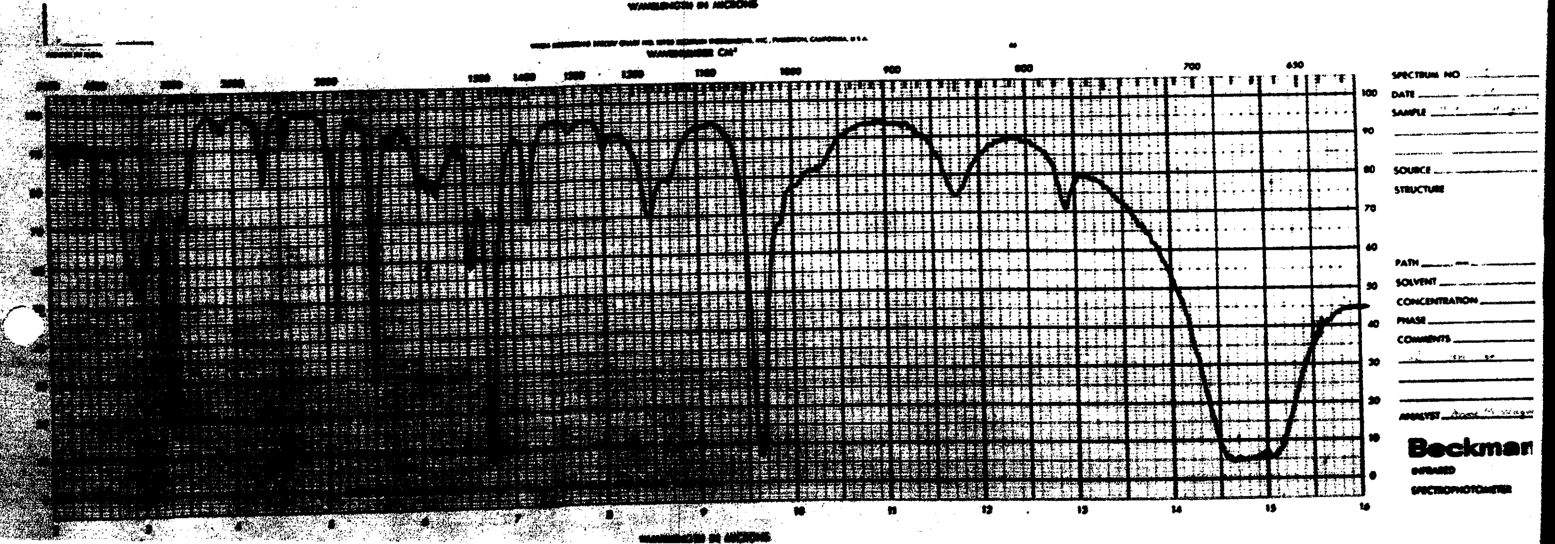
SOLVENT
CONCENTRATION
PHASE
COMMENTS
ANALYST
Beckman
INFRARED
SPECTROPHOTOMETER
WAVELENGTH IN MICRONS



WAVENUMBER CM⁻¹
SPECTRUM NO.
DATE
SAMPLE
SOURCE
STRUCTURE
PATH
SOLVENT
CONCENTRATION
PHASE
COMMENTS
ANALYST
Beckman
INFRARED
SPECTROPHOTOMETER
WAVELENGTH IN MICRONS



WAVENUMBER CM⁻¹
SPECTRUM NO.
DATE
SAMPLE
SOURCE
STRUCTURE
PATH
SOLVENT
CONCENTRATION
PHASE
COMMENTS
ANALYST
Beckman
INFRARED
SPECTROPHOTOMETER
WAVELENGTH IN MICRONS

CME Associates, Inc.

P.O. Box 554
Central Square, New York 13036
(315) 668-3868
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www.cmeassociates.com

Transmittal

OCT 0 8 2004

October 6, 2004

C&S Engineers, Inc.
499 Col. Eileen Collins Boulevard
North Syracuse, New York 13212

Attn: Mr. Steve Calocerinos, P.E.

Re: Subsurface Exploration-Test Boring Logs
Roth Steel Parking Lot Project
Syracuse, New York
CME Job No.: 25645-05

Gentlemen:

Enclosed you will find …

Number of Copies	Report No.:/Description
3	25645B-01-0904/Subsurface Exploration-Test Boring Logs

Respectfully submitted,
CME Associates, Inc.

Nicole L. Craft for

Marc L. Cheney
Dept. Head of Drilling Services

MC.nlc

SUBSURFACE EXPLORATION – TEST BORING LOG

Project: Roth Steel Parking Lot Project, Syracuse, New York
Report No.: 25645B-01-0904
Client: Roth Steel Corporation
Date Started: 09/20/04 **Finished:** 09/20/04
Location of Boring: See Boring Location Sketch
Elevation of Surface of Boring:

METHODS OF INVESTIGATION

Casing: N/A **Driller:** Dave Lyons
Casing Hammer: **Driller:** Beau Fletcher
Other: 4" Core Bit **Inspector:**
Soil Sampler: 2" OD Split Barrel **Rod Size:** AWJ
Sampler Hammer: Wt. 140 lbs./Auto **Fall:** 30 in.
Make & Model of Drill Rig: CME 55 Truck Mounted

GROUND WATER OBSERVATIONS

Date	Time	Depth	Casing At
09/20/04	While drilling	Water used for Coring	
09/20/04	After casing removed	Caved @ 3.6'	out

LOG OF BORING SAMPLES / CLASSIFICATION OF MATERIAL

Depth Scale (Feet)	Casing Blows/ Foot	Sample I.D.	Depth of Sample (Feet) From	Depth of Sample (Feet) To	Sample Type/ Recovery (Inches)	Blows On Sampler Per 6 inches	Depth Of Change (feet)	c – coarse, m – medium, f – fine; **and** – 35 to 50 %, **some** – 20 to 35 %, **little** – 10 to 20 %, **trace** – 0 to 10 %	SPT "N" or RQD
0	XXX	1	0.0	0.3	C	4" Core Bit		Asphalt Core – 3" Piece	
							0.5		
		2	0.5	2.0	SS/12	8-6-6		Black COAL SLAG and cmf SAND, trace SILT (wet) ~ Miscellaneous Fill ~	12
		3	2.0	4.0	SS/18	5-5-5-3		Similar Fill (wet)	10
		4	4.0	6.0	SS/20	4-5-5-3		Pink SOLVAY WASTE and mf SAND, little SILT (wet)	10
5									
	XXX							Bottom of Boring @ 6.0'	
10									
15									

*SS – Split Spoon, U – Undisturbed Tube, C - Core

Remarks:

SUBSURFACE EXPLORATION – TEST BORING LOG

Project: Roth Steel Parking Lot Project, Syracuse, New York
Report No.: 25645B-01-0904
Client: Roth Steel Corporation
Date Started: 09/20/04 **Finished:** 09/20/04
Location of Boring: See Boring Location Sketch
Elevation of Surface of Boring:

METHODS OF INVESTIGATION

Casing: N/A **Driller:** Dave Lyons
Casing Hammer: **Driller:** Beau Fletcher
Other: 4" Core Bit **Inspector:**
Soil Sampler: 2" OD Split Barrel **Rod Size:** AWJ
Sampler Hammer: Wt. 140 lbs./Auto **Fall:** 30 in.
Make & Model of Drill Rig: CME 55 Truck Mounted

GROUND WATER OBSERVATIONS

Date	Time	Depth	Casing At
09/20/04	While drilling	Water used for Coring	
09/20/04	After casing removed	3.2	out
09/20/04	After casing removed	Caved @ 4.3'	out

LOG OF BORING SAMPLES / CLASSIFICATION OF MATERIAL

c – coarse, m – medium, f – fine; **and** – 35 to 50 %, **some** – 20 to 35 %, **little** – 10 to 20 %, **trace** – 0 to 10 %

Depth Scale (Feet)	Casing Blows/ Foot	Sample I.D.	Depth of Sample (Feet) From	Depth of Sample (Feet) To	Sample Type/ Recovery (Inches)	Blows On Sampler Per 6 inches	Depth Of Change (feet)	Classification of Material	SPT "N" or RQD
0	XXX	1	0.0	0.3	C	4" Core Bit		Asphalt Core – 3" Piece	
							0.5		
		2	0.5	2.0	SS/10	11-6-4		Black COAL ASH SLAG and cmf SAND, little SILT, trace fine GRAVEL (wet) ~ Miscellaneous Fill ~	10
		3	2.0	4.0	SS/16	3-2-3-2		Similar Fill (saturated)	5
		4	4.0	6.0	SS/12	2-1-1-3		Brown SOLVAY WASTE, some COAL SLAG, little SILT (saturated)	2
5									
	XXX							Bottom of Boring @ 6.0'	
10									
15									

*SS – Split Spoon, U – Undisturbed Tube, C - Core
Remarks:

SUBSURFACE EXPLORATION – TEST BORING LOG

Project: Roth Steel Parking Lot Project, Syracuse, New York
Report No.: 25645B-01-0904
Client: Roth Steel Corporation
Date Started: 09/20/04 **Finished:** 09/20/04
Location of Boring: See Boring Location Sketch
Elevation of Surface of Boring:

METHODS OF INVESTIGATION

Casing: N/A **Driller:** Dave Lyons
Casing Hammer: **Driller:** Beau Fletcher
Other: 4" Core Bit **Inspector:**
Soil Sampler: 2" OD Split Barrel **Rod Size:** AWJ
Sampler Hammer: Wt. 140 lbs /Auto **Fall:** 30 in.
Make & Model of Drill Rig: CME 55 Truck Mounted

GROUND WATER OBSERVATIONS

Date	Time	Depth	Casing At
09/20/04	While drilling	Water used for Coring	
09/20/04	After casing removed	None Noted	out
09/20/04	After casing removed	Caved @ 4.0'	out

LOG OF BORING SAMPLES / CLASSIFICATION OF MATERIAL

c – coarse, m – medium, f – fine; **and** – 35 to 50 %, **some** – 20 to 35 %, **little** – 10 to 20 %, **trace** – 0 to 10 %

Depth Scale (Feet)	Casing Blows/ Foot	Sample I.D.	Depth of Sample (Feet) From	Depth of Sample (Feet) To	Sample Type/ Recovery (Inches)	Blows On Sampler Per 6 inches	Depth Of Change (feet)	Classification of Material	SPT "N" or RQD
0	XXX	1	0.0	0.3	C	4" Core Bit	0.5	Asphalt Core – 3" Piece	
		2	0.5	2.0	SS/12	17-9-4		Brown cmf SAND and SOLVAY WASTE, little SILT, trace BRICK (wet, medium compact) ~ Miscellaneous Fill ~	13
		3	2.0	4.0	SS/18	4-3-3-1		Similar Fill (wet)	6
		4	4.0	6.0	SS/20	1-WH-1-WH		Grey SOLVAY WASTE and SILT (saturated)	1
5									
	XXX							Bottom of Boring @ 6.0'	
10									
15									

*SS – Split Spoon, U – Undisturbed Tube, C - Core
Remarks: WH = Weight of Hammer and Rods.

SUBSURFACE EXPLORATION – TEST BORING LOG

Project: Roth Steel Parking Lot Project, Syracuse, New York **Report No.:** 25645B-01-0904
Client: Roth Steel Corporation **Date Started:** 09/20/04 **Finished:** 09/20/04
Location of Boring: See Boring Location Sketch **Elevation of Surface of Boring:**

METHODS OF INVESTIGATION

Casing: N/A **Driller:** Dave Lyons
Casing Hammer: **Driller:** Beau Fletcher
Other: 4" Core Bit **Inspector:**
Soil Sampler: 2" OD Split Barrel **Rod Size:** AWJ
Sampler Hammer: Wt. 140 lbs./Auto **Fall:** 30 in.
Make & Model of Drill Rig: CME 55 Truck Mounted

GROUND WATER OBSERVATIONS

Date	Time	Depth	Casing At
09/20/04	While drilling	Water used for Coring	
09/20/04	After casing removed	None Noted	out
09/20/04	After casing removed	Caved @ 4.0'	out

LOG OF BORING SAMPLES / CLASSIFICATION OF MATERIAL

c – coarse, m – medium, f – fine; **and** – 35 to 50 %, **some** – 20 to 35 %, **little** – 10 to 20 %, **trace** – 0 to 10 %

Depth Scale (Feet)	Casing Blows/ Foot	Sample I.D.	Depth of Sample (Feet) From	To	Sample Type/ Recovery (Inches)	Blows On Sampler Per 6 inches	Depth Of Change (feet)	Classification of Material	SPT "N" or RQD
0	XXX	1	0.0	2.0	SS/14	32-30-13-9		Brown cmf SAND and Run-of-Crush GRAVEL, some SOLVAY WASTE, little SILT, trace COAL ASH SLAG, trace WOOD (moist, very compact) ~ Miscellaneous Fill ~	43
		2	2.0	4.0	SS/10	5-4-5-3		Black COAL ASH SLAG and SOLVAY WASTE, little SILT (wet)	9
		3	4.0	6.0	SS/6	1-1-1-1		Black COAL ASH SLAG, little cmf SAND, trace GLASS (saturated)	2
5									
	XXX							Bottom of Boring @ 6.0'	
10									
15									

*SS – Split Spoon, U – Undisturbed Tube, C - Core
Remarks: WH = Weight of Hammer and Rods.

SUBSURFACE EXPLORATION – TEST BORING LOG

Project: Roth Steel Parking Lot Project, Syracuse, New York **Report No.:** 25645B-01-0904
Client: Roth Steel Corporation **Date Started:** 09/20/04 **Finished:** 09/20/04
Location of Boring: See Boring Location Sketch **Elevation of Surface of Boring:**

METHODS OF INVESTIGATION

Casing: N/A **Driller:** Dave Lyons
Casing Hammer: **Driller:** Beau Fletcher
Other: 4" Core Bit **Inspector:**
Soil Sampler: 2" OD Split Barrel **Rod Size:** AWJ
Sampler Hammer: Wt. 140 lbs /Auto **Fall:** 30 in.
Make & Model of Drill Rig: CME 55 Truck Mounted

GROUND WATER OBSERVATIONS

Date	Time	Depth	Casing At
09/20/04	While drilling	Water used for Coring	
09/20/04	After casing removed	2.7'	out
09/20/04	After casing removed	Caved @ 4.4'	out

LOG OF BORING SAMPLES / CLASSIFICATION OF MATERIAL

c – coarse, m – medium, f – fine; **and** – 35 to 50 %, **some** – 20 to 35 %, **little** – 10 to 20 %, **trace** – 0 to 10 %

Depth Scale (Feet)	Casing Blows/ Foot	Sample I.D	Depth of Sample (Feet) From	To	Sample Type/ Recovery (Inches)	Blows On Sampler Per 6 inches	Depth Of Change (feet)	Classification of Material	SPT "N" or RQD
0	XXX	1	0.0	0.4	C	4" Core Bit	0.5	Asphalt Core – 4" Recovery	
		2	0.5	2.0	SS/16	10-11-12		Black SOLVAY WASTE and COAL ASH SLAG, little mf SAND, trace SILT (wet) ~ Miscellaneous Fill ~	23
		3	2.0	4.0	SS/8	7-5-3-2		Black COAL ASH SLAG, some SOLVAY WASTE, trace SILT (saturated)	8
		4	4.0	6.0	SS/5	2-2-1-1		Similar Fill (saturated)	3
5									
	XXX							Bottom of Boring @ 6.0'	
10									
15									

*SS – Split Spoon, U – Undisturbed Tube, C - Core
Remarks:

SUBSURFACE EXPLORATION – TEST BORING LOG

Project: Roth Steel Parking Lot Project, Syracuse, New York
Report No.: 25645B-01-0904
Client: Roth Steel Corporation
Date Started: 09/20/04 **Finished:** 09/20/04
Location of Boring: See Boring Location Sketch
Elevation of Surface of Boring:

METHODS OF INVESTIGATION

Casing: N/A **Driller:** Dave Lyons
Casing Hammer: **Driller:** Beau Fletcher
Other: 4" Core Bit **Inspector:**
Soil Sampler: 2" OD Split Barrel **Rod Size:** AWJ
Sampler Hammer: Wt. 140 lbs./Auto **Fall:** 30 in.
Make & Model of Drill Rig: CME 55 Truck Mounted

GROUND WATER OBSERVATIONS

Date	Time	Depth	Casing At
09/20/04	While drilling	Water used for Coring	
09/20/04	After casing removed	None Noted	out
09/20/04	After casing removed	Caved @ 4.4'	out

LOG OF BORING SAMPLES / CLASSIFICATION OF MATERIAL

c – coarse, m – medium, f – fine; **and** – 35 to 50 %, **some** – 20 to 35 %, **little** – 10 to 20 %, **trace** – 0 to 10 %

Depth Scale (Feet)	Casing Blows/ Foot	Sample I.D.	Depth of Sample (Feet) From	To	Sample Type/ Recovery (Inches)	Blows On Sampler Per 6 inches	Depth Of Change (feet)	Classification of Material	SPT "N" or RQD
0	XXX	1	0.0	0.4	C	4" Core Bit	0.5	Asphalt Core – 3½" Recovery	
		2	0.5	2.0	SS/12	44-53-32		Grey Run-of-Crush LIMESTONE, some cmf SAND, little SILT, trace SLAG (moist) ~ Miscellaneous Fill ~	85
		3	2.0	4.0	SS/16	10-5-5-3		Grey SOLVAY WASTE, some GLASS with WIRE, little SILT, trace SLAG (moist)	10
		4	4.0	6.0	SS/3	1-2-WH-1		Similar Fill (saturated)	2
5									
	XXX							Bottom of Boring @ 6.0'	
10									
15									

*SS – Split Spoon, U – Undisturbed Tube, C - Core
Remarks: WH = Weight of Hammer and Rods

SUBSURFACE EXPLORATION – TEST BORING LOG

Project: Roth Steel Parking Lot Project, Syracuse, New York **Report No.:** 25645B-01-0904
Client: Roth Steel Corporation **Date Started:** 09/20/04 **Finished:** 09/20/04
Location of Boring: See Boring Location Sketch **Elevation of Surface of Boring:**

METHODS OF INVESTIGATION

Casing: N/A **Driller:** Dave Lyons
Casing Hammer: **Driller:** Beau Fletcher
Other: 4" Core Bit **Inspector:**
Soil Sampler: 2" OD Split Barrel **Rod Size:** AWJ
Sampler Hammer: Wt. 140 lbs./Auto **Fall:** 30 in.
Make & Model of Drill Rig: CME 55 Truck Mounted

GROUND WATER OBSERVATIONS

Date	Time	Depth	Casing At
09/20/04	While drilling	Water used for Coring	
09/20/04	After casing removed	None Noted	out
09/20/04	After casing removed	Caved @ 3.0'	out

LOG OF BORING SAMPLES / CLASSIFICATION OF MATERIAL

c – coarse, m – medium, f – fine; **and** – 35 to 50 %, **some** – 20 to 35 %, **little** – 10 to 20 %, **trace** – 0 to 10 %

Depth Scale (Feet)	Casing Blows/ Foot	Sample I.D.	Depth of Sample (Feet) From	To	Sample Type/ Recovery (Inches)	Blows On Sampler Per 6 inches	Depth Of Change (feet)	Classification of Material	SPT "N" or RQD
0	XXX	1	0.0	0.4	C	4" Core Bit	0.5	Asphalt Core – 3½" Recovery	
		2	0.5	2.0	SS/10	35-28-16		Grey Run-of-Crush LIMESTONE, some cmf SAND, little SILT, trace SLAG (saturated) ~ Miscellaneous Fill ~	44
		3	2.0	4.0	SS/8	12-10-8-3		Similar Fill (saturated)	18
		4	4.0	6.0	SS/4	2-2-3-2		Black COAL ASH and cmf SAND, little SILT, trace GLASS (saturated)	5
5									
	XXX							Bottom of Boring @ 6.0'	
10									
15									

*SS – Split Spoon, U – Undisturbed Tube, C - Core

Remarks:

SUBSURFACE EXPLORATION – TEST BORING LOG

Project: Roth Steel Parking Lot Project, Syracuse, New York **Report No.:** 25645B-01-0904
Client: Roth Steel Corporation **Date Started:** 09/21/04 **Finished:** 09/21/04
Location of Boring: See Boring Location Sketch **Elevation of Surface of Boring:**

METHODS OF INVESTIGATION

Casing: N/A **Driller:** Dave Lyons
Casing Hammer: **Driller:** Beau Fletcher
Other: 4" Core Bit **Inspector:**
Soil Sampler: **Rod Size:** AWJ
Sampler Hammer: Wt. **Fall:**
Make & Model of Drill Rig: Hand Auger

GROUND WATER OBSERVATIONS

Date	Time	Depth	Casing At
09/21/04	While drilling	Water used for Coring	
09/21/04	After casing removed	None Noted	out
09/21/04	After casing removed	Caved @ 3.0'	out

LOG OF BORING SAMPLES / CLASSIFICATION OF MATERIAL

c – coarse, m – medium, f – fine; **and** – 35 to 50 %, **some** – 20 to 35 %, **little** – 10 to 20 %, **trace** – 0 to 10 %

Depth Scale (Feet)	Casing Blows/ Foot	Sample I.D.	Depth of Sample (Feet) From	To	Sample Type/ Recovery (Inches)	Blows On Sampler Per 6 inches	Depth Of Change (feet)	Classification of Material	SPT "N" or RQD
0	XXX	1	0.0	0.4		4" Core Bit	0.5	Asphalt Core – 4¼" Recovery	
		2	0.5	2.0		Hand Auger		Grey Run-of-Crush LIMESTONE and cmf SAND, little SILT (moist, very compact)	
		3	2.0	3.0		Hand Auger	3.0	Brown cmf GRAVEL and cmf SAND, little SILT (moist, very compact)	
		4	3.0	4.0		Hand Auger		Grey SOLVAY WASTE and SLAG (wet) ~ Miscellaneous Fill ~	
		5	4.0	5.0		Hand Auger		Grey SOLVAY WASTE and SLAG, little BRICK, trace CERAMIC (saturated)	
5		6	5.0	6.0		Hand Auger		Similar Fill with WIRE (saturated)	
	XXX							Bottom of Boring @ 6.0'	
10									
15									

*SS – Split Spoon, U – Undisturbed Tube, C - Core

Remarks:

SUBSURFACE EXPLORATION – TEST BORING LOG

Project: Roth Steel Parking Lot Project, Syracuse, New York **Report No.:** 25645B-01-0904
Client: Roth Steel Corporation **Date Started:** 09/20/04 **Finished:** 09/20/04
Location of Boring: See Boring Location Sketch **Elevation of Surface of Boring:**

METHODS OF INVESTIGATION

Casing: N/A **Driller:** Dave Lyons
Casing Hammer: **Driller:** Beau Fletcher
Other: 4" Core Bit **Inspector:**
Soil Sampler: 2" OD Split Barrel **Rod Size:** AWJ
Sampler Hammer: Wt. 140 lbs /Auto **Fall:** 30 in.
Make & Model of Drill Rig: CME 55 Truck Mounted

GROUND WATER OBSERVATIONS

Date	Time	Depth	Casing At
09/20/04	While drilling	Water used for Coring	
09/20/04	After casing removed	None Noted	out
09/20/04	After casing removed	Caved @ 3.4'	out

LOG OF BORING SAMPLES / CLASSIFICATION OF MATERIAL

c – coarse, m – medium, f – fine; **and** – 35 to 50 %, **some** – 20 to 35 %, **little** – 10 to 20 %, **trace** – 0 to 10 %

Depth Scale (Feet)	Casing Blows/ Foot	Sample I.D.	Depth of Sample (Feet) From	Depth of Sample (Feet) To	Sample Type/ Recovery (Inches)	Blows On Sampler Per 6 inches	Depth Of Change (feet)	Classification of Material	SPT "N" or RQD
0	XXX	1	0.0	0.25	C	4" Core Bit	0.5	Asphalt Core – 3" Recovery	
		2	0.5	2.0	SS/18	47-69-31		Grey Run-of-Crush LIMESTONE, some SOLVAY WASTE, little COAL ASH SLAG, trace SILT (wet) ~ Miscellaneous Fill ~	100
		3	2.0	4.0	SS/14	12-10-8-5		Grey SOLVAY WASTE and COAL ASH SLAG, little SILT (moist)	18
		4	4.0	6.0	SS/10	4-5-4-8		Black COAL ASH SLAG, trace WOOD, trace CERAMIC (saturated)	9
5									
	XXX							Bottom of Boring @ 6.0'	
10									
15									

*SS – Split Spoon, U – Undisturbed Tube, C - Core

Remarks:

DRAFT REPORT

Site Investigation Report
Roth Steel Facility
Syracuse, New York

RothSteel

June 2013

O'BRIEN & GERE

BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-1 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	7.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
7/21/08 - 7/21/08	Parratt Wolff	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83	Easting: 927937.3 ft.
Doug	Direct Push	Ingersoll Rand 8200	Vert Datum: -- Ground Surface Elev: --	Northing: 1115519.0 ft. TOC Elev: --

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GW	**Anthropogenic Fill** Brown/Grey-moist, cmf GRAVEL, little (-) Silt		1					75.2	
			Concrete								
		SM	Dark Brown-moist, mf SAND, little (-) f Gravel, trace Silts. (Glass and other debris)		2					28.4	
5		SM	Dark Brown-wet, mf SAND, little (-) Silt. (Glass)		3					2.5	

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-2 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	5.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method:
7/21/08 - 7/21/08	Parratt Wolff		N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 927934.3 ft. Northing: 1115504.2 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	PID Readings (ppm)	Remarks
		GW GM	**Anthropogenic Fill** Dark brown m GRAVEL little (-) Silt, trace f Sand. (Glass and plastic)		1		8.2	
			Concrete					
		GW GM	Dark brown mf GRAVEL, little (+) Silt, trace f Sand. (metal, glass, plastic and fabric)		2		12.1	
5								

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BORING LOG

BROWN AND CALDWELL	**Project Name:** Roth Steel Preliminary Investigation **Project Number:** 131364.040 **Project Location:** Syracuse, New York	**Permit Number:** N/A	**Boring No.** B-3 **Page** 1 **of** 1

Geologist/Office	**Checked By:**	**Borehole Diameter:**	**Screen Diameter and Type:**	**Slot Size:**	**Total Boring Depth (ft)**
T Joki/Allendale		2"	NA	N/A"	5.0 ft.

Start/Finish Date	**Drilling Contractor:**	**Sampling:** Split Spoon	**Development Method:**
7/21/08 - 7/21/08	Parratt Wolff	**Hammer Type:** N/A	N/A

Driller:	**Drilling Method:**	**Drilling Equipment:**	**Horiz Datum/Proj:** State Plane NY/NAD83 **Vert Datum:** -- **Ground Surface Elev:** --	**Easting:** 927942.0 ft. **Northing:** 1115488.9 ft. **TOC Elev:** --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GW GM	**Anthropogenic Fill** Dark brown, mf GRAVEL, little(-)Silt, trace Sand. (Glass, plastic and wood)		1					16.0	
			Concrete								
5		GW GC	Dark brown, cmf GRAVEL, little (-) Clayey Silt, trace f Sand. @5' wet to saturated (Glass and metal)		2					1.2	

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-4 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
7/21/08 - 7/21/08	Parratt Wolff	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 927967.2 ft. Northing: 1115499.3 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
			Anthropogenic Fill Concrete		1					10.8	
5		GC	Dark brown-wet, mf GRAVEL, some (-) Clayey Silt, Trace (-) f Sand. (Glass)		2					11.9	

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-5 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method: N/A
7/21/08 - 7/21/08	Parratt Wolff		

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 927964.0 ft. Northing: 1115521.0 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	PID Readings (ppm)	Remarks
		GM	**Anthropogenic Fill** Dark brown, cm GRAVEL, little (-) Silt. (Metal, wood and glass)		1	38.8	
			Concrete				
5		ML CL	Dark brown-wet, Clayey SILT, some (+) mf Gravel		2	0.3	

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-6 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
7/21/08 - 7/21/08	Parratt Wolff	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 927982.0 ft. Northing: 1115421.7 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GM	**Anthropogenic Fill** Grey-dry, cmf GRAVEL, little (-) Silt		1					0.8	
			Concrete								
5		GW	Dark brown, mf GRAVEL, little (-) cm Sand, trace Silt. (Glass and metal)		2					22.3	

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-7 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	5.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
7/21/08 - 7/21/08	Parratt Wolff	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83	Easting: 927975.5 ft.
Doug	Direct Push	Ingersoll Rand 8200	Vert Datum: -- Ground Surface Elev: --	Northing: 1115447.0 ft. TOC Elev: --

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GM	Dark brown-moist, mf GRAVEL, little (+) Silt, trace (-) m Sand. (Brick and glass) **Anthropogenic Fill**		1					2.1	
			Concrete Auger refusal @ 3.0'								
5											

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-8 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	1.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method: N/A
7/21/08 - 7/21/08	Parratt Wolff		

Driler:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 927972.2 ft. Northing: 1115462.3 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Graphic Log: Backfill	PID Readings (ppm)	Remarks
		GW	Light brown-wet, cmf GRAVEL, trace mf Sand, trace Silt		1						
			Concrete Auger refusal @ 2'								

BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-9 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method: N/A
7/22/08 - 7/22/08	Parratt Wolff		

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 927999.7 ft. Northing: 1115462.3 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	PID Readings (ppm)	Remarks
		GW	**Anthropogenic Fill** Grey, cmf GRAVEL, trace Silt, trace f Sand		1		3.1	
			Concrete					
5		GW	Dark brwn-moist, cmf GRAVEL, trace Silt. (Wood, cloth, and glass)		2		45.0	

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-10 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method:
7/22/08 - 7/22/08	Parratt Wolff		N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 928003.3 ft. Northing: 1115447.8 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	PID Readings (ppm)	Remarks
		GM	**Anthropogenic Fill** Brown/grey-dry, cmf GRAVEL, little (-) Silt, trace mf Sand. (Glass and wood)		1		97.0	
			Concrete					
		GW	Grey-wet, cmf GRAVEL, trace Silt		2		7.7	
5		MH	Black, Clayey SILT, little (-) Gravel. (Plastic material)					
		SW	Wet, f SAND, with some shells					

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-11 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	2.5 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method: N/A
7/22/08 - 7/22/08	Parratt Wolff		

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 927999.0 ft. Northing: 1115467.3 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GM	**Anthropogenic Fill** Grey-dry, cm GRAVEL, little (+) Silt, trace mf Sand. (Glass and metal)		1					3.5	
			Concrete Auger refusal @ 2.5'								

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. **B-12** Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	3.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method:
7/22/08 - 7/22/08	Parratt Wolff		N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 927994.0 ft. Northing: 1115495.7 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GM	**Anthropogenic Fill** Grey, mf GRAVEL, little (-) mf Sand, trace (-) Silt. (Glass and metal)		1					2.5	
			Concrete Auger refusal @ 3'								

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-13 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
7/22/08 - 7/22/08	Parratt Wolff	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 927996.5 ft. Northing: 1115519.1 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GW	**Anthropogenic Fill** Light brown-dry, mf GRAVEL, trace mf Sand, trace mf Silt. (Metal, glass and wood)		1					103	
		GC	Brown-wet, mf GRAVEL, little(+)Clay Silt								
			Concrete								
5		SW	Dark brown-wet, cmf SAND, little(+)mf Gravel, trace Silt		2					6.2	
		SC SM	Black-wet, ClayeySILT, m Sand								

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-14 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	3.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method:
7/22/08 - 7/22/08	Parratt Wolff		N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 927989.0 ft. Northing: 1115551.4 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GW	**Anthropogenic Fill** Brown-wet, fmc GRAVEL, little(-) cmf Sand, trace Silt		1					14.9	
			Concrete Auger refusal @ 3'								

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-15 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	2.5 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method:
7/22/08 - 7/22/08	Parratt Wolff		N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 927989.0 ft. Northing: 1115590.8 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GW	**Anthropogenic Fill** Brown-dry, cmf GRAVEL, little(-) mf Sand, trace Silt		1					27.3	
			Concrete Auger refusal @ 2.5'								

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-16 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	4.5 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method:
7/23/08 - 7/23/08	Parratt Wolff		N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 928091.6 ft. Northing: 1115552.1 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GM	Brown-dry, cmf GRAVEL, little mf Sand, trace(+) Silt **Anthropogenic Fill**		1					16	
			Concrete								
		GW	Brown-dry, cm GRAVEL, trace Silt		2					N/A	

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-17 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	4.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
7/23/08 - 7/23/08	Parratt Wolff	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83	Easting: 928093.9 ft.
Doug	Direct Push	Ingersoll Rand 8200	Vert Datum: --	Northing: 1115575.1 ft.
			Ground Surface Elev: --	TOC Elev: --

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GM	**Anthropogenic Fill** Brown-moist, cmf GRAVEL, little (-) f Sand, trace (+) Silt		1					1.4	
		GW SW	Brown/Black-wet, mcf GRAVEL, little (+) cmf Sand, trace Silt		2					1.2	Soil is stained black

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-18 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
7/23/08 - 7/23/08	Parratt Wolff	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 928091.8 ft. Northing: 1115600.2 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	PID Readings (ppm)	Remarks
		GM	**Anthropogenic Fill**		1	43.3	
		SM	Dark brown-moist, cm GRAVEL, little (+) m Sand, trace Silt. (Glass and metal)				
			Concrete				
		SW	Dark Grey-wet, cm SAND, little(-) c Gravel, trace Silt. (wood)		2	2.3	
5		SW	Black-wet, mf SAND, little (-) mf Gravel, trace Silt. (Wood and shells)				

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-19 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	5.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
7/23/08 - 7/23/08	Parratt Wolff	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 928086.6 ft. Northing: 1115625.1 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GM	**Anthropogenic Fill** Brown-moist, mf GRAVEL, little cm Sand, Trace Silt		1					119	
			Concrete								
		GW SW	Dark brown/ black, mc GRAVEL, some(-) mc Sand, trace(-)Silt		2					1.2	
		GM	Shells								
5			Black, cm GRAVEL, little(-) mf Sand, trace Silt								

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. **B-20** Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method:
7/23/08 - 7/23/08	Parratt Wolff		N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 928086.6 ft. Northing: 115648.5 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
			Anthropogenic Fill Concrete								
		GC	Light brown, cmf GRAVEL, some Silty Clay		1					17.5	
			Concrete								
5		SW GW	Dark brown, mf SAND, little (+) f Gravel, trace Silt. (Wood and Glass)		2					4.6	

BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-21 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
7/23/08 - 7/23/08	Parratt Wolff	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83	Easting: 928071.3 ft.
Doug	Direct Push	Ingersoll Rand 8200	Vert Datum: --	Northing: 1115552.4 ft.
			Ground Surface Elev: --	TOC Elev: --

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GM	**Anthropogenic Fill** Brown-moist, cm GRAVEL, little Silt, trace mf Sand		1					58.5	
			Concrete								
5		SW GW	Light brown, mf SAND, little (+) cmf Gravel, trace (+) Silt. (Wood and shells)		2					5.4	

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-22 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	5.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method:
7/23/08 - 7/23/08	Parratt Wolff		N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 928070.2 ft. Northing: 1115576.9 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GW	**Anthropogenic Fill** Brown-moist, cmf GRAVEL, little (-) Silt, trace mf Sand. (Glass and metal)		1					44.3	
			Concrete								
		GM	Dark brown-moist, mf GRAVEL, little (+) Silt, trace mf Sand		2					3.4	
5											

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-23 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method:
7/23/08 - 7/23/08	Parratt Wolff		N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 928070.7 ft. Northing: 1115601.4 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GW	**Anthropogenic Fill** Brown, cmf GRAVEL, little (-) mf Sand, trace Silt. (Glass and cloth)		1					17.6	
			Concrete								
5		SW GW	Dark brown/black, cmf SAND, little (+) Gravel, trace Silt		2					6.4	

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-24 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method:
7/23/08 - 7/23/08	Parratt Wolff		N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 928068.6 ft. Northing: 1115626.3 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
			Anthropogenic Fill Concrete								
		GM	Brown, cmf GRAVEL, little(+) mf Sand, trace Silt		1					138	
			Concrete								
5		GW SW	Dark brown-wet, mf GRAVEL, some cm Sand, trace (-) Silt. (Glass and plastic material)		2					3.4	

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-25 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
7/24/08 - 7/24/08	Parratt Wolff	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 928064.9 ft. Northing: 1115649.4 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
			Anthropogenic Fill Concrete								
		GM	Brown-dry, cmf GRAVEL, little (+) mf Sand, trace Silt		1					101	
			Concrete								
5		SW GW	Dark brown-wet, mf GRAVEL, some(-) cmf Sand, trace(+) Silt. (Glass and plastic material)		2					30.2	

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-26 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method:
7/24/08 - 7/24/08	Parratt Wolff		N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 928040.1 ft. Northing: 1115547.7 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int / Recovery / Lithology / Backfill	PID Readings (ppm)	Remarks
		GM	**Anthropogenic Fill** Dark brown-moist, cm GRAVEL, some (-) mf Sand, trace Silt. (Glass, wood and brick)		1		6.6	
			Concrete					
		GM	Brown grey, cm GRAVEL, little(-) cmf Sand, trace(-) Silt		2		2.8	
5		SW	Moist, mf SAND, little (+) mf Gravel, trace (+) Silt					

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-27 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
7/24/08 - 7/24/08	Parratt Wolff	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 928037.3 ft. Northing: 1115575.2 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	PID Readings (ppm)	Remarks
		GW	**Anthropogenic Fill** Brown-dry, cmf GRAVEL, little(-) cmf Sand, trace Silt. (Wood and Glass)		1	17.5	
			Concrete				
5		SW	Dark brown/black wet, mf SAND, little(-) mf Gravel, trace (-) Silt. (Wood, glass and shells)		2	4	

BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-28 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
7/24/08 - 7/24/08	Parratt Wolff	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83	Easting: 928035.3 ft.
Doug	Direct Push	Ingersoll Rand 8200	Vert Datum: -- Ground Surface Elev: --	Northing: 1115600.7 ft. TOC Elev: --

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GW	**Anthropogenic Fill** Brown, mf GRAVEL, little (-) cmf Sand, trace (-) Silt		1					12.2	
			Concrete								
5		SW	Dark brown/black-wet, cmf SAND, little(+) fm Gravel, trace Silt		2					6.0	

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. **B-29** Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
7/24/08 - 7/24/08	Parratt Wolff	Hammer Type: N/A	N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 928028.0 ft. Northing: 1115624.3 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Sample Int	Recovery	Lithology	Backfill	PID Readings (ppm)	Remarks
		GM	**Anthropogenic Fill** Brown, cmf GRAVEL, little (+) cmf Sand, trace Silt		1					196	
			Concrete								
5		SW	Black-wet, mf SAND, trace (+) m Gravel, trace (-) Silt		2					11.3	soil stained black

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BORING LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number: N/A	Boring No. B-30 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		2"	NA	N/A"	6.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method:
7/24/08 - 7/24/08	Parratt Wolff		N/A

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: 928036.7 ft. Northing: 1115647.7 ft. TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	Graphic Log: Sample Int	Graphic Log: Recovery	Graphic Log: Lithology	Backfill	PID Readings (ppm)	Remarks
			Concrete								
		SW	Light brwn, cmf SAND, little (+) mf Gravel, trace Silt		1					85.3	
			Concrete								
5											

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MONITORING WELL LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number:	Well No. MW-1 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		6.25"	2.0" PVC	.010"	16.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
8/12/08 - 8/12/08	Parratt Wolff	Hammer Type: N/A	Surge with Whale Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: -- Northing: -- TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	PID Readings (ppm)	Remarks
		GW	**Anthropogenic Fill** Brown mf GRAVEL, little (-) c Sand, trace Silt	N/A	1	0	0-1' Cement Pad
		GM	Dark brown/black mf GRAVEL, little (+) c Sand trace Silt		2	0	1'-3' Bentonite Pellets
5		GM	Dark brown/black mf GRAVEL little(+) c Sand, trace Silt		3	0	
		GM	Black cmf GRAVEL, little c Sand, trace Silt		4	0	
			(No recovery)		5	0	3'-15' #1 Filter Pack Sand
10		ML	White SILT (Solvay Waste)		6	0	
					7	0	5'-15' .010 Slot PVC Screen
15					8	0	

Graphic Log: Sample Int | Recovery | Lithology | Well (Stick Up)

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MONITORING WELL LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number:	Well No. **MW-2** Page 1 of 1

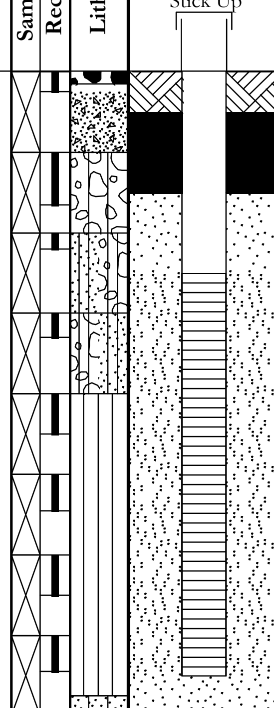
Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		6.25"	2.0" PVC	.010"	16.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
8/12/08 - 8/12/08	Parratt Wolff	Hammer Type: N/A	Surge with Whale Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: -- Northing: -- TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	PID Readings (ppm)	Remarks
		GW	**Anthropogenic Fill** Brown cmf GRAVEL, little c Sand, trace Silt	N/A	1	0	0-1' Cement Pad
			Concrete				
		GM	Dark brown cmf GRAVEL, little (+) cm Sand, trace (+) Silt		2	0.3	1'-3' Bentonite Pellets
5		SM GM	Brown cmf SAND, little mf Gravel, trace Silt. Mixed with Solvay waste		3	0.1	
		GM SM	Brown/Grey mf GRAVEL, some cmf Sand, trace Silt		4	0.3	
		ML	White SILT (Solvay waste)		5	0.1	
10							3'-15' #1 Filter Pack Sand
					6	0.1	
					7	0.1	
							5'-15' .010 Slot PVC Screen
15					8	0	
		SM	Grey mf SAND, trace Silt				

Graphic Log: Sample Int, Recovery, Lithology, Well



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MONITORING WELL LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number:	Well No. **MW-3** Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		6.25"	2.0" PVC	.010"	16.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method:
8/13/08 - 8/13/08	Parratt Wolff		Surge with Whale Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: -- Northing: -- TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	PID Readings (ppm)	Remarks
0			**Anthropogenic Fill** Concrete	N/A	1	4.4	0-1' Cement Pad
2		GM SM	Dark brown-dry cmf GRAVEL, some (-) cm Sand, trace Silt.		2	45.6	1'-3' Bentonite Pellets
4		GM SM	Dark brown/black cm GRAVEL, some (-) m Sand, trace Silt		3	3.7	
6		SM	Dark brown m SAND, little (-) f Gravel, trace (+) Silt		4	4.1	
8					5	0	3'-15' #1 Filter Pack Sand
10		ML	White SILT (Solvay Waste)		6	0	
12					7	0	5'-15' .010 Slot PVC Screen
14					8	0	
15.5		SW	Brown, cm SAND, trace Silt				

Graphic Log: Sample Int, Recovery, Lithology, Well (Stick Up)

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MONITORING WELL LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number:	Well No. MW-4 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		6.25"	2.0" PVC	.010"	16.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method:
8/13/08 - 8/13/08	Parratt Wolff		Surge with Whale Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: -- Northing: -- TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	PID Readings (ppm)	Remarks
		GW	**Anthropogenic Fill** Brown cmf GRAVEL, little c Sand, trace (+) Silt.	N/A	1	4.9	0-1' Cement Pad
			Concrete				
		SM	Dark brown f SAND, little (+) Silt, trace (+) f Gravel		2	7.7	1'-3' Bentonite Pellets
5		GM	Dark Brown mf GRAVEL, little (+) mf Sand, trace (+) Silt		3	4.9	
		GM	Dark brown f GRAVEL, little cmf Sand, trace (+) Silt		4	0	
		SM GM	Dark brown cmf SAND, some(+) f Gravel, trace Silt		5	0	3'-15' #1 Filter Pack Sand
10		ML	White SILT (Solvay Waste)		6		
					7		5'-15' .010 Slot PVC Screen
					8	0	
15		SW	Brown, cmf SAND with shells				

Graphic Log: Sample Int, Recovery, Lithology, Well (Stick Up)

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MONITORING WELL LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number:	Well No. MW-5 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		6.25"	2.0" PVC	.010"	16.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: N/A	Development Method:
8/13/08 - 8/13/08	Parratt Wolff		Surge with Whale Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: -- Northing: -- TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	PID Readings (ppm)	Remarks
		GM	**Anthropogenic Fill** Brown cmf GRAVEL, little (-) mf Sand, trace Silt	N/A	1	8.3	0-1' Cement Pad
			Concrete		2	0.0	1'-3' Bentonite Pellets
5		GM	Dark brown cmf GRAVEL, little(-) mf Sand, trace (+) silt		3	3.4	
		GM SM	Dark brown f GRAVEL, some(+) cm Sand, trace(+) Silt		4	10.1	
			(No recovery)		5		3'-15' #1 Filter Pack Sand
10		ML	White SILT (Solvay Waste)		6	0	
					7	0	5'-15' .010 Slot PVC Screen
15					8	0	
		ML	Grey SILT, little cmf SAND				

Graphic Log: Sample Int, Recovery, Lithology, Well (Stick Up)

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MONITORING WELL LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number:	Well No. **MW-6** Page 1 of 1

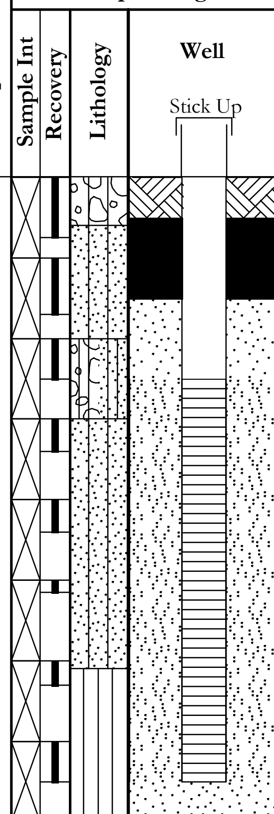
Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		6.25"	2.0" PVC	.010"	16.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon / Hammer Type: N/A	Development Method:
8/14/08 - 8/14/08	Parratt Wolff	Hammer Type: N/A	Surge with Whale Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: -- Northing: -- TOC Elev: --
Doug	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	PID Readings (ppm)	Remarks
		GM	Brown mf GRAVEL, little (+) cm Sand, trace Silt	N/A	1	.04	0-1' Cement Pad
		SM	Brown/Grey m SAND mixed with Solvay waste		2	0	1'-3' Bentonite Pellets
5		GM SM	Light brown m GRAVEL, some (+) cm Sand. Solvay Waste		3	0	
		SM	Grey m SAND mixed with Solvay Waste		4	0	
					5	0	3'-15' #1 Filter Pack Sand
10					6	0	
		ML	White SILT (Solvay Waste)		7	0	5'-15' .010 Slot PVC Screen
15					8	0	

Graphic Log



MONITORING WELL LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number:	Well No. MW-7 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		6.25"	2.0" PVC	.010"	13.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
9/12/08 - 9/12/08	Parratt Wolff	Hammer Type: Manual	Surge with Whale Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: -- Northing: -- TOC Elev: --
	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	PID Readings (ppm)	Remarks
		GW	Grey, cmf GRAVEL, little cmf Sand, trace Silt	14-14-13-12	1	N/A	0-1' Cement Pad 1'-2' Bentonite Pellets
		GW	Grey, mf GRAVEL, little (-) mf Sand, trace (+) Silt	8-8-16-20	2		
5		GW SM	Grey, mf GRAVEL, little (+) Silt, trace mf Sand Brown, mf SAND, little (+) Silt	4-3-2-2	3		2'-13' #1 Filter Pack Sand
		GM	Grey, mf GRAVEL, little (+) mf Sand, trace (+) Silt	3-3-3-3	4		
		SM GM	Black, cm SAND, little (+) f Gravel, trace (+) Silt	3-3-2-1	5		3'-13' .010 Slot PVC Screen
10		ML	White SILT (Solvay Waste)	1-1-3-1	6		

Graphic Log: Sample Int, Recovery, Lithology, Well (Stick Up)

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MONITORING WELL LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number:	Well No. MW-8 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		6.25"	2.0" PVC	.010"	13.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon Hammer Type: Manual	Development Method:
9/12/08 - 9/12/08	Parratt Wolff		Surge with Whale Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: -- Northing: -- TOC Elev: --
	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	PID Readings (ppm)	Remarks
		GW	Grey, cmf GRAVEL, trace f Sand, trace Silt	30-26-31-35	1	N/A	0-1' Cement Pad
				50/4	2		1'-2' Bentonite Pellets
			(No recovery)	5-2-1-2	3		
5				3-3-2-2	4		2'-13' #1 Filter Pack Sand
		SM ML	Grey, mf SAND little (+) Silt (Solvay waste)	3-2-2-6	5		3'-13' .010 Slot PVC Screen
10		ML	White green SILT (Solvay waste with a slight green tint)	3-1-1-2	6		

Graphic Log: Sample Int, Recovery, Lithology, Well (Stick Up)

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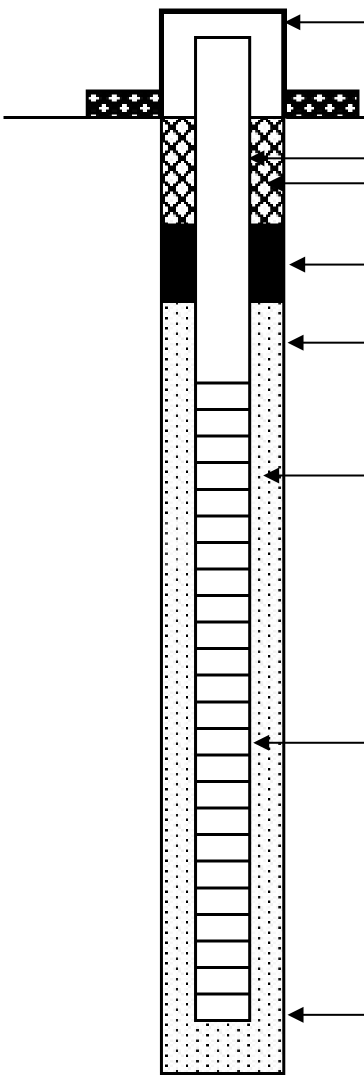
AECOM

MONITORING WELL DIAGRAM - SINGLE CASED

Well No. MW-8A

Project: Roth Steel	Location: Syracuse, NY	Page 1 of 1		
AECOM Project No.: 60156356	Subcontractor:	Water Levels		
Surface Elevation: Ft	Driller: Parratt Wolff	Date	Time	Depth
Top of PVC	Well Permit No.:			
Casing Elevation: Ft	AECOM Rep.: G. White			
Datum:	Date of Completion: 3/29/2011			



Locking protective stickup with concrete pad

Ground Surface

Riser Pipe from +2.0 ft to 3.0 ft

Cement-bentonite grout from 0.0 ft to 1.0 ft

Bentonite seal from 1.0 ft to 2.0 ft

Borehole diameter 6 inches

Filter pack from 2.0 ft to 13.0 ft

Sand Size 1

Well screen from 3.0 ft to 13.0 ft

Diameter 2 inches

Slot size 0.010 inches

Type PVC

Bottom Cap at 13.0 ft

Bottom of Borehole at 13.0 ft

Notes: NOT TO SCALE; Measurements given in feet below ground surface save "+" = above ground surface; This monitoring well serves as a replacement for destroyed monitoring well MW-8 and is located approximately 4' to the east of MW-8.

MONITORING WELL LOG

BROWN AND CALDWELL	Project Name: Roth Steel Preliminary Investigation Project Number: 131364.040 Project Location: Syracuse, New York	Permit Number:	Well No. MW-9 Page 1 of 1

Geologist/Office	Checked By:	Borehole Diameter:	Screen Diameter and Type:	Slot Size:	Total Boring Depth (ft)
T Joki/Allendale		6.25"	2.0" PVC	.010"	13.0 ft.

Start/Finish Date	Drilling Contractor:	Sampling: Split Spoon	Development Method:
9/12/08 - 9/12/08	Parratt Wolff	Hammer Type: Manual	Surge with Whale Pump

Driller:	Drilling Method:	Drilling Equipment:	Horiz Datum/Proj: State Plane NY/NAD83 Vert Datum: -- Ground Surface Elev: --	Easting: -- Northing: -- TOC Elev: --
	Direct Push	Ingersoll Rand 8200		

Depth (feet)	Elevation (feet)	USC Soil Type	Description	Blow Counts	Sample No.	PID Readings (ppm)	Remarks
		GW	Grey, cmf GRAVEL, little (-) mf Sand, trace (+) Silt	21-16-13-18	1	N/A	0-1' Cement Pad
							1'-2' Bentonite Pellets
				31-26-16-10	2		
		GW	Grey, cmf GRAVEL, little cmf Sand, trace (-) Silt	9-5-3-5	3		
5							2'-13' #1 Filter Pack Sand
		SW	Grey, cmf SAND little (+) Silt (Solvay waste)	7-6-7-10	4		
				2-1-1-1	5		
							3'-13' .010 Slot PVC Screen
10				2-6-2-1	6		
		ML CL	White SILT (Solvay Waste)				

Graphic Log: Sample Int, Recovery, Lithology, Well (Stick Up)

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AECOM
5015 Campuswood Dr., Ste. 104
East Syracuse, New York 13057

Well ID: MW-10

Project Name: Roth Steel Facility
Client/Project Number: Roth Steel/60156356
Date Started/Date Completed: 6/22/2010
Boring Location: North central part of the Site
Drilling Company: Parratt Wolff

Sampling Method: Hollow Stem Auger
PVC Elevation (ft/msl, NAVD 88): 372.90
Ground Elevation (ft/msl, NAVD 88): 371.25
Total Depth: 12 Feet
Logged By: Keith Stahle

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	USCS	Geologic Description	Remarks	Well Remarks
0 to -2	1.3	35.0	MW-10 (0-2)	GP	brown medium Gravel, some fine to medium Sand, Fill Material, trace brick and ash	Medium Compaction, Dry	
-2 to -4	0.4	19.3		GP	brown; same as above (SAA) large rock fragment in tip of spoon	Wet @ 3.5'	Well Screen 2-12'
-4 to -6	1.5	4.9		GP	brown; SAA Gravel, dark brown stain from 5.5-6.0'	Loose, Wet	
-6 to -8	0.8	1.8	MW-10 (6-8)	GP	brown Gravel; some brick fragments and cinders throughout	Loose, Wet	
-8 to -10	0.4	1.3		GP	brown; SAA	Wet	
-10 to -12	1.8	1.4		GP	white Solvay waste material	Moist, Medium Compaction	

Staining or visual impacts observed

Comments: MW-10 sampled for VOCs, SVOCs, PCBs, Glycols, TAL Metals, and Mercury

AECOM
5015 Campuswood Dr., Ste. 104
East Syracuse, New York 13057

Well ID: MW-11

Project Name: Roth Steel Facility
Client/Project Number: Roth Steel/60156356
Date Started/Date Completed: 6/22/2010
Boring Location: South central part of the Site
Drilling Company: Parratt Wolff

Sampling Method: Hollow Stem Auger
PVC Elevation (ft/msl, NAVD 88): 373.52
Ground Elevation (ft/msl, NAVD 88): 371.69
Total Depth: 13 Feet
Logged By: Keith Stahle

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	USCS	Geologic Description	Remarks	Well Remarks
0	1.7	16.4	MW-11 (0-2)	GP	brown medium Gravel, some fine Sand	Medium Compact, Dry	
-2	1.6	3.4		GP	brown medium to coarse Gravel, some fine Sand, trace Brick and Ash, Glass Fragments and Staining 3.8-4.0', Wet @ 3.8'	Loose, Dry	Well Screen 3-13'
-4	1.3	7.3		GP	brown Gravel same as above (SAA)	Dry to wet	
				SM	brown fine Sand and Silt		
				GP	brown Gravel		
-6				GP	SAA	Moist	
	1.2	2.3		SM	white fine to medium Sand, Solvay waste material, black staining		
-8	1.0	1.6		SM	white Solvay waste material	Moist	
-10	1.8	1.1	MW-11 (10-12)	SM	SAA	Medium Compact, Moist to wet	
-12				SM	brown fine Sand, trace shell fragments		

Staining or visual impacts observed

Comments: MW-11 sampled for VOCs, SVOCs, PCBs, Glycols, TAL Metals, and Mercury

AECOM

5015 Campuswood Dr., Ste. 104
East Syracuse, New York 13057

Well ID: MW-12

Project Name: Roth Steel Facility

Client/Project Number: Roth Steel/60156356

Date Started/Date Completed: 6/23/2010

Boring Location: Central part of the Site

Drilling Company: Parratt Wolff

Sampling Method: Hollow Stem Auger

PVC Elevation (ft/msl, NAVD 88): 372.83

Ground Elevation (ft/msl, NAVD 88): 371.00

Total Depth: 12 Feet

Logged By: Keith Stahle

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	USCS	Geologic Description	Remarks	Well Remarks
0 to -2	0.5	2.0		GP	brown coarse Gravel, some medium Sand, some metal debris, large rock in tip of spoon	Wet	
-2 to -4	0.3	1.5		GP	brown Fill, Gravel, Sand, organics, metal debris	Loose, Wet	Well Screen 2-12'
-4 to -6	1.8	6.6	MW-12 (4-6)	GP	brown, fine Sand, trace medium Gravel	Medium Compact, Wet	
-6 to -8	1.5	6.4		SP	brown fine to medium Sand, some medium Gravel, trace cinders	Loose, Wet	
-8 to -10	2.0	2.4	MW-12 (8-10)	SP	brown medium Sand, black stain white Solvay waste	Loose, Wet	
-10 to -12	1.5	0.8		SP	white Solvay waste	Medium Compact, Moist	

Staining or visual impacts observed

Comments: MW-12 sampled for VOCs, SVOCs, PCBs, Glycols, TAL Metals, and Mercury

AECOM

5015 Campuswood Dr., Ste. 104
East Syracuse, New York 13057

Well ID: MW-13

Project Name: Roth Steel Facility
Client/Project Number: Roth Steel/60156356
Date Started/Date Completed: 6/22/2010
Boring Location: Northwest part of the Site
Drilling Company: Parratt Wolff

Sampling Method: Hollow Stem Auger
PVC Elevation (ft/msl, NAVD 88): 374.06
Ground Elevation (ft/msl, NAVD 88): 371.98
Total Depth: 12 Feet
Logged By: Keith Stahle

Depth (Feet)	Recovery (Feet)	PID (ppm)	Sample ID	Sample Interval	Lithology	USCS	Impacts	Geologic Description	Remarks	Well Construction	Well Remarks
0 to -2	0.7	0.4				GP		brown medium to coarse Gravel, some fine to medium Sand	Loose, Dry		
-2 to -4	1.6	0.3	MW-13 (2-4)	2-4		GP		brown medium Gravel, some fine to medium Sand	Wet @ 3.0'		Well Screen 2-12'
-4 to -6	1.2	0.4				GP		brown, same as above (SAA), trace ash, brick fragments	Loose, Wet		
-6 to -8	0.4	0.2				GP		brown Gravel, SAA, some cinders throughout	Wet		
-8 to -10	1.7	0.1				GP		brown SAA	Wet		
-10 to -12	1.8	0.4				GP		brown Gravel SAA	Wet to Moist		
-12							Staining or visual impacts observed	white Solvay waste			

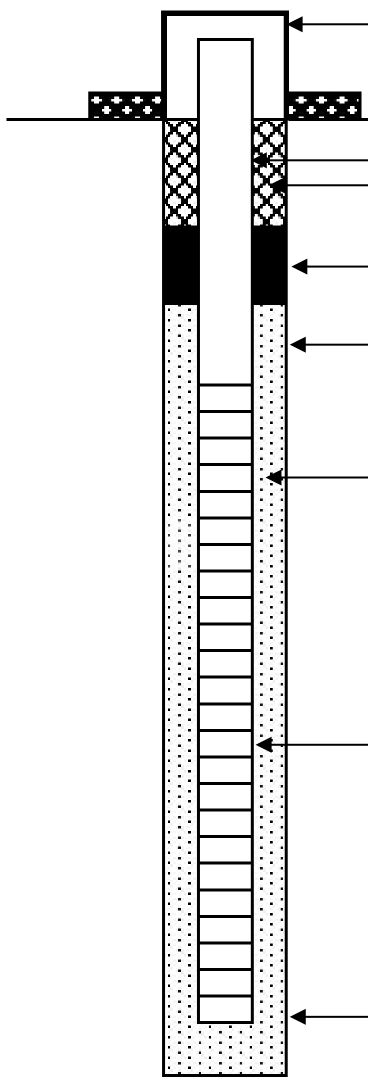
Staining or visual impacts observed

Comments: MW-13 sampled for VOCs, SVOCs, PCBs, Glycols, TAL Metals, and Mercury

MONITORING WELL DIAGRAM - SINGLE CASED

Well No. MW-14

Project: Roth Steel	Location: Syracuse, NY	Page 1 of 1		
AECOM Project No.: 60156356	Subcontractor:	Water Levels		
Surface Elevation: Ft	Driller: Parratt Wolff	Date	Time	Depth
Top of PVC	Well Permit No.:			
Casing Elevation: Ft	AECOM Rep.: G. White			
Datum:	Date of Completion: 3/29/2011			



Locking protective stickup with concrete pad

Ground Surface

Riser Pipe from +2.0 ft to 4.0 ft

Cement-bentonite grout from 0.0 ft to 1.0 ft

Bentonite seal from 1.0 ft to 2.0 ft

Borehole diameter 6 inches

Filter pack from 2.0 ft to 14.0 ft

Sand Size 1

Well screen from 4.0 ft to 14.0 ft

Diameter 2 inches

Slot size 0.010 inches

Type PVC

Bottom Cap at 14.0 ft

Bottom of Borehole at 14.0 ft

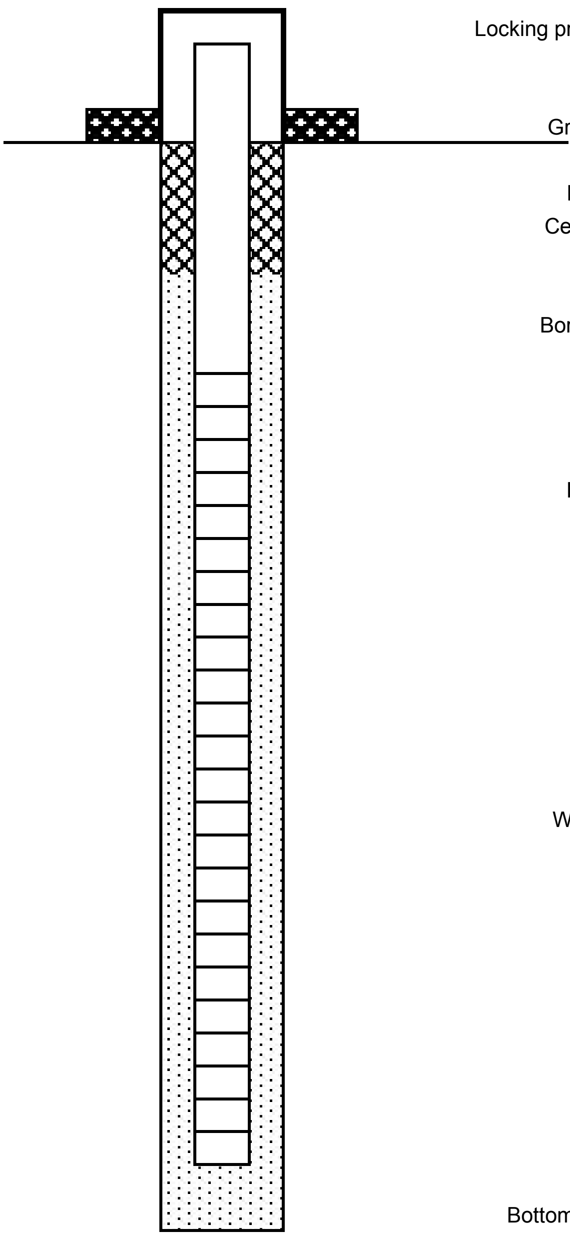
Note: NOT TO SCALE; Measurements given in feet below ground surface save "+" = above ground surface

AECOM

MONITORING WELL DIAGRAM - SINGLE CASED

Well No. MW-15

Project: Roth Steel	Location: Syracuse, NY	Page 1 of 1		
AECOM Project No.: 60156356	Subcontractor:	Water Levels		
Surface Elevation: Ft	Driller: Parratt Wolff	Date	Time	Depth
Top of PVC	Well Permit No.:			
Casing Elevation: Ft	AECOM Rep.: K. Jaglal			
Datum:	Date of Completion: 5/18/2012			



Locking protective stickup with concrete pad

Ground Surface

Riser Pipe from +2.0 ft to 3.0 ft

Cement-bentonite grout from 0.0 ft to 1.0 ft

Borehole diameter 4 inches

Filter pack from 1.0 ft to 12.0 ft

Sand Size 0

Well screen from 2.0 ft to 12.0 ft

Diameter 2 inches

Slot size 0.010 inches

Type PVC

Bottom Cap at 12.0 ft

Bottom of Borehole at 12.0 ft

Notes: NOT TO SCALE; Measurements given in feet below ground surface save "+" = above ground surface;
The boring for this monitoring well was created by a soft dig technique using a vacuum truck.
4' to the east of MW-8.

DRAFT

O'BRIEN & GERE ENGINEERS, INC.	SOIL BORING LOG	REPORT OF BORING MW-16
Client: Roth Steel Proj. Loc: Syracuse, NY File No.: 10875.49565	Sampler: 2in. Split Spoon Hammer: 130 lb. Fall: 24 in.	Location: East of Pond Start Date: 2/13/2013 End Date: 2/13/2013
Boring Company: Parratt-Wolff Foreman: Shawn Bodha OBG Geologist: Nate Vogan		Screen = ; Riser ; \ Grout ; Sand Pack ; Bentonite

Depth Below Grade	No.	Depth (feet)	Blows /6"	Penetr/ Recovery (in ft)	"N" Value	Sample Description	Stratum Change General Descript	Equip. Installed	Field Testing PID (ppm)	Field Testing Time
0	1	2	4-10-14-19	2.0/1.4	24	Moist, dense, moderate yellowish brown (10YR 5/4) to dark yellowish brown (10YR 4/2) SILT; some fmc subangular gravel, little rooty fibers throughout, trace glass			3.2	1323
2	2	4	35-50/0.5	1.0/0.4	>50	Moist, loose, dusky brown (5YR 2/2), SILT; some mc sand, little crushed stone and metal fragments.	FILL		0.0	1330
4	3	6	28-50/0.3	0.8/0.4	>50	Wet, soft, dusky brown (5YR 2/2) SILT; some mc sand, trace fm subangular gravel and glass fragments.	6.8	=	0.0	1400
6	4	8	10-9-13-13	2.0/1.8	22	0-0.8 SAA 0.8-1.5 Wet, soft, light gray (N7) to medium light gray (N6) SOLVAY WASTE, silt sized, pastelike, trace glass fragments. 1.5-1.8 Loose, moist, brownish black (5YR 2/1) fmc GRAVEL; little fm sand, tarry odor.	SOLVAY WASTE & FILL	=	0.0	1415
8	5	10	6-5-3-3	2.0/0.0	8	No recovery, marl looking material on outside of spoon.	10	=	NA	1430
10	6	12	3-4-3-2	2.0/0.9	7	Wet, soft, white (N9) SOLVAY WASTE, silt sized, pastelike.	SOLVAY WASTE	=	0.0	1442
12	7	14	1-2-3-1	2.0/1.1	5	SAA with some sand sized particles.		=	0.0	1445

EOB at 14 ft bgs

Well Construction:
0.010" slot screen: 4-14bgs
#0 Sand: 3-14 ft bgs
Bentonite chips: 1-3 ft bgs
Concrete pad: 0-1 ft bgs

Notes: Samples taken from 0-2 (VOCs, metals, PCBS) and 4-6 (PCBs)
Water table at ~4 ft bgs
Boney drilling 2-6 ft bgs

DRAFT

O'BRIEN & GERE ENGINEERS, INC.	SOIL BORING LOG	REPORT OF BORING MW-17
Client: Roth Steel	Sampler: 2in. Split Spoon	Location: West Road
Proj. Loc: Syracuse, NY	Hammer: 130 lb.	Start Date: 2/14/2013
File No.: 10875.49565	Fall: 24 in.	End Date: 2/14/2013
Boring Company: Parratt-Wolff Foreman: Shawn Bodha OBG Geologist: Nate Vogan		Screen =, Riser; \ Grout; Sand Pack; Bentonite

Depth Below Grade	No.	Depth (feet)	Blows /6"	Penetr/ Recovery (in ft)	"N" Value	Sample Description	Stratum Change General Descript	Equip. Installed	Field Testing PID (ppm)	Field Testing Time
0	1	2	13-23-50-45	2.0/1.2	73	Wet, dense, pale brown (5YR 5/2) SILT; some fm sand, little to some large crushed stone.	FILL		0.0	815
2	2	4	50/0.3	0.3/0.3	>50	SAA, loose, crushed stone lodged in spoon nose.			0.0	818
4	3	6	33-13-5-5	2.0/0.2	18	SAA, poor recovery, marl looking material on outside of spoon.	POSSIBLE MARL	=	0.0	838
6	4	8	3-2-1-1	2.0/0.3	3	Poor recovery, saturated, loose, black (N1) stained mf GRAVEL with fmc sand; strong sheen, and chemical odor.		=	0.0	840
8	5	10	2-2-2-3	2.0/0.0	4	No recovery, loose, wet, marl looking material on outside of spoon, some sheen, slight chemical odor.	10	=	0.0	845
10	6	12	1-3-4-1	2.0/1.1	7	Wet, medium dense to soft, white (N9) SOLVAY WASTE, pastelike, silt sized particles.	SOLVAY WASTE 12.75	=	0.0	900
12	7	14	1-3-3-3	2.0/1.1	6	0-0.75 SAA, coarsening to sand sized particles at 0.7. 0.75-1.1 Moist, soft, olive gray (5Y 4/1) fmc SAND with some rooty organics throughout, peat odor.	PEAT	=	0.0	905

EOB at 14 ft bgs

Well Construction:
0.010" slot screen: 4-14bgs
#0 Sand: 3-14 ft bgs
Bentonite chips: 1-3 ft bgs
Concrete pad: 0-1 ft bgs

Notes:
Samples taken from 0-2 (PCBs) and 6-8 (VOCs)
Water table at ~1 ft bgs
Boney drilling 0-4 ft bgs

APPENDIX C

QUALITY ASSURANCE PROJECT PLAN

ENVIRONMENTAL GROUP, INC.
ENGINEERING, ARCHITECTURE & SURVEYING, PC

QUALITY ASSURANCE PROJECT PLAN

BROWNFIELD CLEANUP PROGRAM
800 HIAWATHA BOULEVARD WEST
(FORMER ROTH STEEL SITE)
SYRACUSE, NEW YORK

Prepared by:

Spectra Environmental Group, Inc.
19 British American Boulevard
Latham, New York 12110
Project #16140

June 2016
Amended October 2017

QUALITY ASSURANCE PROJECT PLAN
BROWNFIELD CLEANUP PROGRAM
800 HIAWATHA BOULEVARD WEST
(FORMER ROTH STEEL SITE)
SYRACUSE, NEW YORK

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1.0 PROJECT ORGANIZATION AND RESPONSIBILITY

This QAPP provides for designated qualified personnel to review sampling procedures, laboratory test methods, data results, and data interpretations. This QAPP also outlines the approach to be followed to ensure that the remedial investigation results are of sufficient quality to accurately represent the environmental field conditions. This plan will identify operational responsibility, lines of authority, and the integration of QA activities. The various QA functions of the project positions are explained in the following subsections.

Project Manager

The project manager will have overall responsibility for ensuring that the project meets the objectives and quality standards as presented in the Work Plan and this QAPP. He/she will be responsible for implementing the project and will have the authority to commit the resources necessary to meet project objectives and requirements. The project manager’s primary function is to ensure that programmatic, technical, and scheduling objectives are achieved successfully. The project manager will be the major point of contact and is responsible for overall control of the project. In addition, he/she will be responsible for technical quality control.

Team Leaders

The project manager will be supported by a team leader who will be responsible for leading and coordinating the day-to-day activities of the various tasks under their supervision. The team leader is a highly experienced environmental professional who will report directly to the project manager.

Technical Staff

The technical staff (team members) for this project will be drawn from corporate resources and appropriately qualified subcontractors. The technical team staff will be used to gather and analyze data, to prepare various task reports and to oversee field activities. The designated technical team members will be experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

Project QA Director

The Project QA Director will be responsible for maintaining QA for the project. This position may be filled by the Project Manager, Team Leader, or another designated staff person.

2.0 QA OBJECTIVES FOR DATA MEASUREMENT

Measurements will be made to ensure that analytical results are representative of the media and conditions measured. Unless otherwise specified, data will be calculated and reported in units consistent with the analytical method, the media sampled, and regulatory standards.

The key considerations for the QA assessment of generated data are accuracy, precision, completeness, representativeness, and comparability. These characteristics are defined below:

Accuracy: Accuracy is the degree of agreement of a measurement or average of measurements with an accepted reference or "true" value and is a measure of bias in the system.

Precision: Precision is the degree of mutual agreement among individual measurements of a given parameter.

Completeness: Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount expected to be obtained under correct normal conditions.

Representativeness: Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition or and environmental condition.

Comparability: Comparability expresses the confidence with which one data set can be compared to another.

2.1 GOALS

The QA/QC goal will focus on controlling measurement error within the limits established and will ultimately provide a database for evaluating potential uncertainty in the measurement data.

Target values for detection limit, percent spike recovery and percent deviation from known check standards, and relative percent difference of duplicates/replicates are provided in the referenced analytical procedures. It should be noted that EPA method target values are not always attainable, depending upon the chemical compound and sampling media. Instances may arise where high samples concentrations, non-homogeneity of samples, or matrix interferences preclude achievement of target detection limits or other quality control criteria. In such instances, the laboratory will report reasons for deviations from these detection limits or noncompliance with quality control criteria.

3.0 SAMPLING PROCEDURES

The sampling of various environmental media will be completed as part of the investigation activities. The proposed analytical testing for the site including location, matrix and analytical requirements, is contained within the remedial investigation work plan. QAPP Table 1 provides a summary of the analytical methods, sampling/preservation requirements, and quality control samples.

3.1 SAMPLING PROTOCOL

The following sections outline the sampling procedures for the collection of environmental media samples of soils, groundwater, and soil vapor. Groundwater monitoring well installation procedures are described in the Work Plan.

3.1.1 Soil Samples from Geoprobe and/or Hollow Stem Auger (HSA) Soil Borings

Continuous soil samples will be collected from each Geoprobe or HSA soil boring to the target depth as outlined in the Work Plan. An experienced geologist or environmental scientist will observe the work associated with the soil borings.

Collected soil samples will be described according to soil type, color, texture, grain size, moisture content, and will be visually noted for physical indications of contamination, such as staining, oils, fill material and/or odor.

Each soil sample interval will be screened with a photoionization (PID-Minirae Model 2000 or equivalent) with a 10.6 eV lamp for the presence of elevated levels of volatile organic vapors.

During the drilling operations, select soil intervals will be submitted for lab testing. The intervals will be selected based upon prescribed depths/objectives in the work plan. Additional intervals may be tested based on field screening and visual objectives. Headspace analysis for VOCs using the PID will also be used to help select which soil sample is submitted for laboratory analyses.

Soil samples to be submitted for chemical analysis will be extracted from drilled boring sleeves using a stainless steel trowel, knife, or latex glove. Each sample container will be handled, packaged, and shipped in accordance with the procedures as outlined in Section 4.0.

3.1.2 Groundwater Samples from Monitoring Wells

Newly installed groundwater monitoring wells will be developed by surge-pumping or bailing prior to sampling. All development water will be collected and stored on site in 55-gallon drums. All drums will be labeled with paint markers according to matrix, location, and date of generation. Turbidity readings and the number of consecutive well volumes removed will be recorded during well development. The wells will be developed to reduce sediment and turbidity to the maximum extent possible. During development, the well will be surged by physical agitation with a bailer, pump or surge block. Groundwater will be pumped until it is visually free of suspended sediment, with a goal of achieving a turbidity of less than 50 NTU and field parameters have stabilized for three consecutive readings (pH +/- 0.1, temperature +/- 3%, conductivity +/- 3%) or asymptotic conditions are achieved after 50 minutes. A minimum of five casing volumes will be removed during development, unless the well becomes dewatered before that. All well development water will be containerized for sampling and disposal.

Following well development, each well will be allowed to equilibrate for at least 24-hours prior to purging and sampling. Purging of each new and existing well will be performed with a low flow peristaltic pump and dedicated polyethylene tubing. Purging of each well will allow representative formation water to enter the well prior to sample collection. Low-flow sampling will be performed using a peristaltic pump with tubing inserted to the approximate mid-screen depth of the well. If a specific water bearing zone is present, the pump will be lowered to this depth. The pump depth will be at least 1 ft. below the top of the water table. The pump will be set to a minimal flow rate (0.5 to 1 L/min) and water quality parameters (i.e. redox, dissolved oxygen, temperature, turbidity, pH, conductivity) will be measured every 3-5 minutes as the purge water is removed. Depth to water will be measured with a goal of causing less than 1 ft. of drawdown during purging. When field parameters have stabilized (three successive readings within ± 0.1 for pH, ±3% for conductivity, ± 10 mv for redox, and 10% for turbidity and dissolved oxygen), a groundwater sample will be collected. The goal is to achieve a stabilized turbidity of 50 NTU or less, prior to sample collection and to collect any VOC sample at a pumping rate of between 100- 250 ml/min. Groundwater samples (depending on the location) will include volatile organic compounds by EPA method 8260 TCL, PCBs by Method 8082 and TAL metals, as specified in the Work Plan. All groundwater and QA/QC samples will be submitted to a NYSDOH ELAP-approved laboratory. If a well does not stabilize or reach the NTU goal after 1-hour, a sample can be collected if at least 3 well volumes have been purged.

New latex gloves will be used for collection of each sample. Each sample container will be labeled, handled, packaged, and shipped in accordance with the procedures as outlined in Section 4.0.

3.1.3 Soil Vapor Samples

Per NYSDOH Soil Vapor Intrusion Guidance (October 2006), soil vapor samples will be collected in laboratory-certified clean Summa® canisters at least 24-hours after the installation of permanent probes. Alternatively, temporary probes may also be installed, in which case soil vapor samples will be collected shortly after installation. Up to three volumes (i.e., the volume of the sample probe and tube) will be purged prior to sample collection. The purge and collection flow rates will not exceed 0.2 L per minute to minimize outdoor air infiltration. Tube warmers will be used to eliminate condensation in tube sampling, if weather conditions permit. A tracer gas (e.g., helium, butane, sulfur hexafluoride, etc.) will be used when collecting soil vapor samples to verify that adequate sampling techniques are being implemented (i.e., to verify infiltration of outdoor air is not occurring).

The following information will be recorded at the time of sampling to identify any conditions that may influence interpretation of the results:

- If sampling is near a commercial or industrial building, uses of volatile chemical during normal operations of the facility should be identified;
- Outdoor plot sketches should be drawn that include the Site, area streets, neighboring commercial or industrial facilities (with estimated distance to the Site), outdoor air sampling locations (if applicable), and compass orientation (north);
- Weather conditions (e.g., precipitation and outdoor temperature) should be noted for the past 24 to 48 hours; and
- Any pertinent observation should be recorded, such as odors, readings from field instrumentation, barometric pressure, wind speed, and direction.

Spectra field personnel will maintain a sample log sheet summarizing the following:

- Sample identification;
- Date and time of sample collection;
- Sampling depth;
- Identity of samplers;
- Sampling methods and devices;
- Purge volumes;
- Volume of soil vapor extracted;
- Vacuum before and after samples were collected;
- Apparent moisture content (dry, moist, saturated, etc.) of the sampling zone; and
- Chain of custody protocols and records used to track samples from sampling point to analysis.

3.2 FIELD QUALITY CONTROL SAMPLES

The following quality control samples will be used during the investigation activities:

3.2.1 Field Duplicates

Field quality control samples will be collected to verify reproducibility of the sampling and analytical methods. Field duplicates will be obtained as follows:

- one field duplicate per 20 soil samples collected from the soil borings;
- one field duplicate groundwater sample collected per 20 samples; and
- one field duplicate soil vapor sample collected per 20 samples, with a minimum of 1 duplicate per sampling event.

3.2.2 Trip Blanks

Trip blanks will be used to assess whether samples has been exposed to volatile constituents during sample storage and transport. Trip blanks will be submitted at a frequency of once per cooler for samples to be analyzed for volatile organics, except for soil vapor samples. The trip blank will consist of a container filled by the laboratory with analyte-free water. The trip blank will remain unopened throughout the sampling event and will only be analyzed for volatile organics.

3.2.3 Matrix Spike/Matrix Spike Duplicates

Matrix Spike/Matrix Spike Duplicates (MS/MSD) will be obtained as follows:

- one MS/MSD per 20 soil samples collected from a representative soil boring; and
- one MS/MSD groundwater sample collected per 20 samples.

3.2.4 Laboratory Quality Control Checks

Internal laboratory quality control checks will also be used to monitor data integrity. These checks include method (equipment) blanks, spike blanks, internal standards, surrogate samples, calibration standards and reference standards, as specified in the SW-846 method.

3.3 Sample Containers

The volumes and container types required for the sampling activities will be based upon the specific lab procedure and SW-846 methodologies. Pre-washed sample containers will be provided by the laboratory. All bottles are to be prepared in accordance with EPA bottle washing procedures.

3.4 Decontamination

Dedicated and/or disposable sampling equipment will be used to minimize decontamination requirements and the possibility of cross-contamination.

The water level indicator, stainless steel trowels, split spoons and Geoprobe are pieces of sampling equipment to be used at more than one location. They will be decontaminated between locations by the following decontamination procedures:

- initial cleaning of any foreign matter with paper towels;
- low phosphate detergent wash;
- de-ionized water rinse; and
- air-dry.

3.5 LEVELS OF PROTECTION/SITE/SAFETY

Field sampling will be conducted under a documented Health and Safety Plan (see Appendix D). On the basis of air monitoring, the level of protection may be downgraded or upgraded at the discretion of the site safety officer.

All work will initially be conducted in Level D (refer to Site Specific Health and Safety Plan). Air purifying respirators (APRs) will be available if monitoring indicates an upgrade to Level C is appropriate.

4.0 SAMPLE CUSTODY

This section describes standard operating procedures for sample identification and chain-of-custody to be used for all field activities. The purpose of these procedures is to ensure that the quality of the samples is maintained during collection, transportation, storage and analysis. All chain-of-custody requirements comply with standard operating procedures indicated in USEPA and NYSDEC sample-handling protocol.

Sample identification documents will be carefully prepared so that sample identification and chain-of-custody can be maintained and sample disposition controlled. Sample identification documents include:

- Field records;
- Sample label;
- Custody seals; and
- Chain-of-custody records.

4.1 CHAIN-OF-CUSTODY

The primary objective of the chain-of-custody (COC) procedures is to provide an accurate written or computerized record that can be used to trace the possession and handling of a sample from collection to completion of all required analyses. COC forms will be provided by the environmental laboratory and completed by Spectra field personnel to document sample collection information and requested analytical tests. Spectra field staff will sign the custody forms and transfer of the sample to the lab staff will be documented by the lab sample custodian.

4.1.1 Sample Labels

Sample labels attached to or affixed around the sample container must be used to properly identify all samples collected in the field. The sample labels are to be placed on the bottles so as not to obscure any QA/QC lot numbers on the bottles. Sample information must be printed in a legible manner using waterproof ink. Field identification must be sufficient to enable cross- reference with the field sampling records or sample logbook. For chain-of-custody purposes, all QC samples are subject to exactly the same custodial procedures and documentation as “real” samples.

4.1.2 Custody Seals

Custody seals are preprinted adhesive-backed seals with security slots designed to break if the seals are disturbed. Sample shipping containers (coolers, cardboard boxes, etc., as appropriate) will be sealed to ensure security. Seals must be signed and dated before use. On receipt at the laboratory, the custodian must check (and certify, by completing logbook entries) that seals on shipping containers are intact. Strapping or other clear packaging tape should be placed over the seals to ensure that seals on shipping containers are not accidentally broker during shipment. Custody seals will not be used when samples are picked-up by a lab courier.

4.1.3 Chain-of-Custody Record

The chain-of-custody record must be fully completed at least in duplicate by the field staff who has been designated by the project manager as being responsible for sample shipment to the appropriate laboratory for analysis. In addition, if samples are known to require rapid turnaround in the laboratory because of project time constraints or analytical concerns (e.g. extraction time or sample retention period limitations, etc.), the person completing the chain-of-custody record should note these constraints in the “Remarks” section of the custody record.

4.1.4 Field Custody Procedures

a. As few persons as possible should handle samples.

b. Sample bottles will be obtained pre-cleaned by the laboratory and shipped to the sampling personnel in charge of the field activities. Coolers or boxes containing cleaned bottles should be sealed with a custody tape seal during transport to the field or while in storage prior to use.

c. The sample collector is personally responsible for the care and custody of samples collected until they are transferred to another person or dispatched properly under chain-of-custody rules.

d. The sample collector will record sample data in a controlled field notebook and/or an appropriate field sampling records.

4.2 DOCUMENTATION

4.2.1 Sample Identification

All containers of samples collected from the project will be identified using the following typical format on a label or tag fixed to the sample container:

- These initials identify the sample matrix in accordance with the following abbreviations:

  <u>Soil:</u>

  (17) [Parent Location] (Depth Interval) e.g. (17) B-1 (0-1)

  <u>Groundwater:</u>

  MW-[Well Number]

  <u>Vapor Points</u>

  VP-[Point Number]

- Sub Sample Type – Field duplicates, rinsate blanks and trip blanks will be assigned unique sample numbers (if applicable):

  DUP – Duplicate Sample

  TB – Trip Blank

  MS/MSD – Matrix Spike/Matrix Spike Duplicate

Each sample will be labeled, chemically preserved, if required, and sealed immediately after collection. To minimize handling of sample containers, labels will be filled out using waterproof ink and will be firmly affixed to the sample containers. The Sample label will give the following information:

- Name of sampler;
- Date and time of collection;
- Sample number;
- Intended analysis; and

- Preservation required.

4.2.2 Daily Logs

Daily logs and data forms are necessary to provide sufficient data and observations to enable participants to reconstruct events that occurred during the project. All daily logs will be kept in a notebook, and/or an appropriate field log, and consecutively numbered. All entries will be made in waterproof ink, dated and signed. Sampling data will be recorded in the sampling records. All information will be completed in waterproof ink. Corrections will be made according to the procedures given at the end of this section.

4.3 SAMPLE HANDLING, PACKAGING AND SHIPPING

The transportation and handling of samples will be accomplished in a manner that protects the integrity of the sample, sample bottles will be packed with ice and cushioning materials to maintain proper temperature and reduce bottle movement.

All chain-of-custody requirements will comply with standard operating procedures in the NYSDEC and USEPA sample handling protocol. Field personnel will make arrangements for Transportation of samples to the laboratory. If not pre-arranged, when custody is relinquished to a shipper, field personnel will telephone the laboratory custodian to inform him of the expected time of arrival of the sample shipment and to advise him of any time constraints on sample analysis. All samples will be delivered to the laboratory no later than 48 hours from the day of collection.

5.0 CALIBRATION PROCEDURES AND FREQUENCY

Instruments and equipment used during sampling and analysis will be operated, calibrated, and maintained according to the manufacturer's guidelines and recommendations as well as criteria set forth in the applicable analytical methodology references.

5.1 FIELD INSTRUMENTS

A calibrations program will be implemented to ensure that routine calibration is performed on all field instruments. Field team members familiar with the field calibration and operations of the equipment will maintain proficiency and perform the prescribed calibration procedures outlines in the Operation and Field Manuals accompanying the respective instruments. Calibration records for each field instrument used on the project will be maintained on-site during the respective field activities and a copy will be kept in the project files.

5.1.1 Portable Total Organic Vapor Monitor

Any vapor monitor will undergo routine maintenance and calibration prior to shipment to the project site. Daily calibration and instrument checks will be performed by a trained team member at the start of each day. Daily calibrations will be performed according to the manufacturer's specifications and are to include the following:

- Battery check: If the equipment fails the battery check, recharge the battery;
- Gas standard: The gauge should display an accurate reading when a standard gas is used; and
- Cleaning: If proper calibration cannot be achieved, then the instrument ports must be cleaned.

5.1.2 pH, Specific Conductance and Turbidity (if applicable)

The following steps should be observed by personnel engaged in groundwater sampling for pH and specific conductance:

- The operations of the instruments should be checked with fresh standard buffer solution (pH 4 and pH 10) prior to each day's sampling;
- The specific conductance meter should be calibrated prior to each day's sampling using a standard solution of known specific conductance;
- The turbidity meter should be calibrated prior to each day's sampling using a standard solution of known turbidity; and
- More frequent calibrations may be performed as necessary to maintain analytical integrity.

Calibration records for each field instrument used on the project should be maintained and a copy kept in the project files.

6.0 ANALYTICAL PROCEDURES

6.1 FIELD

On-site procedures for analysis of total organic vapor and other field parameters are addressed in the Work Plan.

6.2 LABORATORY

Analytical methods to be used for the sampling tasks are referenced in the NYSDEC's Analytical Services Protocols (ASP), 1995 or its most current version.

Specific analytical methods for constituents of interest in soil, groundwater, and air are listed in the RIWP. The laboratory will maintain and have available for the appropriate operators, standard operating procedures relating to sample preparation and analysis according to the methods.

7.0 DATA REDUCTION AND REPORTING

QA/QC requirements will be strictly adhered to during sampling and analytical work. Laboratory data generated will be reviews by comparing and interpreting results from chromatograms (responses, stability of retention times), accuracy (mean percent recovery of spiked samples), and precision (reproducibility of results).

Data storage and documentation will be maintained using logbooks and data sheets that will be kept on file. Analytical QC will be documented and included in the analytical testing report. A central file will be maintained for the sampling and analytical effort after the final laboratory report is issued.

Relevant calculations and data manipulations are included in the appropriate methodology references. Control charts and calibration curves will be used to review the data and identify outlying results. Prior to the submission of the report to the client, all the data will be evaluated for precision, accuracy, and completeness.

Laboratory reports will be reviewed by the laboratory supervisor, the QA officer, laboratory manager and/or director, and the project manager. Analytical reports will contain a data tabulation including results and supporting QC information will be provided. Raw Data will be available for later inspection, if required, and maintained in the control job file.

8.0 INTERNAL QUALITY CONTROL CHECKS

QC data are necessary to determine precision and accuracy and to demonstrate the absence of interferences and/or contamination of glassware and reagents. The procedures to be followed for internal quality control checks are to be consistent with NYSDEC and NYSDOH Programs.

9.0 PREVENTIVE MAINTENANCE

9.1 FIELD

Field personnel assigned to complete the work will be responsible for preventative maintenance of all field instruments. The field sampling personnel will protect the portable total organic vapor monitors, temperature, conductivity, pH and turbidity instruments by placing them in portable boxes and/or protective cases.

Field equipment will be subjected to a routine maintenance program, prior to and after each use. The routine maintenance program for each piece of equipment will be in accordance with the manufacturer's operations and maintenance manual. All equipment will be cleaned and checked for integrity after each use. Necessary repairs will be performed immediately after any defects are observed, and before the item of equipment is used again. Equipment parts with a limited life (such as batteries, membranes and some electronic components) will be periodically checked and replaces or recharged as necessary according to the manufacture's specifications.

10.0 DATA ASSESSMENT PROCEDURES

Laboratory data results will be evaluated for accuracy, precision and completeness of collected measurement data.

10.1 PRECISION

Precision of a particular analysis is measured by assessing its performance with duplicate or replicate samples. Duplicate samples are pairs of samples taken in the field transported to the laboratory as distinct samples. Their identity as duplicated is sometimes not known to the laboratory and usually not known to bench analysts. For most purposes, precision is determined by the analysis of replicate pairs (i.e., two samples prepared at the laboratory from one original sample). Replicate pairs of spiked samples, known as matrix spike/matrix spike duplicate samples, are used for precision studies. This has the advantage that two real positive values for a target analyte can be compared.

Precision is calculated in terms of Relative Percent Difference (RPD), which is expressed as follows:

$$RPD = \frac{(X_1 - X_2) \times 100}{(X1 + X2)/2}$$

Where X_1 and X_2 represent the individual values found for the target analyte in the two replicate analyses or in the matrix spike/matrix duplicate analyses.

RPDs must be compared to the method RPD for the analysis. The analyst or his supervisor must investigate the cause of RPDs outside stated acceptance limits. This may include a visual inspection of the sample for non-homogeneity, analysis of check samples, etc. Follow-up action may include sample re-analysis or flagging of the data as suspect if problems cannot be resolved.

10.2 ACCURACY

Accuracy of a particular analysis is measured by assessing its performance with ‘known” samples. These “knowns” can take the form of EPA traceable standards (usually spiked into a pure water matrix), or laboratory prepared solutions of target analytes into a pure water or sample matrix, or (in the case of GC or GC/MS analyses) solutions of surrogate compounds which can be spiked into every sample and are designed to mimic the behavior of target analytes without interfering with their determination. In each case the recovery of the analyte is measured as a percentage, corrected for analytes known to be present in the original sample if necessary, as in the case of a matrix spike analysis. For EPA supplied known solutions, this recovery is compared to the published data that accompany the solution. For prepared solutions, the recovery is compared to

EPA-developed data or historical data as available. For surrogate compounds, recoveries are compared to USEPA CLP acceptable recovery tables. If recoveries do not meet required criteria, then the analytical data for the batch (or, in the case of surrogate compounds, for the individual sample) are considered potentially inaccurate.

For highly contaminated samples, recovery of matrix spike may depend on sample homogeneity. As a rule, analyses are not corrected for recovery of matrix spike or surrogate compounds.

10.3 COMPLETENESS

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the total amount expected to be obtained under normal conditions. Completeness for each parameter is calculated as:

$$\text{Completeness} = \frac{\text{Number of successful analyses x 100}}{\text{Number of requested analyses}}$$

Target value for completeness for all parameters is 100%. A completeness value of 95% will be considered acceptable. Incomplete results will be reported to the client project officer.

10.4 REPRESENTATIVENESS

The characteristic of representatives is not quantifiable. Subjective factors to be taken into account are as follows:

- The degree of homogeneity of a site;
- The degree of homogeneity of a sample taken from one point in a site; and
- The available information on which a sampling plan is based.

To maximize representatives of results, sampling techniques and sample locations will be carefully chosen so that they provide laboratory samples representatives of the site and the specific area.

11.0 QUALITY ASSURANCE SUMMARY

Upon completion of a project sampling effort, analytical and QC data will be included in a comprehensive report that summarizes the work and provides a data evaluation. A discussion of the validity of the results in the context of QA/QC procedures will be made, as well as a summation of all QA/QC activity, and an identification of any analytical problems. A Data Usability Report (DUSR), if required, will be prepared by an independent third-party data validator consistent with DER-10 guidance.

Appendix C

Table 1: Analytical Methods/Quality Assurance Summary Table

Matrix	Analytical Group	Number of Samples	Number of Trip Blanks	Number of MS/MSD	Number of Duplicates	Analytical & Preparation Method/SOP Reference	Sample Volume	Containers per Sample (number, size, and type)	Preservation Requirements	Maximum Holding Time (preparation/analysis)
Soil	VOCs	15-20[4]	1 per cooler	1 per 20 samples, or 1 per sampling event if fewer than 20 samples collected	1 per 20 samples, or 1 per sampling event if fewer than 20 samples collected	EPA Method 8260B	5 grams	(1) Terra Core Sampler Kit	Cool to 4°C	Ship to laboratory within 48 hours, analyze within 14 days
	SVOCs	15[4]	None			EPA Method 8270C	4 oz	(1) 4 oz Wide-mouth glass jar with Teflon-lined screw cap	Cool to 4°C	Extract within 14 days, analyze within 40 days following extraction
	Metals[5]	40-50				EPA Method 6010B/7000A	4 oz	(1) 4 oz Wide-mouth glass jar with Teflon-lined screw cap	Cool to 4°C	6 months (28 days for Mercury)
	Mercury and Lead	3				EPA Method 6010B/7000A	4 oz	(1) 4 oz Wide-mouth glass jar with Teflon-lined screw cap	Cool to 4°C	6 months (28 days for Mercury)
	PCBs	150-200				EPA Method 8082	4 oz	(1) 4 oz Wide-mouth glass jar with Teflon-lined screw cap	Cool to 4°C	Extract within 14 days, analyze within 40 days following extraction
Groundwater	VOCs	8	1 per cooler			EPA Method 8260C/2108	40 ml	(2) 40 ml VOA vials w/PTFE-faced silicone septum	1:1 HCL to pH<2; cool to 1-4°C	14 days
	Metals	10	None			EPA Method 6010C/2144	500 ml	(1) 500 ml plastic	1:1 Nitric acid to a pH of <2; 4 ± 2°C	180 days
	PCBs	8				EPA Method 8082A/2129	1 L	(2) 1 L Amber glass jars	4 ± 2 °C	Extract within 7 days, analyze within 40 days following extraction
Soil Vapor	VOCs	3		None		EPA Method TO-15-SIM	1 L	(1) 1 L Summa Canister	Valve sealed	30 days

Notes:
1. The number of duplicates are included in the number of samples above.
2. The number of MS/MSD are not included in the number of samples above.
3. EPA Methods refer to SW-846.
4. Number of samples may change; VOCs/SVOCs will be tested on additional intervals if elevated PID readings or oil staining is observed.
5. TCLP metals will also be run on select intervals, based on the "totals" analysis.

APPENDIX D

HEALTH AND SAFETY PLAN

SPECTRA
ENVIRONMENTAL GROUP, INC.
ENGINEERING, ARCHITECTURE & SURVEYING, PC

SITE SPECIFIC HEALTH & SAFETY PLAN

800 HIAWATHA BOULEVARD WEST
SYRACUSE, NEW YORK
(FORMER ROTH STEEL SITE)

NYSDEC BCP SITE #C734083

Prepared by:

Spectra Environmental Group, Inc.
19 British American Boulevard
Latham, New York 12110
Project #16140

June 2016

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SITE SPECIFIC HEALTH & SAFETY PLAN
800 HIAWATHA BOULEVARD WEST, SYRACUSE, NY
NYSDEC BCP SITE #C734083

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FIELD HEALTH AND SAFETY PLAN

This Site Specific Health and Safety Plan (SSHSP) is designed to assure compliance with OSHA's regulations covering hazardous waste sites (29 CFR 1910.120).

The purpose of the Site Specific Health and Safety Plan is to assure clear delegation of responsibilities, consistent work practices and proper oversight of health and safety issues during activities at the Site as identified in the attached Figure 1.

This plan is site-specific and has been reviewed and approved by Spectra's Corporate Health and Safety Officer and Project Manager prior to adoption.

A copy of this plan will available at the site. At the completion of planned activities, a copy of this plan shall be retained with other project related documentation including soil boring logs and well installation diagrams, etc.

APPROVED BY:

Paul M. Adl — June 2, 2016

Corporate Health and Safety Officer (CHSO) — Date

John D. Ciampa — June 2, 2016

Project Manager / On-Site Supervisor — Date

1.0 INTRODUCTION

This Site Specific Health and Safety Plan (SSHSP) has been developed to identify potential hazardous substances and conditions known or suspected to be present on the site and ensure that they do not adversely impact the health or safety of personnel conducting field activities. It is also intended to ensure that the procedures used during these field activities meet reasonable professional standards to protect human health and safety of workers and the surrounding community. This plan incorporates by reference to applicable requirements of the Occupational Safety and Health Administration in 29 CFR Parts 1910 and 1926.

The requirements in this SSHSP are based on review of site-specific information. Based on existing site information, it is known that elevated levels of PCBs, VOCs, SVOCs, and various metals exist or may exist at the site.

All field personnel working on this project must familiarize themselves with this SSHSP and abide by their requirements. Since every potential health and safety hazard encountered at a site cannot be anticipated, it is imperative that personnel are equipped and trained to respond promptly to a variety of possible hazards. Adherence to this plan will minimize the possibility that personnel at the site will be injured or exposed to significant hazards. Information on potential health, safety and environmental hazards is discussed in conjunction with appropriate protective measures including assignment of responsibility, personal protective equipment requirements, work practices, and emergency response procedures.

In general, subcontractors are responsible for the health and safety of their employees and complying with all regulations applicable to the work they are performing.

Spectra personnel can and must stop work when a subcontractor is observed to not be following health and safety procedures required by the plan. Spectra will also require that subcontractors develop a site and activity specific health and safety plan.

This SSHSP is specifically intended for Spectra personnel who will be conducting activities within the defined scope of work at the site.

2.0 SCOPE OF WORK

The scope of work for the former Roth Steel site (herein known as the “Site”) will involve site assessment and the oversight of subcontracted services. These services include, but are not limited to:

- The staging and ultimate removal of drums and 5-gallon buckets of waste automotive fluids (oil, antifreeze, gasoline, etc.);
- The staging and ultimate removal of suspected PCB-containing oil (capacitors);
- The staging and ultimate removal of various containers of unlabeled materials;
- Sampling and characterization of waste materials prior to removal;
- Soil boring, well drilling, test pit excavation;
- Environmental sample collection (soil, groundwater, surface water, vapor); and
- Remediation construction oversight.

3.0 DESIGNATION OF RESPONSIBILITIES

The responsibility for implementing this SSHSP is shared by the Corporate Health and Safety Officer (CHSO), project manager (PM), and the On-Site Supervisor (OSS). The PM will recommend policy on all safety matters including work practices, training and response actions, and will provide the necessary resources to conduct the project safely.

The CHSO has overall responsibility for developing safety procedures and training programs, maintaining a high level of safety awareness; ensuring compliance with applicable federal, state and local health and safety regulations; determining appropriate protection including the selection of protective equipment, maintenance schedules and monitoring protocols; and maintaining close communication with the OSS and field personnel. The CHSO is the final decision point for determination of health and safety policies and protocols for all projects.

The OSS is responsible for establishing operating standards and coordinating all safety activities occurring at the site, with guidance from the CHSO. Specifically, the OSS is responsible for:

- Assuring that a copy of this SSHSP is at the site prior to the start of field activities and that all workers are familiar with it;
- Conducting training and briefing sessions if appropriate, prior to the start of field activities at the site and repeat sessions as necessary;
- Ensuring the availability, use, and proper maintenance of specified personal protective, decontamination, and other health or safety equipment;
- Maintaining a high level of safety awareness among team members and communicating pertinent matters to them promptly;
- Assuring that all field activities are performed in a manner consistent with Company policy and this SSHSP;
- Monitoring for dangerous conditions during field activities;
- Assuring proper decontamination of personnel and equipment;
- Coordinating with emergency response personnel and medical support facilities, and other Health and Safety representatives of the client and contractors;
- Initiating immediate corrective actions in the event of an emergency or unsafe condition;

- Notifying the CHSO promptly of any emergency, unsafe condition, problem encountered, or significant exceptions to the requirements in the SSHSP; and
- Recommending improved health and safety measures to the Project Manager, or the CHSO.

The OSS has the authority to:

- Suspend field activities or otherwise limit exposures if the health and safety of any person appears to be endangered;
- Direct Company or subcontractor personnel to alter work practices that are deemed not properly protective of human health or the environment; and
- Suspend an individual from field activities for significant infraction of the requirements in this SSHSP.

However, the presence of the OSS shall in no way relieve any person, company or subcontractor of its obligations to comply with the requirements of this Plan and all applicable federal, state and local laws and regulations.

The key element in the responsibility for health and safety is the individual field team member. Everyone must be familiar with and conform to the safety protocols prescribed in this SSHSP and communicate any relevant experience or observations to provide valuable inputs to improving overall safety.

4.0 SITE-SPECIFIC HEALTH AND SAFETY CONCERNS

4.1 SITE LOCATION

Hiawatha Boulvard Site
Former Roth Steel
800 Hiawatha Blvd West
Syracuse, NY

4.2 SITE HISTORY AND SETTING

The Site is the former location of The Roth Steel metal recycling facility. The Onondaga County Industrial Development Agency (OCIDA) currently owns the site. Various articles of scrap metal, primarily automobiles, were brought to the Facility for recovery of ferrous and non-ferrous metals. Automobiles were stored at various locations at the site before being shredded. Automobile shredder residue (ASR) tested for PCBs is buried in various areas onsite. The Site is located in an industrial/commercial area on the southern end of Onondaga Lake, in the City of Syracuse, Onondaga County, New York (Figure 1).

This Health and Safety Plan applies to the real property shown on Figure 1 in connection with the former Roth Steel Facility located in Syracuse, New York.

4.3 CHEMICAL CONSTITUENTS OF CONCERN

The primary health concerns and routes for exposure at this site are injection, ingestion, and absorption of soil and groundwater through injection, inhalation, ingestion, puncture, and direct skin contact while collecting soil and groundwater samples.

Skin and eye contact hazards are also potentially high. The protective equipment specified in Section 5.0 will provide adequate protection. Any symptoms are to be reported to the Project Manager and the CHSO immediately.

The potential for exposure will be further reduced by prohibiting eating, drinking, or smoking during all activities within the fieldwork areas.

Unknown or unexpected materials of a hazardous nature may be encountered during site activities. No work will be conducted if field measurements or observations indicate that a potential exposure is greater than the protection afforded by the requirements in this Plan.

- Potential contaminants include; PCBs, BTEX and other VOCs, SVOCs, and metals in soil and groundwater.

5.0 SITE-SPECIFIC HEALTH AND SAFETY REQUIREMENTS

5.1 KEY PERSONNEL

Site Contact:

Isabelle Harris (OCIDA)
333 W. Washington Street, Suite 130
Syracuse, NY 13202
(315) 435-3669

Project Manager

Name: John Ciampa (Spectra)
Telephone Number: (518) 782-0882

Project Engineer

Name: Frank Peduto, P.E. (Spectra)
Telephone Number: (518) 782-0882

Spectra Corporate Health and Safety Officer

Name: Paul M. Adel, P.E. (Spectra)
Telephone Number: (518) 782-0882

Site On-Site Supervisor (Depending on Activity)

Name: Brian Baulsir, Yaicha Winters, Joe Krikorian (Spectra)

5.2 TRAINING

All personnel working at the site that may come into contact with contaminated soil or groundwater while performing environmental sampling or remediation activities must have received training at least meeting the requirements established by the Occupational Safety and Health Administration in 29 CFR 1910.120 prior to the start of field activities.

Before authorized persons enter the active site for the first time, they will be briefed by the Project Manager or OSS as to the potential hazards that may be encountered. Topics will include:

- This SSHSP and the nature of its contents;
- Selection and use of personal protection equipment (PPE) to be worn;
- Decontamination procedures for personal protection and other equipment, as necessary;
- Emergency forms of notification, and evacuation routes to be followed;

- Prohibitions on smoking and carrying of tobacco products, eating, drinking, and open fires (except by permit) in the work area;
- Methods to obtain outside emergency assistance and medical attention;
- Specific health, safety, and emergency response requirements imposed by the facility's owner or operator; and
- The frequency and types of air monitoring, personnel monitoring, and environmental sampling techniques and instrumentation to be used, including methods of maintenance and calibration of monitoring and sampling equipment.

5.3 AIR MONITORING

Site-specific monitoring programs have been designed and are consistent with known or suspected exposure to hazardous materials. The following monitoring is planned as part of this project.

All areas are adequately ventilated and do not present a potential for accumulation of harmful or ignitable quantities of vapors. During excavation/drilling activities a photoionization detector will be used to measure total volatile organic compounds both around the hole and in the employees' breathing zone.

5.4 PERSONAL PROTECTIVE EQUIPMENT

The minimum level of protection that will be required on site is Level D. Level D will be worn when a potential dermal hazard exists and air monitoring indicates that no inhalation hazard exists. The following equipment will be used:

- Work clothing as prescribed by weather;
- Safety-toe work boots meeting ANSI Z41;
- Hard hat, meeting ANSI Z89 (when near excavation or drilling activities);
- Tyvek suit and safety glasses (if splash protection is necessary);
- Hearing protection (when near excavation or drilling activities); and
- Nitrite gloves (when collecting samples).

Air monitoring will be performed when intrusive activities (i.e. excavation) are being conducted. Air monitoring will involve use of a PID to screen ambient air. If elevated levels of VOCs are detected, work will cease and an assessment will be made by the OSS. If the OSS determines that the airborne concentration of VOC contaminants continues to be elevated, PPE will be upgraded to Level C and will include the addition of an air purifying respirator with combination organic vapor and HEPA dust cartridges.

Unless the CHSO directs otherwise, when respirators are used, the cartridges should be changed after eight hours of use, or at the end of each shift, or when any indication of breakthrough or excess resistance to breathing is detected.

Based on the potential presence of BTEX compounds, an upgrade to level C respiratory protection will be required if the PID meter exceeds 5 ppm above background for 5 minutes, in the breathing zone. If the PID exceeds 25 ppm in the breathing zone, field operations will cease and workers will move to an upwind area. The Spectra project manager or project engineer will be notified for further instructions.

5.5 OTHER PROTECTIVE EQUIPMENT

A first aid kit, and vehicle will be kept in close proximity to the site.

5.6 EXCAVATION PROCEDURES

On-site excavations can pose hazards to employees if they are not carefully controlled. Prior to excavation, the presence and locations of underground utilities within and near the work area must be determined. Utilities will be identified through review of historical records and through contact with DigSafe. No excavations will occur within the vicinity of any underground utilities.

All activities within the excavation will be performed remotely, without entering the excavation. Personnel will not enter excavations unless they are required to do so and no remote options are available

No person shall be permitted underneath loads handled by lifting or excavating equipment. Site personnel are required to stand away from any vehicle being loaded or unloaded to avoid being struck by the equipment or any falling debris.

Excavation equipment typically results in noise levels exceeding 85 decibels (dBA). All personnel must wear hearing protection when noise levels exceed 85 dBA.

PPE for operations involving excavation includes: hard hat, safety-toed shoes, safety glasses and hearing protection.

5.7 HEAT STRESS

Heat stress is a common but potentially serious illness at work sites and warrants preventive measures. Heat stress is caused by a number of interacting factors, including environmental conditions, clothing, workload, and individual characteristics of the worker. Depending on the ambient conditions and the work being performed, heat stress can occur very rapidly – within as little as 15 minutes. In its early stages, heat stress can cause rashes, cramps, and drowsiness. This can result in impaired functional ability that threatens the safety of both the individual and co-workers. Persistent heat stress can lead to heat stroke and death.

Fieldwork involves activities such as walking, surveying, hand-digging, soil and water sampling etc. that range from light hand work to moderate work with the body. All personnel must consider the danger of heat stress when making decisions regarding conduct and duration of fieldwork.

The following heat stress protocol applies to on-site personnel working in lightweight cotton clothing (i.e., short-sleeve shirts and cotton pants) that allow for sweat evaporation.

Caution for heat illness is indicated when the temperature reaches 85°F or greater and the relative humidity is greater than 35%. When the temperature reaches 95°F or greater and the relative humidity is greater than 60%, there is extreme danger for heat illness. Personnel should take precautions in the field to reduce the potential for heat illnesses during daytime temperatures that are within the caution zone.

Precautions

It is important to be aware of the preventive measures, symptoms, and remedies for heat stress. These conditions can be caught and addressed early by learning to protect yourself. Precautions that reduce the possibility of heat stress include the following:

- avoid caffeine and alcohol during work hours;
- drink water before feeling thirsty;
- watch for signs and symptoms of heat stress;
- rest in cool/dry areas, such as a vehicle or building or in the shade;
- use shifts when possible, e.g., early morning, cool part of the day; and
- use cooling devices such as vehicle air conditioning to cool off.

Work/Rest Regimen

The OSS will monitor the environmental conditions and condition of employees in the field and implement a work/rest cycle as appropriate.

Symptoms and Remedies

Symptoms of heat stress and appropriate responses include the following:

- Heat Rash: redness of skin.

Remedy: Frequent rest and change of clothing.

- Heat Cramp: painful muscle spasms in hands, feet, and/or abdomen.

  Remedy: Administer lightly salted water (3 tsp per gallon) orally unless there are medical restrictions.

- Heat Exhaustion: clammy, moist, pale skin; dizziness, nausea, rapid pulse, fainting.

  Remedy: Remove to cooler area and administer fluids orally or have physician administer saline solution intravenously.

- Heat Stroke: hot dry skin; red, spotted or bluish; high body temperature of 104^{o} mental confusion, loss of consciousness, convulsions or coma.

  Remedy: Immediately cool victim by immersion in cool water. Wrap in wet sheet while fanning, sponge with cool liquid. While fanning, treat for shock. Call for an ambulance.

DO NOT DELAY TREATMENT. COOL BODY WHILE AWAITING AMBULANCE.

6.0 EMERGENCY PLAN

The following standard emergency procedures will be used by on-site personnel. The PM / OSS will be notified of any on-site emergency and be responsible for ensuring the appropriate procedures are followed and the CHSO is notified. A first aid kit, eye wash unit, and fire extinguisher will be readily available to field personnel. Questions regarding procedures and practices described in this plan should be directed to the CHSO.

6.1 NOTIFICATION

Upon the occurrence of an emergency, personnel will be alerted and the area evacuated immediately.

The following alarm system will be utilized to alert personnel to evacuate the restricted area.

______ Audible Alarm ____
Describe

__X__ Direct Verbal Communication (10 employees or less)

______ Radio Communication or Equivalent (Remote Sites)

______ Other ____
Describe

The following standard hand signals will also be used as necessary:

Hand gripping throat	Cannot breath / Out of air
Grip Partner's wrist	Leave area immediately (No debate)!
Hands of top of head	Need assistance
Thumbs up	Yes / Okay
Thumbs down	No / A problem

6.2 PERSONNEL INJURY

If anyone is injured, the OSS will evaluate the nature of the injury, and the affected person will be decontaminated to the extent feasible prior to movement. Appropriate first aid will be initiated, and if required, contact will be made for an ambulance and with the designated medical facility. No person will re-enter the work area until the cause of injury or symptoms is determined.

6.3 FIRE/EXPLOSION

Upon the occurrence of a fire beyond the incipient stage or an explosion anywhere on the site, the fire department will be alerted and all personnel will moved to a safe distance from the effected area.

6.4 PERSONAL PROTECTION EQUIPMENT FAILURE

If any worker in Level C experiences a failure or alteration of protective equipment that affects the protection factor (e.g. torn protective suit, odor inside respirator), that person (and his/her buddy, if in a regulated area) will immediately leave the work area. Re-entry will not be permitted until the equipment has been repaired or replaced and the cause of the problem is known.

6.5 OTHER EQUIPMENT FAILURE

If any other equipment at the work site fails to operate properly, the PM / OSS will be notified and will then determine the effect of this failure on continuing operations. If the failure affects the safety of personnel (e.g. failure of monitoring equipment) prevents completion of the planned tasks, all personnel will leave the work area until appropriated corrective actions have been taken.

6.6 OFF-SITE EMERGENCY RESPONSE

Emergency response requiring actions beyond evacuation of personnel from the work area will be handled by notification of off-site emergency response agencies. Phone numbers for these agencies and other support services are listed below:

Fire Department:	911
Ambulance:	911

Poison Control Center:	(800) 282-3171
Chemical Emergency Advice (CHEMTREC):	(800) 424-9300

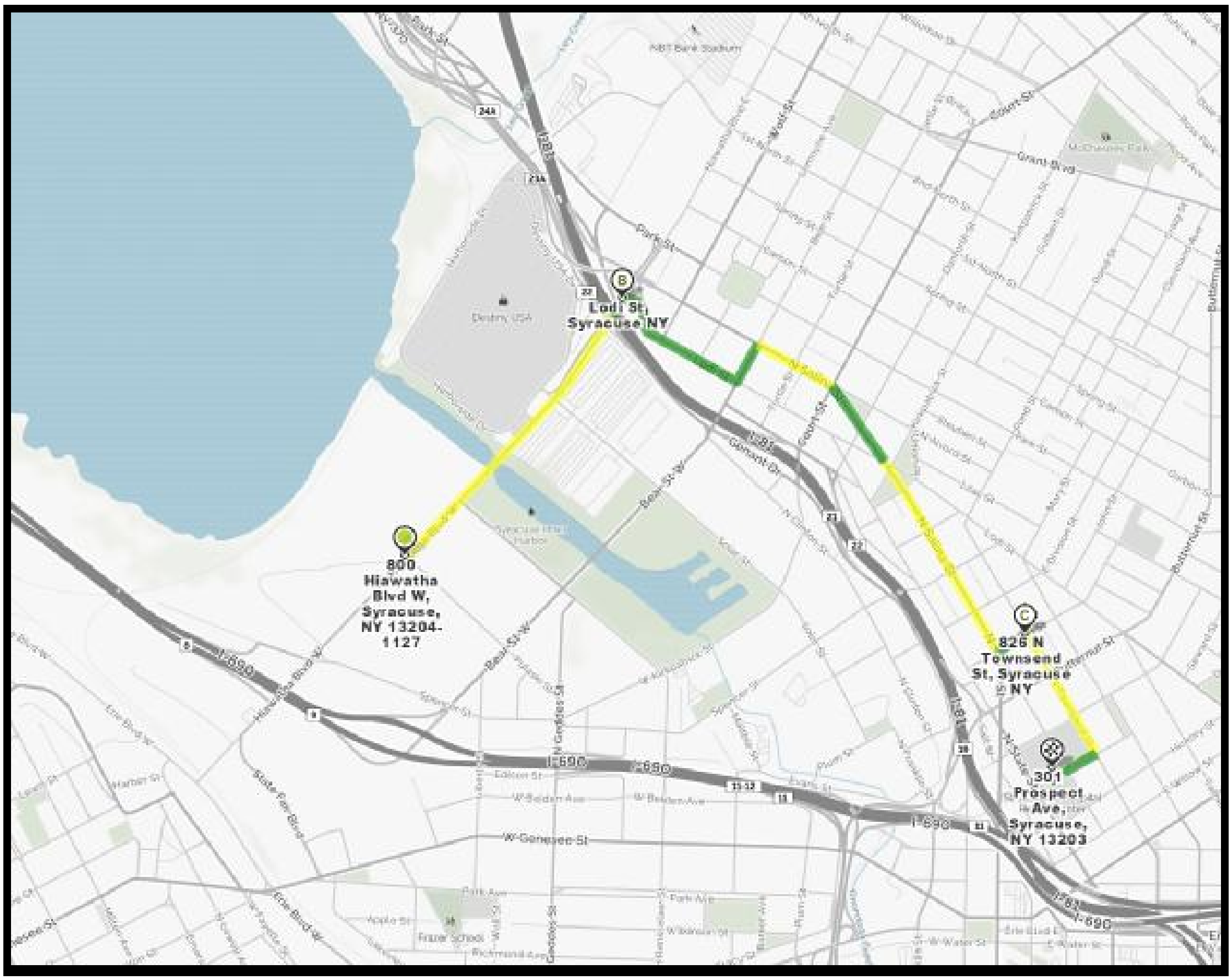
6.7 DIRECTIONS AND MAP TO NEAREST HOSPITAL

St. Joseph's Hospital
301 Prospect Avenue
Syracuse, NY 13203

1. Start out going NORTHEAST on HIAWATHA BLVD WEST toward DUKE DRIVE.
2. Turn RIGHT onto LODI ST. Continue to follow LODI ST for 0.7 MILES.
3. Turn RIGHT onto N SALINA ST. Continue to follow N SALINA ST for 0.5 MILES.

4. Turn LEFT onto ASH ST.
5. Turn RIGHT onto N TOWNSEND ST. Continue to follow N TOWNSEND ST for 0.3 MILES.
6. Turn RIGHT onto UNION AVE.
7. 301 PROSPECT AVE is on the RIGHT.

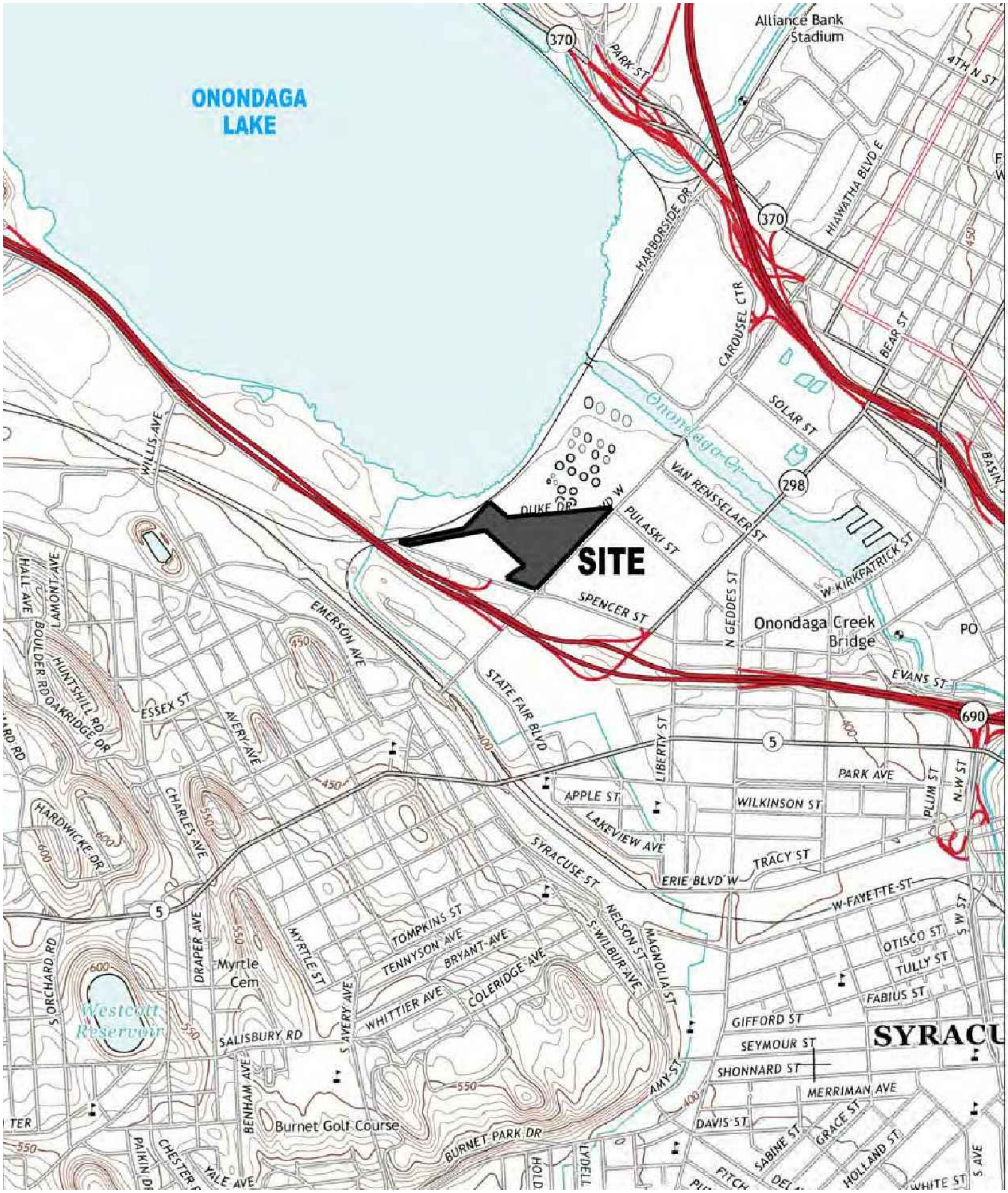
Map from 800 Hiawatha Boulevard West to Nearest Hospital (St. Joseph's Hospital)



6.8 RECORD KEEPING

Spectra shall maintain records of reports concerning occupational injuries and illnesses in accordance with 29 CFR 1904.

FIGURE



REF.: USGS - SYRACUSE WEST (NY) QUAD., 2013

Spectra Environmental Group, Inc.
19 British American Blvd.
Latham, NY 12110

Site Location Map
800 Hiawatha Boulevard Site
Syracuse, New York

CITY OF SYRACUSE | ONONDAGA CO., NY

PROJ. #: 15180	DATE: 4/29/16	SCALE: NTS	DWG. NO. 15180B	FIGURE 1

APPENDIX A

GENERAL FIELD SAFETY RULES

FIELD SAFETY
GENERAL SAFETY RULES

1. Field Service personnel should maintain communications with their office counterparts. Periodic phone calls may be warranted to assure no mishaps have occurred.

2. The location and phone numbers of the nearest emergency care facility and local fire and police department should be determined and be readily available to field service employees prior to site access.

3. During initial site characterization potential hazards arising from unstable topography, presence of water, construction debris, plants, insects or animals should be identified and measures taken to avoid them.

4. Access to remote locations warrants careful consideration of protective clothing and/or first aid supplies to prevent and/or address insect or animal bites/stings etc. Proper first aid supplies and use of a buddy system are especially important for employees who have known allergies. Employees requiring immediate access to special first aid supplies (e.g. prescription drugs for allergies), shall be responsible for obtaining and arranging for administration of these medications as prescribed by their physician.

5. Spectra's employees who are at a customer's facility will be expected to adhere to the plant or facility safety and health rules in addition to the health and safety plan for the project. Where there are conflicts between facility rules and Spectra's health and safety plan, the project manager and corporate health and safety officer should be contacted for resolution of inconsistencies. Wherever possible, the two plans should be reviewed prior to site access to identify and resolve any conflicts.

APPENDIX B

FIRST AID EQUIPMENT LIST

First Aid Equipment List

The first aid kits that will be kept at the site will consist of a weatherproof container with individually sealed packages for each type of item. The kit will include at least the following items:

- Gauze roller bandages, l-inch and 2-inch
- Gauze compress bandages, 4-inch
- Gauze pads, 2-inch
- Adhesive tape, l-inch
- Band aids, 1-inch
- Butterfly bandages
- Triangular bandages, 4-inch
- Antiseptic applicators or swabs
- Burn dressing and sterilized towels
- Surgical scissors
- Eye dressing
- Emergency eye-wash
- Alcohol
- Hydrogen Peroxide
- Clinical Grade Thermometer

APPENDIX C

PROTECTIVE CLOTHING

GENERAL PROTECTIVE CLOTHING REQUIREMENTS

Protective clothing shall meet the following minimum requirements:

1. They shall provide adequate protection against the particular hazards for which they area designed;

2. They shall be reasonably comfortable when worn under the designated conditions;

3. They shall fit snuggly and shall not unduly interfere with the movements of the water;

4. They shall be durable;

5. They shall be capable of being disinfected;

6. They shall be easily cleanable; and

7. Protective clothing should be kept clean and in good repair.

Note: See subsequent sections for additional activity-specific PPE.

APPENDIX D

DONNING AND DOFFING PROTECTIVE CLOTHING LEVEL C

DONNING AND DOFFING PROTECTIVE CLOTHING - LEVEL C

DONNING

1. Inspect equipment to ensure it is in good condition.
2. Place feet into the legs of chemically resistant protective suit (as specified in task specific health and safety plan and gather suit around waist.
3. Put on chemically resistant outer boots (as specified in the task specific health and safety plan) over feet of the suit and tape at boot/suit junction.
4. Don inner gloves (if required) placing wrist of glove beneath the chemically resistant suit.
5. Close suit and tape closure flaps.
6. Don air purifying respirator equipped with appropriate cartridges.
7. Perform negative/positive pressure tests.
8. Don safety glasses and hard hat (as required).
9. Don chemically resistant outer gloves and tape at glove/suit junction.
10. Have assistant check all closures and observe wearer to ensure fit and durability of protective gear.

DOFFING

1. Wash outer boots, gloves, and protective suit.
2. Remove tape at seams.
3. Remove boot covers and outer gloves.
4. Wash safety boots (as necessary).
5. Remove safety boots and suit.
6. Wash inner gloves.
7. Wash and remove face piece (and set aside for final decontamination).
8. Remove inner gloves.
9. Remove inner clothing (as necessary).
10. Field wash (as necessary).
11. Redress.

APPENDIX E

TEMPERATURE STRESSES
POLICIES AND PROCEDURES

TEMPERATURE STRESSES POLICIES AND PROCEDURES

Cold Stress

Exposure to cold environments can result in reduced mental alertness, confusion, irritability and loss of consciousness. These effects are due to a lowering of the body's core temperature and can occur even if exposure is to air (or water) above freezing temperature (32 F, 0 C). High wind currents can aggravate exposure to cold temperatures by increased perceived cooling known as wind chill. Bodily extremities are at risk of "frost bite" when temperatures in the work environment are below freezing. The extremities are particularly sensitive to frostbite because of circulatory changes the body makes to maintain body core temperature. Symptoms of excessive exposure to cold include severe shivering and or pain in the extremities.

Fatal exposures are almost always due to an inability to escape from the cold environment (air or water).

Older employees or those with circulatory problems are more susceptible to cold stress.

Controls

The objectives of a cold stress management program are to maintain body core temperatures above 96.8 F (36 C) and prevent injury to the extremities (frost bite). The methods by which this is done include provision of appropriate clothing (including face, hand and foot coverings), scheduling periodic "warm-up" breaks in heated shelters and careful monitoring of employees and conditions in which they are working.

Clothing

Insulated clothing may be necessary for sustained work in environments below 40 F. Exposure to air currents at temperature below 40 F requires additional protective insulated clothing including outer windbreak garments.

Light work around water under cold conditions may require the use of impervious outer clothing to prevent wetting of inner insulating layers. Heavy work involving the use of impervious outer clothing is of concern as sweat may wet inner clothing and actually leads to cold stress. Impervious clothing should be equipped with provisions for adequate "breathing" to allow for evaporation of sweat. Wet clothing must be changed immediately when working in air temperatures near freezing.

Breathability of undergarments should also be high to encourage sweat evaporation, good examples include special weaves of synthetic or wool socks which encourage wicking away of sweat from inner to outer layers.

Work in temperatures below freezing requires special protection of extremities through face and head covers, insulated gloves and boots.

Warm-up Breaks

Periodic warm-up breaks in heated shelters should be scheduled for work below 20 F. The frequency of breaks should be increased and the duration should be shortened as temperature decreases, wind chill increases (winds > 5-20 mph) or based on careful observation of employees. The onset heavy shivering, occurrence of frost bite, or feelings of excessive fatigue or euphoria should trigger prompt return to the shelter.

Shelter areas should offer protection from the wind. When the employee first enters the shelter, the outer layer of clothing should be removed and remaining clothing loosened to allow for sweat evaporation. Dry clothing should be issued as necessary. Reentry to cold stress environments with wet clothing is to be avoided.

Provision of warm, sweet fluids or hot soups can help control dehydration. Coffee is not recommended due to its diuretic effect.

Monitoring/Work Scheduling

Employees should be closely monitored for development of cold stress symptoms. Constant observation is recommended at temperatures below 10 F.

Ambient air temperature measurements may be of value in establishing prescribed work/warm-up regiments for environments below 60 F. Wind speed measurements are necessary when air temperatures are below freezing. The ACGIH has published work/warm-up schedules based on air temperature and wind velocity when air temperatures are –15 F or colder.

Working intensity should be paced slow enough to avoid heavy sweating (without provisions for changes of dry clothing), but heavy enough to minimize prolonged periods of sitting or standing still.

Heat Stress

The stress of working in a hot environment can cause a variety of strains on the body, including heat exhaustion or heat stroke; the latter can be fatal. Personal protective equipment can significantly increase heat stress. You should learn to recognize the symptoms of heat stress in yourself and coworkers and take necessary actions when they occur. Your supervisor should provide instructions on ways to reduce or prevent heat stress, including frequent rest cycles to cool down and replace the body fluids and salts lost through perspiration. Some of the symptoms, which indicate heat exhaustion, are:

- Clammy skin
- Light-headedness
- Confusion
- Slurred speech
- Weakness, fatigue
- Fainting

- Rapid pulse
- Nausea (vomiting)

If these conditions are noted, take the following actions in the order given:

- Take victim to a cooler and uncontaminated area.
- Remove protective clothing
- Give water to drink, if conscious.
- Allow to rest.

Symptoms that indicate heat stroke include:

- Staggering gait.
- Hot skin, temperature rise (yet may feel chilled).
- Incoherent, delirious.
- Mental confusion.
- Convulsions.
- Unconsciousness.

If heat stroke conditions are noted, take the following actions in the order given:

- Take victim to a cooler and uncontaminated area.
- Remove protective clothing.
- Give water to drink, if conscious.
- Cool victim with water, cold compresses, and/or rapid fanning.
- Transport victim to a medical facility for further cooling and monitoring of body functions. HEAT STROKE IS A MEDICAL EMERGENCY.

Background

Heat stress is one of the most common stresses encountered in work at hazardous waste sites. This is especially true when work tasks require the wearing of impervious personal protective equipment. Heat stress can occur in environments where the ambient temperature is as low as 75 F (24 C) depending on humidity, solar load, work schedules and use of personal protective equipment.

The goal of heat stress management is to maintain the body temperature of employees below 100.4 F (38 C). The key to a successful program is to recognize when a potential heat stress condition exists, carefully monitor employees and work conditions and schedules and control heat build up by work rotation, employee selection and training, provision of fluids and cooling aids ranging from a shaded rest area to vortex cooled suits depending on the severity of conditions.

Preparation for prompt response to the occurrence of heat stress symptoms is essential. Appropriate levels of response range from observed rest in a cool area to immediate medical attention. The location of and access to necessary support services including emergency medical care should be firmly established prior to work in potential heat stress environments.

Recognition

Individual employees vary greatly in their ability to withstand heat stress. The most important factors related to ability to work in heat stress environments include physical conditioning, general health status, acclimatization to heat environments, weight, job demands, and age.

Acclimatization is a process in which the body gradually becomes better able to withstand heat stress through more effective sweating without extreme loss of body salts, while maintaining lower heart rates and body temperature. The acclimatization process usually takes from several days to a week to take effect. Acclimatization can be lost within one week's absence from the work environment.

Reactions to heat stress progress from discomfort to inefficiency, physiological risk, collapse and pain as exposure increases. It is important to be alert to the appearance of heat stress symptoms among exposed employees. Initial symptoms include confusion, altered behavior (including sudden fits of anger) and affected judgments. The onset of these symptoms is often unrecognized by the victims of heat stress.

The classic symptoms of heat stress include:

Heat Rash

Due to blockage of sweat glands, this is often perceived as a tingling or burning sensation on the skin. Recommended treatment is removal to a cool environment. Cool showers and gentle drying may help.

Heat Cramps

The occurrence of intense and painful cramps in the skeletal and abdominal muscles often caused by salt depletion due to heavy sweating. Prevention consists of maintaining adequate salt intake through a balanced diet. Supplemental fluids containing minerals may also help (such as fruit juices, Gatorade, etc.). No caffeine beverages or alcoholic beverages.

Heat Exhaustion

General feelings of fatigue culminating with circulatory insufficiency due to dehydration. The skin is wet and pale. Nausea and fainting may occur but the body temperature is not unusually elevated. Treatment consists of placing the patient in a cool environment and providing water.

Heat Stroke

The most serious reaction to heat stress as a result of failure of the temperature regulatory system. Medical attention is required <u>immediately</u> to avoid fatalities or possible brain damage. Symptoms of heat stroke include elevated body temperature (>104 F) often accompanied with <u>hot, dry skin with decreased or no sweating.</u>

Treatment consists of immediate reduction of body core temperature and immediate medical attention. If heat stroke symptoms are noted in the field, accompanying personnel should attempt any measures available to reduce body temperature immediately. Such steps may include ice and cold packs, water immersion, fanning, etc.

Monitoring

When heat stress conditions are suspected, it is important to monitor environmental conditions and the employees. There are a number of heat stress indices based upon environmental combinations of ambient temperature, humidity and solar loading. The most popular indices are the Wet Bulb Globe Temperature Index (W.B.G.T. – ACGIH-TLV's) and Apparent Temperature (A.T.). Unfortunately none are universally accepted due to limitations of study populations or conditions on which they are based. Most common concerns with heat stress indices relate to variables in physical condition, solar and convective heat loading and clothing. <u>No</u> heat stress index is appropriate for work in impervious clothing, a frequent requirement for hazardous waste site work. As such, heat stress indices should be viewed as indicators of potential heat stress conditions but control measures are based on keen observation and monitoring of the employees themselves.

With normal work clothing and heavy work loads, one should be alert to potential heat stress at ambient temperatures of 75 to 80 F and high humidity. With very low humidity and similar work conditions observers should be alert for signs of heat stress at temperatures of 80-90 F.

Impervious work clothing interferes with man's primary cooling mechanism; evaporative cooling of sweat. As the sweat cannot evaporate, heat storage and elevated body temperature could be expected at much lower ambient temperatures, probably better correlated with work level and intensity than ambient temperature. NIOSH has recommended frequent (hourly) monitoring of employees working in impervious clothing in full sunlight at ambient temperatures as low as 70-75F.

An effective means to monitor employees in addition to observation for signs or symptoms of heat stress, is through heart rate check at the beginning of scheduled cycles. The goal is to establish a work-rest schedule, which maintains heart rates below 110 beats per minute. Heart rate checks above 110 beats per minute should be followed by reducing the subsequent work period duration by 1/3.

The frequency of employee monitoring should be increased up to 4 times per hour in extreme conditions, for employees wearing impervious clothing.

Monitoring of oral temperature (<99.6 F) and/or water loss (<1.5% of body weight) has been suggested by NIOSH. These measures, while useful, may prove difficult under field conditions.

Control Measures

The most common and universally applicable control for management of heat stress involves adjustment of work loads and work-rest scheduling. Work breaks should be scheduled at a frequency of between 1 every 2 hours up to 1 every 15 minutes depending upon work rate, heat load, personal protective equipment used, and workers' physical condition.

As newly exposed employees begin work in hot environments their work schedules should be set at 50% and increased 10% per day to allow for acclimatization. Employees will generally self limit exposure based on signs or symptoms of heat strain, but the insidious nature of heat stress symptom onset warrants caution in relying on self to control heat stress.

Work break areas should be shaded or cooler than the work environment, if possible. Cool, portable water should be immediately available to workers and administered in a manner, which encourages frequent drinks of small amounts (approximately 4 oz.). Mineral supplemented water (e.g. Gatorade) may be found more acceptable to employees under hot conditions. Once acclimated, employees are generally able to obtain adequate minerals (and salt) from a well balanced diet.

NOTE: Additional salt tablets should not be used in field.

Extreme conditions of temperature, humidity or impervious protective clothing, warrant provision of additional cooling measures e.g. fans, field showers and possibly artificially cooled suits.

The most effective control for management of heat stress is thorough training of employees to enable recognition of potential heat stress conditions and taking of appropriate preventative actions. Any behavior exhibiting signs or symptoms of heat stress should be promptly investigated and appropriate treatment rendered.

Susceptible Populations

Employees who are not physically fit or who suffer cardiovascular insufficiency are more susceptible to heat stress. Employees under the influence of drugs or alcohol may be increased risk. Employees who have previously suffered sun or heat strokes are also more susceptible to repeat occurrences of heat stress.

APPENDIX F

SOIL AND WELL SAMPLING HEALTH AND SAFETY GUIDELINES

SOIL AND WELL SAMPLING HEALTH AND SAFETY GUIDELINES

Collection of soil, waste, and/or other environmental samples at hazardous waste sites presents a variety of potential health and safety hazards, many of which are due to the use of required equipment decontamination agents to assure appropriate quality control. Health and safety concerns due to potential hazards posed by the particular work site under investigation are addressed by the formal health and safety plan for that site. The following are key health and safety issues and recommend practices for field work involving sample collection at any work site. They address concerns posed by work activities necessary as part of proper sample collection techniques and quality assurance practices.

1. Protection from skin contact with soil, water or waste borne chemicals requires the selection and use of garments and protective coverings that will stop the chemicals in question and will not degrade upon chemical contact. This is especially important for highly concentrated chemicals (e.g., free product, concentrated wastes and decontamination chemicals).

    a. Thin, disposable latex or vinyl gloves are not designed to prevent entry of or withstand prolonged contact with many chemicals for which sampling is performed or which are used to decontaminate sampling equipment. These gloves are used primarily for quality control purposes as part of sample collection techniques.

    b. Where protection is necessary to prevent skin contact with suspect contaminants, the protective coverings should be worn <u>under</u> outer disposable gloves used for quality control purposes. This may require the use of large or extra large disposable gloves to accommodate inner coverings and not rip during donning/doffing.

2. Collection of samples containing high solvent concentrations may liberate volatile organics at levels sufficient to warrant respirator use (in addition to skin protection). This is especially true where high concentrations of materials or chemical layers (floating product) are encountered. Potential emissions should be monitored and protective equipment upgraded as specified in the health and safety plan.

3. During equipment decontamination activities involving extensive use of acetone, hexane, methanol or other solvents, Level C protection including organic vapor cartridges or equivalent, may be warranted.

    In addition, eye and skin protection may be required during decontamination activities requiring the use of nitric acid. It should be noted that improper preparation by the laboratory of acid preservatives in sampling containers might release irritating “fumes” unexpectedly upon addition of liquid samples.

4. Transport and storage of chemicals required for decontamination procedures require appropriate safeguards to prevent contact between incompatible and/or combustible materials. Nitric Acid is an oxidizer capable of starting a fire upon contact with flammable or combustible materials.

APPENDIX G

HEARING PROTECTION

HEARING PROTECTION

1. Hearing protection (ear muffs or plugs) is required whenever employees are exposed to noise levels of 85 decibels or greater as an 8-hour time weighted average (TWA). Industrial Hygiene workers exposed to noise levels in excess of 90 dBA will wear hearing protection regardless of the duration.

2. Hearing protection is to be inspected before each use, for tears and contamination. If deficiencies are noted; the hearing protector should be cleaned, repaired, or replaced before use.

APPENDIX H

PROCEDURES FOR EXCAVATION TRENCH OR TEST PIT DIGGING

PROCEDURES FOR EXCAVATION TRENCH OR TEST PIT DIGGING

Trench or test pit digging can be expected to present hazards in addition to those encountered during general field work or drilling. Added control measures to be considered include the following:

1. Careful positioning of equipment with respect to the presence of known submerged objects.

   a. Where possible, power to underground electrical lines should be turned off (and locked out) while excavation activities are in process or until the area is secure from entrance of personnel.

   b. known gas (or chemical) lines adjacent to the immediate excavation site should also be secured (valves turned off and locked out) while excavation is underway or access by outside personnel possible. Where possible, it is desirable to purge these lines of their contents prior to start of excavation.

2. Controlled digging under careful observation of a watch person who has clear communication with the equipment operator. The watch person should be alert to notice the presence of (unknown) buried objects by visual inspection of the immediate excavation area.

3. Significant surface area of ground is exposed to the atmosphere as part o the trenching process. This may increase vapor exposures from volatile contaminants. Provisions should be made for air monitoring to trigger appropriate protective actions including temporary work stoppage. Use of vapor emissions controls or suppressants space entry procedures for greater details regarding control measures considerations.

4. Trenches or pits greater than 4 feet deep should be considered confined spaces, which may contain concentrated vapors, gases or oxygen deficient atmospheres. These areas must be checked to assure non-explosive, non-hazardous atmospheres before allowing entry and periodically (or continuously) thereafter. See confined space entry procedures for greater details regarding control measures considerations.

5. OSHA provisions regarding shoring and sloping of trench sides may apply. Subcontractors performing trenching or pit digging as part of sub-surface investigation must be aware that they will be expected to follow provisions under 29 CFR 1926.

6. Pits or trenches should be inspected daily for evidence of cracks, slides or scaling. Inspection should be more frequent if it is raining.

7. Heavy equipment should be kept away from the sides of trenches or pits.

8. Means of egress (e.g., steps, ladders) should be readily available (within 25’) of employees working in pits or other excavations from which rapid exit is difficult.

9. Excavations, mud pits, etc, must be protected with barricades or covers. Temporary pits/trenches should be back filled upon completion of work.

APPENDIX I

GENERAL HEALTH AND SAFETY GUIDELINES FOR DRUM HANDLING

GENERAL HEALTH AND SAFETY GUIDELINES FOR DRUM HANDLING

Drum handling can pose serious hazards such as detonation, fire, explosion, vapor generation, and physical injury if proper precautions and procedures are not taken. Spectra personnel will be present to provide oversight of drum handling and will be enforcing the following procedures in order to maintain a safe work environment. In general, subcontractors are responsible for complying with all regulations and client policies applicable to the work they are performing. As previously stated, Spectra personnel can and must stop work when a Spectra subcontractor is observed to not be following health and safety procedures required by the plan.

The subcontractor will provide more specific health and safety procedures for drum handling. The following are typical protocols that should be followed when handling drums:

1. Visual Inspection: Prior to handling, the drums should be checked for symbols or labels indicating potential contents, signs of deterioration (i.e. corrosion, rust, leaks, evidence of pressure (i.e. swelling and bulging), drum type, and the configuration of the drum head.

2. Assess conditions in the immediate vicinity of the drum: Monitor around the drums using organic vapor monitors and a combustible gas meter to possibly determine drum contents and associated hazards. Radiation Surveys should be performed where drum contents may include Radioactive Materials.

3. Based on this preliminary investigation, develop a plan to specify the extent of handling necessary; the personnel selected for the activity and the most appropriate precautions to be taken. Be aware that negative determinations regarding organic vapors and radiation do not rule our hazards such as corrosives, unstable compounds, spontaneous ignition, or reactive materials.

4. Select drum handling equipment may include:

    a. Drum handling grappler attached to a hydraulic excavator.
    b. Small front-end loader.
    c. Rough-terrain fork-lift.
    d. Roller conveyor equipped with solid rollers.
    e. Drum cart designed specifically for drum handling.

5. Prior to initiation of drum handling operations:

    a. Personnel designated to handle drums should be trained in the proper lifting and movement techniques.
    b. Vehicle selection: vehicles should have a sufficient load capacity to handle the anticipated load to be carried.
    c. Respirator protection: a health and safety professional should recommend the proper respiratory protection to be utilized.

d. Overpacks: there should be a sufficient number of overpacks available in case of accidental spills or leaks.

e. Movement: an appropriate sequence of events regarding movement should be determined.

6. Special Conditions

Contents/Condition of Drums	Special Precautions
Bulging or Swelling Drums	• Same as for explosive drums. • Carefully overpack as necessary.
Leaking, Open or Deteriorating Drums	• If ruptures are noted, transfer contents to a drum in sound condition, using a pump designed for transporting that liquid. • Using a drum grappler, immediately place drum in an overpack.
Buried Drums	• Prior to subsurface excavation, use ground-penetrating systems such as electromagnetic wave, electrical sensitivity, ground penetrating radar, magnetometry, or a metal detector to locate and determine the depth of the drum. • Have a dry chemical fire extinguisher available.

7. Drum Opening: The following procedure should be followed when opening drums:

a. Depending on the nature of the materials, a supply of air cylinders available for Supplied Air Respirators outside the work area and supply air to operator via airline and escape SCBA's may be needed.

b. Place explosion resistant shields between operators and drums where drum contents are suspected to include explosives or unstable materials. All controls for drum opening equipment, monitors and fire suppression equipment should be located behind the shield.

c. Monitor continuously during opening. Place sensor as close to the drum opening as possible.

d. Utilize remote control devices to open drums. Examples of such devices are:

§ Pneumatically operated impact wrench to remove drum bungs;

§ Hydraulically or pneumatically operated drum piercers; and

- § Backhoes equipped with bronze spikes for penetrating drum tops in large scale operations.

Do not use chisels, picks, or firearms to open drums.

Hang or balance the drum opening equipment to minimize worker exertion.

If the drum exhibits signs of swelling and/or bulging, relieve excess pressure prior to opening it. When possible, remote control devices should be employed. If manual opening is necessary an explosive resistant plastic shield should be used.

e. PVC/polyethylene or exotic metal drums should be opened by removing or drilling the bung. The drum should then re re-sealed as soon as possible. When re-sealing is not possible, overpacks should be used and any holes plugged with 5 psi pressure venting caps.

8. Sampling: Since one of the most dangerous tasks associated with drum handling is sample collection, the following precautionary measures should be taken when collecting samples:

   a. Research background information about the waste;
   b. Determine, which drums, should be sampled;
   c. Select an appropriate sampling device and container;
   d. Develop sampling strategy;
   e. Develop standard procedures for opening, sampling, sample packaging, and transportation;
   f. Have a health and safety professional determine the level of protection to be used during sampling, decontamination and packaging; and
   g. Obtain samples with glass rods or vacuum pumps.

9. Characterization: obtain necessary information to determine how to deal and efficiently package and transport wastes for treatment and disposal.

10. Staging: to facilitate characterization, remedial action and to protect from potentially dangerous site conditions, a staging area should be identified. The staging area is site specific and can consist of up to five separate areas (i.e. opening area, sampling area, second staging area, and final staging area). When staging drums, they should be in two rows spaced 7-8 feet apart.

11. Bulking: once characterized, wastes can be mixed together and placed in tanks or vacuum trucks for shipment and treatment at a disposal facility (i.e. bulking) wastes:

   a. Inspect each tank and trailer and remove any residual materials from trailer prior to transporting (e.g. to prevent mixing of incompatible materials).

b. Use pumps for removing hazardous liquids. These pumps must be appropriately rated and have a safety relief valve with a splash shield. Hoses, gaskets, valves, and fittings should be compatible with the material being pumped.

c. Store flammable wastes in appropriate containers.

12. Shipment:

a. All shipments must comply with US DOT and EPA regulations pertaining to the shipment of hazardous materials.

b. The bulking area should be as close to the site exit as possible.

c. Prepare a circulation plan to minimize the conflict between clean-up teams and waste haulers.

d. Allow adequate space for vehicles to turn around.

e. Require drivers to remain in cabs in vehicle staging area.

f. Provide for the proper protection for vehicle drivers.

g. Do not double stack drums.

h. Tightly seal drums.

I. Make sure the truck and bed walls are clean and smooth.

j. Keep bulk solids several inches lower than the top of the truck bed.

i. Make sure the truck and bed walls are clean and smooth.

j. Keep bulk solids several inches lower than the top of the truck bed.

k. Cover loads with a clean layer of soil, foam, or a tarp.

l. Weigh vehicles to assure safe operation.

m. Decontaminate vehicle tires.

n. Check vehicle for visible emissions.

o. Develop procedures to be followed in the event that the vehicle has a mechanical malfunction or accident.

APPENDIX J

MSDS SHEETS

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Material Safety Data Sheets Collection:

Sheet No. 683
Polychlorinated Biphenyls (PCBs)

Issued: 11/88 Revision: A, 9/92

Section 1. Material Identification

Polychlorinated Biphenyls [$C_{12}H_{10-n}Cl_n$ (n=3, 4, 5)] Description: A class of nonpolar chlorinated hydrocarbons with a biphenyl nucleus (two benzene nuclei connected by a single C-C bond) in which any or all of the hydrogen atoms have been replaced by chlorine. Commercial PCBs are mixtures of chlorinated biphenyl isomers with varying degrees of chlorination. Prepared industrially by the chlorination of biphenyl with anhydrous chlorine in the presence of a catalyst such as ferric chloride or iron filings. Except for limited research and development applications, PCBs have not been produced in the US since 1977. When large quantities of PCBs were manufactured in the US, they were marketed under the tradename Aroclor (Monsanto) and were characterized by four digit numbers. The first two digits indicating biphenyls (12), triphenyls (54), or both (25, 44), the last two digits indicating the weight percent of chlorine. PCBs' thermal stability, nonflammability, and high dielectric capability made them very useful in electrical equipment. Formerly used as additives in hydraulic fluids, heat transfer systems, lubricants, cutting oils, printer's ink, fire retardants, asphalt, brake linings, automobile body sealants, plasticizers, adhesives, synthetic rubber, floor tile, wax extenders, dedusting agents, pesticide extenders, and carbonless reproducing paper. PCBs are still used in certain existing electrical capacitors and transformers that require enhanced electrical protection to avoid heating from sustained electric faults.

Other Designations: CAS No. 1336-36-3, Aroclor, Clophen, Chlorextol, chlorinated biphenyls, chlorinated diphenyl, chlorinated diphenylene, chloro biphenyl, chloro-1,1-biphenyl, Dykanol, Fenclor, Inerteen, Kaneclor, Montar, Noflamol, Phenoclor, Pyralene, Pyranol, Santotherm, Sovol, Therminol FR-1

R 1
I 4
S 3*
K 1
* Skin absorption

NFPA
1
2 0
–

HMIS
H 2‡
F 1
R 0
PPE†
† Sec. 8
‡ Chronic Effects

Cautions: PCBs are potent liver toxins that may be absorbed through skin. Potentially, chronic or delayed toxicity is significant because PCBs accumulate in fatty tissue and may reasonably be anticipated to be carcinogens. PCBs are a bioaccumulative environmental hazard. When burned, decomposition products may be more hazardous than the PCBs.

Section 2. Ingredients and Occupational Exposure Limits

PCBs, contain various levels of polychlorinated dibenzofurans and chlorinated naphthalenes as contaminants

1991 OSHA PELs, Skin
8-hr TWA (Chlorodiphenyl, 42% chlorine): 1 mg/m^3
8-hr TWA (Chlorodiphenyl, 54% chlorine): 0.5 mg/m^3

1990 DFG (Germany) MAK, Danger of Cutaneous Absorption
TWA (Chlorodiphenyl, 42% chlorine): 0.1 ppm (1 mg/m^3)
Category III: Substances with systemic effects, onset of effect > 2 hr., half-life > shift length (strongly cumulative)
Short-term Level: 1 ppm, 30 min., average value, 1 per shift
TWA (Chlorodiphenyl, 54% chlorine): 0.05 ppm (0.5 mg/m^3)
Category III: (see above)
Short-term Level: 0.5 ppm, 30 min., average value, 1 per shift

1985-86 Toxicity Data*
Rat, oral, TD: 1250 mg/kg administered intermittently for 25 weeks produced liver tumors.
Mammal, oral, TD_{Lo}: 325 mg/kg administered to female for 30 days prior to mating and from the 1st to the 36th day of gestation produced effects on newborn (stillbirth; live birth index; viability index).

1990 NIOSH REL
TWA (Chlorodiphenyl, 42% chlorine): 0.001 mg/m^3
TWA (Chlorodiphenyl, 54% chlorine): 0.001 mg/m^3

1992-93 ACGIH TLVs, Skin *
TWA (Chlorodiphenyl, 42% chlorine): 1 mg/m^3
TWA (Chlorodiphenyl, 54% chlorine): 0.5 mg/m^3

* These guidelines offer reasonably good protection against systemic intoxication, but may not guarantee that chloroacne won't occur.
† See NIOSH, *RTECS* (TQ1350000), for additional reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data*

Boiling Point: 644-707 °F (340-375 °C)
Melting Point: 42%: -2.2 °F (-19°C); 54%: 14 °F (-10 °C)
Vapor Pressure: 1 mm Hg at 100 °F (38 °C); 10^{-6} to 10^{-3} mm at 20 °C
Molecular Weight: 188.7 to 398.5
Specific Gravity: 1.3 to 1.8 at 20 °C
Water Solubility: Low solubility (0.007 to 5.9 mg/L)
Other Solubilities: Most common organic solvents, oils, and fats; slightly soluble in glycerol and glycols.

Appearance and Odor: PCBs vary from mobile oily liquids to white crystalline solids and hard non-crystalline resins, depending upon chlorine content.

* Physical and chemical properties vary widely according to degree and to the position of chlorination.

Section 4. Fire and Explosion Data

Flash Point: 286-385 °F (141-196 °C) OC*	Autoignition Temperature: 464 °F (240 °C)	LEL: None reported	UEL: None reported

Extinguishing Media: Use extinguishing media suitable to the surrounding fire. Use dry chemical, foam, carbon dioxide (CO_2), or water spray. Water spray may be ineffective. Use water spray to cool fire-exposed containers or transformers. Do not scatter PCBs with high-pressure water streams. **Unusual Fire or Explosion Hazards:** Combustion products (hydrogen chloride, phosgene, polychlorinated dibenzofurans, and furans) are more hazardous than the PCBs themselves. **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. Approach fire from upwind to avoid highly toxic decomposition products. Structural firefighter's protective clothing will provide *limited* protection. Do not release runoff from fire control methods to sewers or waterways. Dike for later disposal.

* Flash points shown are a range for various PCBs. Some forms do not have flash points.

Section 5. Reactivity Data

Stability/Polymerization: PCBs are very stable materials but are subject to photodechlorination when exposed to sunlight or UV (spectral region above 290 nanometers). Hazardous polymerization cannot occur. **Chemical Incompatibilities:** PCBs are chemically inert and resistant to oxidation, acids, and bases. **Conditions to Avoid:** Avoid heat and ignition sources.
Hazardous Products of Decomposition: Thermal oxidative decomposition [1112-1202 °F (600-650 °C)] of PCBs can produce highly toxic derivatives, including polychlorinated dibenzo-para-dioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), hydrogen chloride, phosgene and other irritants.

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Section 6. Health Hazard Data

Carcinogenicity: The IARC,[185] and NTP[169] list PCBs as an IARC probable carcinogen (overall evaluation is 2A; limited human data; sufficient animal data) and NTP anticipated carcinogen, respectively. **Summary of Risks:** PCBs are potent liver toxins that can be absorbed through unbroken skin in toxic amounts without immediate pain or irritation. PCBs have low acute toxicity, but can accumulate in fatty tissue and severe health effects may develop later. Generally, toxicity increases with a higher chlorine content; PCB-oxides are more toxic. The toxic action on the liver also increases with simultaneous exposure to other liver toxins, e.g. chlorinated solvents, alcohol, and certain drugs. Pathological pregnancies (abnormal pigmentations, abortions, stillbirths, and underweight births) have been associated with increased PCB serum levels in mothers; PCBs can be passed in breast milk. PCBs can affect the reproductive system of adults. **Medical Conditions Aggravated by Long-Term Exposure:** Skin, liver, and respiratory disease. **Target Organs:** Skin, liver, eyes, mucous membranes, and respiratory tract. **Primary Entry Routes:** Inhalation, dermal contact, ingestion. **Acute Effects:** Exposure to PCB vapor or mist is severely irritating to the skin, eyes, nose, throat, and upper respiratory tract. Intense acute exposure to high concentrations may result in eye, lung, and liver injury. Systemic effects include nausea, vomiting, increased blood pressure, fatigue, weight loss, jaundice, edema and abdominal pain. Cognitive, neurobehavior and psychomotor impairment and memory loss have also been seen after acute exposure. **Chronic Effects:** Repeated exposure to PCBs can cause chloroacne; redness, swelling, dryness, thickening and darkening of the skin and nails; swelling and burning of the eyes, and excessive eye discharge; distinctive hair follicles; gastrointestinal disturbances; neurological symptoms including headache, dizziness, depression, nervousness, numbness of the extremities, and joint and muscle pain; liver enlargement; menstrual changes in women; and chronic bronchitis. Cancer, primarily liver, is also a possible result of exposure, but data is inconclusive.

FIRST AID **Eyes:** *Do not* allow victim to rub or keep eyes tightly shut. Rinsing eyes with medical oil (olive, mineral) initially may remove PCB and halt irritation better than water rinsing alone. 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. *Multiple soap and water washings are necessary.* Avoid the use of organic solvents to clean the skin. For reddened or blistered skin, consult a physician. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** In most cases, accidental PCB ingestion will not be recognized until long after vomiting would be of any value. Never give anything by mouth to an unconscious or convulsing person. Vomiting of the pure substance may cause aspiration. Consult a physician.
Note to Physicians: Monitor patients for increased hepatic enzymes, chloroacne, and eye, gastrointestinal, and neurologic symptoms listed above. Diagnostic tests include blood levels of PCBs and altered liver enzymes.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, evacuate all unnecessary personnel, provide adequate ventilation, and isolate hazard area. Cleanup personnel should protect against vapor inhalation and skin or eye contact. For small spills, take up with sand or other noncombustible material and place into containers for later disposal. For larger spills, dike far ahead of spill to contain for later disposal. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** PCBs have been shown to bio-concentrate significantly in aquatic organisms. **Ecotoxicity:** Bluegill, TLm: 0.278 ppm/96 hr. Mallard Duck, LD_{50}: 2000 ppm. **Environmental Degradation:** In general, the persistence of PCBs increases with an increase degree of chlorination. **Soil Absorption/Mobility:** PCBs are tightly absorbed in soil and generally do not leach significantly in most aqueous soil systems. However, in the presence of organic solvents, PCBs may leach rapidly through the soil. Volatilization of PCBs from soil may be slow, but over time may be significant. **Disposal:** Approved PCB disposal methods include: incineration with scrubbing, high-efficiency boilers, landfills, and EPA-approved alternative disposal methods. Each disposal method has various criteria. 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
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)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1 lb (0.454 kg) [* per CWA, Sec. 311(b)(4) and 307(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. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. Minimum respiratory protection should include a combination dust-fume-mist and organic vapor cartridge or canister or air-supplied, depending upon the situation. 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 all skin contact. Butyl rubber, neoprene, Teflon, and fluorocarbon rubber have break through times greater than 8 hrs. **Ventilation:** Provide general and 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] **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. Segregate contaminated clothing in such a manner so that there is no direct contact by laundry personnel. Implement quality assurance to ascertain the completeness of the cleaning procedures. 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 closed, labelled, container in a ventilated area with appropriate air pollution control equipment. **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:** Inform employees of the adverse health effects associated with PCBs. Limit access to PCB work areas to authorized personnel. Consider preplacement and periodic medical examinations with emphasis on the skin, liver, lung, and reproductive system. Monitor PCB blood levels. Consider possible effects on the fetus. Keep medical records for the entire length of employment and for the following 30 yrs.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Polychlorinated biphenyls
DOT Hazard Class: 9
ID No.: UN2315
DOT Packing Group: II
DOT Label: CLASS 9
Special Provisions (172.102): 9, N81

Packaging Authorizations
a) Exceptions: 173.155
b) Non-bulk Packaging: 173.202
c) Bulk Packaging: 173.241

Quantity Limitations
a) Passenger Aircraft or Railcar: 100 L
b) Cargo Aircraft Only: 220 L

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: 34

MSDS Collection **References:** 26, 73, 89, 100, 101, 103, 124, 126, 127, 132, 133, 136, 163, 164, 168, 169, 174, 175, 180
Prepared by: MJ Wurth, BS; **Industrial Hygiene Review:** PA Roy MPH, CIH; **Medical Review:** AC Darlington, MD

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Material Safety Data Sheets Collection:
Sheet No. 316
Benzene

Issued: 11/78 Revision: E, 8/90

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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.

R 1
I 4
S 2*
K 4
*Skin absorption

NFPA
3
2 0
\-

HMIS
H 3
F 3
R 0
PPG†
† Sec. 8

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.

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/m³
15-min STEL: 5 ppm, 15 mg/m³

(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/m³

1988 NIOSH RELs
TWA: 0.1 ppm, 0.3 mg/m³
Ceiling: 1 ppm, 3 mg/m³

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.

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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 Sheet

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GENIUM PUBLISHING CORP.

No. 317
TOLUENE
(Revision D)

Issued: August 1979
Revised: April 1986

SECTION 1. MATERIAL IDENTIFICATION

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MATERIAL NAME: TOLUENE

OTHER DESIGNATIONS: Methyl Benzene, Methyl Benzol, Phenylmethane, Toluol, C_7H_8, CAS #0108-88-3

MANUFACTURER/SUPPLIER: Available from many suppliers, including:
Allied Corp., PO Box 2064R, Morristown, NJ 07960; Telephone: (201) 455-4400
Ashland Chemical Co., Industrial Chemicals & Solvents Div., PO Box 2219, Columbus, OH; Telephone: (614) 889-3844

HMIS
H: 2
F: 3
R: 0
PPE*
*See sect. 8

3
2 0
-

R 1
I 3
S 2
K 4

SECTION 2. INGREDIENTS AND HAZARDS

	%	HAZARD DATA
Toluene 	ca 100	8-hr TLV: 100 ppm, or 375 mg/m^3* (Skin)**
		Man, Inhalation, TCLo: 100 ppm: Psychotropic***
		Rat, Oral, LD_{50}: 5000 mg/kg Rat, Inhalation, LCLo: 4000 ppm/4 hrs. Rabbit, Skin, LD_{50}: 14 gm/kg
		Human, Eye: 300 ppm

* Current (1985-86) ACGIH TLV. The OSHA PEL is 200 ppm with an acceptable ceiling concentration of 300 ppm and an acceptable maximum peak of 500 ppm/10 minutes.

** Skin designation indicates that toluene can be absorbed through intact skin and contribute to overall exposure.

*** Affects the mind.

SECTION 3. PHYSICAL DATA

Boiling Point ... 231°F (111°C)
Vapor Pressure @ 20°C, mm Hg ... 22
Water Solubility @ 20°C, wt. % ... 0.05
Vapor Density (Air = 1) ... 3.14

Evaporation Rate (BuAc = 1) ... 2.24
Specific Gravity (H_2O = 1) ... 0.866
Melting Point ... -139°F (-95°C)
Percent Volatile by Volume ... ca 100
Molecular Weight ... 92.15

Appearance and odor: Clear, colorless liquid with a characteristic aromatic odor. The odor is detectable to most individuals in the range of 10 to 15 ppm. Because olfactory fatigue occurs rapidly upon exposure to toluene, odor is not a good warning property.

SECTION 4. FIRE AND EXPLOSION DATA

Flash Point and Method	Autoignition Temp.	Flammability Limits In Air	LOWER	UPPER
40°F (4°C) CC	896°F (480°C)	% by Volume	1.27	7.1

EXTINGUISHING MEDIA: Carbon dioxide, dry chemical, alcohol foam. Do not use a solid stream of water because the stream will scatter and spread the fire. Use water spray to cool tanks/containers that are exposed to fire and to disperse vapors.

UNUSUAL FIRE/EXPLOSION HAZARDS: This OSHA class IB flammable liquid is a dangerous fire hazard. It is a moderate fire hazard when exposed to oxidizers, heat, sparks, or open flame. Vapors are heavier than air and may travel a considerable distance to an ignition source and flash back.

SPECIAL FIRE-FIGHTING PROCEDURES: Fire fighters should wear self-contained breathing apparatus with full facepiece operated in a positive-pressure mode when fighting fires involving toluene.

SECTION 5. REACTIVITY DATA

CHEMICAL INCOMPATIBILITIES: Toluene is stable in closed containers at room temperature under normal storage and handling conditions. It does not undergo hazardous polymerization. This material is incompatible with strong oxidizing agents, dinitrogen tetraoxide, silver perchlorate, tetranitromethane, and uranium hexafluoride. Contact with these materials may cause fire or explosion. Nitric acid and toluene, especially in the presence of sulfuric acid, will produce nitrated compounds that are dangerously explosive.

CONDITIONS TO AVOID: Avoid exposure to sparks, open flame, hot surfaces, and all sources of heat and ignition. Toluene will attack some forms of plastics, rubber, and coatings. Thermal decomposition or burning produces carbon dioxide and/or carbon monoxide.

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No. 317 4/86 TOLUENE

SECTION 6. HEALTH HAZARD INFORMATION TLV

Toluene is not considered a carcinogen by the NTP, IARC, or OSHA. SUMMARY OF RISKS: Vapors of toluene may cause
irritation of the eyes, nose, upper respiratory tract, and skin. Exposure to 200 ppm for 8 hours causes mild fatigue,
weakness, confusion, lacrimation (tearing) and paresthesia (a sensation of prickling, tingling, or creeping on the skin that
has no objective cause). Exposure to higher concentrations may cause headache, nausea, dizziness, dilated pupils, and
euphoria, and, in severe cases, may cause unconsciousness and death. The liquid is irritating to the eyes and skin. Contact
with the eyes may cause transient corneal damage, conjunctival irritation, and burns if not promptly removed. Repeated
and/or prolonged contact with the skin may cause drying and cracking. It may be absorbed through the skin in toxic
amounts. Ingestion causes irritation of the gastrointestinal tract and may cause effects resembling those from inhalation of
the vapor. Chronic overexposure to toluene may cause reversible kidney and liver injury. FIRST AID: EYE CONTACT:
Immediately flush eyes, including under eyelids, with running water for at least 15 minutes. Get medical attention if irritation
persists.* SKIN CONTACT: Immediately flush skin (for at least 15 minutes) while removing contaminated shoes and
clothing. Wash exposed area with soap and water. Get medical attention if irritation persists or if a large area has been
exposed.* INHALATION: Remove victim to fresh air. Restore and/or support breathing as required. Keep victim warm and
quiet. Get medical help.* INGESTION: Give victim 1 to 2 glasses of water or milk. Contact a poison control center. Do not
induce vomiting unless directed to do so. Transport victim to a medical facility. Never give anything by mouth to a person
who is unconscious or convulsing. * GET MEDICAL ASSISTANCE = In plant, paramedic, community. Get medical help
for further treatment, observation, and support after first aid, if indicated.

SECTION 7. SPILL, LEAK, AND DISPOSAL PROCEDURES

SPILL/LEAK: Notify safety personnel of large spills or leaks. Remove all sources of heat and ignition. Provide maximum explosion-proof ventilation. Limit access to spill area to necessary personnel only. Remove leaking containers to safe place if feasible. Cleanup personnel need protection against contact with liquid and inhalation of vapor (see sect. 8).
WASTE DISPOSAL: Absorb small spills with paper towel or vermiculite. Contain large spills and collect if feasible, or absorb with vermiculite or sand. Place waste solvent or absorbent into closed containers for disposal using nonsparking tools. Liquid can be flushed with water to an open holding area for handling. Do not flush to sewer, watershed, or waterway.
COMMENTS: Place in suitable container for disposal by a licensed contractor or burn in an approved incinerator. Consider reclaiming by distillation. Contaminated absorbent can be buried in a sanitary landfill. Follow all Federal, state, and local regulations. TLm 96: 100-10 ppm. Toluene is designated as a hazardous waste by the EPA. The EPA (RCRA) HW No. is U220 (40 CFR 261). The reportable quantity (RQ) is 1000 lbs/454 kg (40 CFR 117).

SECTION 8. SPECIAL PROTECTION INFORMATION

Provide general and local exhaust ventilation to meet TLV requirements. Ventilation fans and other electrical service must be nonsparking and have an explosion-proof design. Exhaust hoods should have a face velocity of at least 100 lfm (linear feet per minute) and be designed to capture heavy vapor. For emergency or nonroutine exposures where the TLV may be exceeded, use an organic chemical cartridge respirator if concentration is less than 200 ppm and an approved canister gas mask or self-contained breathing apparatus with full facepiece if concentration is greater than 200 ppm.
Safety glasses or splash goggles should be worn in all work areas. Neoprene gloves, apron, face shield, boots, and other appropriate protective clothing and equipment should be available and worn as necessary to prevent skin and eye contact. Remove contaminated clothing immediately and do not wear it until it has been properly laundered.

Eyewash stations and safety showers should be readily available in use and handling areas.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

SECTION 9. SPECIAL PRECAUTIONS AND COMMENTS

STORAGE SEGREGATION: Store in a cool, dry, well-ventilated area away from oxidizing agents, heat, sparks, or open flame. Storage areas must meet OSHA requirements for class IB flammable liquids. Use metal safety cans for handling small amounts. Protect containers from physical damage. Use only with adequate ventilation. Avoid contact with eyes, skin, or clothing. Do not inhale or ingest. Use caution when handling this compound because it can be absorbed through intact skin in toxic amounts. SPECIAL HANDLING/STORAGE: Ground and bond metal containers and equipment to prevent static sparks when making transfers. Do not smoke in use or storage areas. Use nonsparking tools. ENGINEERING CONTROLS: Preplacement and periodic medical exams emphasizing the liver, kidneys, nervous system, lungs, heart, and blood should be provided. Workers exposed to concentrations greater than the action level (50 ppm) should be examined at least once a year. Use of alcohol can aggravate the toxic effects of toluene.
COMMENTS: Emptied containers contain product residues. Handle accordingly!
Toluene is designated as a hazardous substance by the EPA (40 CFR 116). DOT Classification: Flammable liquid. UN1294.
Data Source(s) Code: 1-9, 12, 16, 20, 21, 24, 26, 34, 81, 82. CR

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	Indust. Hygiene/Safety DW 10-86
	Medical Review Oct 86

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Material Safety Data Sheets Collection:
Sheet No. 385
Ethylbenzene
Issued: 8/78 Revision: B, 9/92

Section 1. Material Identification

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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.

R 1
I 3
S 2*
K 4
* Skin absorption

NFPA: 3 (top), 2 (left), 0 (right), - (bottom)

HMIS
H 2†
F 3
R 0
PPE - Sec. 8
† Chronic effects

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.

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

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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/cm²/hr. Immersion of hand in solutions of 112 & 156 mg/L for 1 hr absorbed 118 & 215.7 µg/cm²/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

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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

45

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.

R	1
I	2
S	2
K	3

NFPA: 3 (top), 2 (left), 0 (right), – (bottom)

HMIS
H 2†
F 3
R 0
PPE ‡
† Chronic Effects
‡ Sec. 8

Cautions: Xylene is an eye, skin, and mucous membrane irritant and may be narcotic in high concentrations. It is a dangerous fire hazard.

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

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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

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Section 1. Material Identification

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Vinyl Chloride (C_2H_3Cl) Description: Derived from ethylene dichloride and alcoholic potassium, by reaction of acetylene and hydrogen chloride (as gas or liquids), or by oxychlorination where ethylene reacts with hydrochloric acid and oxygen. Inhibitors such as butyl catechol, hydroquinone, or phenol are added to prevent polymerization. Used in the plastics industry for the production of polyvinyl chloride resins, in organic synthesis and formerly as a refrigerant, extraction solvent, and propellant (banned in 1974 because of its carcinogenic activity).

Other Designations: CAS No. 75-01-4, chloroethylene, chloroethene, ethylene monochloride, Trovidur, VC, VCM.

Manufacturer: Contact your supplier or distributor. Consult latest *Chemical Week Buyers' Guide*(73) for a suppliers list.

Cautions: Vinyl chloride is a confirmed human carcinogen. Vapor inhalation leads to central nervous system (CNS) depression. The liquid can cause frostbite. It is a flammable gas at room temperature and polymerizes on exposure to air or sunlight. Avoid exposure to VC through engineering controls and wearing PPE.

R 2
I 4
S 4
K 4

NFPA: 4 (flammability), 2 (health), 2 (reactivity), – (special)

HMIS
H 3*
F 4
R 2
PPE - Sec. 8
* Chronic effects

Section 2. Ingredients and Occupational Exposure Limits

Vinyl Chloride, ca 98 to 99%. Impurities include water, acetaldehyde, hydrogen chloride, hydrogen peroxide, methyl chloride, butane, 1,3-butadiene, chlorophene, diacetylene, vinyl acetylene, and propine.

1991 OSHA PELs
8-hr TWA: 1 ppm
Ceiling: 5 ppm; OSHA-X

1990 NIOSH REL
NIOSH-X

1992-93 ACGIH TLV
TWA: 5 ppm (13 mg/m³)
TLV-A1

1990 DFG (Germany) TRK*
Existing Installations: 3 ppm
MAK-A1

1985-86 Toxicity Data†
Man, inhalation, TC_{Lo}: Intermittent exposure to 200 ppm for 14 yr caused liver tumors.
Man, inhalation, TC_{Lo}: 30 mg/m³/5 yr caused spermatogenesis.
Human, inhalation, TC: Continuous exposure to 300 mg/m³ for an undetermined number of weeks caused blood tumors.
Rat, oral, LD_{50}: 500 mg/kg; toxic effects not yet reviewed

* TRK (technical exposure limit) is used in place of MAK when a material is a carcinogen. Unlike an MAK below which no adverse effects are expected, the TRK is a limit set below which adverse effects may still occur. This is based on the theory that 1 molecule of a carcinogenic substance may still produce a tumor. The TRK is set to allow for an acceptable risk (for example, 1 tumor in 1 million persons may be an acceptable risk).
† See NIOSH, *RTECS* (KU9625000), for additional mutation, reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data

Boiling Point: 7 °F (-13.9 °C)
Freezing Point: -245 °F (-159.7 °C)
Molecular Weight: 62.5
Specific Gravity: 0.9106 at 68 °F (20 °C)
Ionization Potential: 9.99 eV
Refraction Index: 1.370 at 20 °C/D
Surface Tension: 23.1 dyne/cm at -4 °F (-20 °C)
Odor Threshold: 2000 to 5000 ppm*
Vapor Density (Air = 1): 2.155
Water Solubility: Slightly soluble, 0.1% at 77 °F (25 °C)
Other Solubilities: alcohol, benzene, carbon tetrachloride, ether, hydrocarbon and oils.
Vapor Pressure: 2530 mm Hg at 68 °F (20 °C), 400 mm Hg at -18.4 °F (-28 °C)
Critical Temperature: 304.7 °F (151.5 °C)
Critical Pressure: 56.8 atm
Viscosity: 0.01072 cP at 68 °F (20 °C), *gas*; 0.28 cP at -4 °F (-20 °C), *liquid*
Appearance and Odor: A gas at room temperature. Usually found as a compressed/cooled liquid. The colorless liquid forms a vapor with a pleasant ethereal odor.

*The actual vapor concentration that can be detected by humans has not been adequately determined and varies from one individual to another, from impurities, and probably from exposure duration. The odor threshold is not an accurate warning of exposure.

Section 4. Fire and Explosion Data

Flash Point: -108.4 °F (-78 °C) OC	Autoignition Temperature: 882 °F (472 °C)	LEL: 3.6% v/v	UEL: 33% v/v

Extinguishing Media: For small fires, use dry chemical or carbon dioxide. For large fires, use water spray, fog, or regular foam. **Unusual Fire or Explosion Hazards:** Large fires can be practically inextinguishable. Vapors may travel to an ignition source and flash back. VC may polymerize in cylinders or tank cars and explode in heat of fire. Vapors pose an explosion hazard indoors, outdoors, and in sewers. VC decomposes in fire to hydrogen chloride, carbon monoxide, carbon dioxide, and phosgene. Burning rate = 4.3 mm/min. **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. Stop gas leak if possible. Let tank, tank car, or tank truck burn unless leak can be stopped. For massive fire in cargo area, use monitor nozzles or unmanned hose holders; if this is impossible, withdraw from area and let fire burn. Withdraw immediately if you hear a 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: Long term exposure to air may result in formation of peroxides which initiates explosive polymerization of the chloride. VC can polymerize on exposure to light or in presence of a catalyst. **Chemical Incompatibilities:** VC can explode on contact with oxide of nitrogen, may liberate hydrogen chloride on exposure to strong alkalies, and is incompatible with copper, oxidizers, aluminum, and peroxides. In the presence of moisture, VC attacks iron and steel. **Conditions to Avoid:** Exposure to sunlight, air, heat, and incompatibles. **Hazardous Products of Decomposition:** Thermal oxidative decomposition of vinyl chloride can produce carbon oxides, and chloride gas.

Section 6. Health Hazard Data

Carcinogenicity: Vinyl chloride is listed as a carcinogen by the IARC (Class 1, *sufficient human evidence*),[164] NTP (Class 1, *sufficient human evidence*),[169] NIOSH (Class X, *carcinogen defined without further categorization*),[163] ACGIH (TLV-A1, *confirmed human carcinogen*),[163] DFG (MAK-A1, *capable of inducing malignant tumors in humans*),[163] and OSHA (Class X, *carcinogen defined without further categorization*).[164] Liver tumors (angiosarcomas) are confirmed from VC exposure. Other tumors of the CNS, respiratory system, blood, and lymphatic system have occurred from exposure to the polyvinyl chloride manufacture process but VC itself may not be the causative agent. **Summary of Risks:** Vapor inhalation causes varying degrees of CNS depression with noticeable anesthetic effects at levels of 1% (10,000 ppm). Studies have shown loss of libido and sperm in men exposed to VC and in Russian studies, 77% of exposed women experienced ovarian dysfunction, benign uterine growths, and prolapsed genital organs. However, no teratogenic effects have been seen in offspring of exposed workers.

Continue on next page

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Section 6. Health Hazard Data, *continued*

It appears that metabolism is necessary before many of VC's toxic effects occur. Some vinyl chloride is exhaled unchanged but most is metabolized to chloroacetaldehyde. Skin absorption may occur if liquid is confined on skin but absorbed amount would be small. It is possible that the phenol inhibitor may be absorbed as well. The compressed liquid can cause frostbite. Vapors are severely irritating to the eyes. Chronic exposure can cause cancer and a triad of syndromes known as *vinyl chloride disease.* **Medical Conditions Aggravated by Long-Term Exposure:** Liver, cardiac, pulmonary, and connective tissue disorders. **Target Organs:** Liver, CNS, respiratory and lymphatic systems, bone, and connective tissue of the skin. **Primary Entry Routes:** Inhalation, skin/eye contact. **Acute Effects:** CNS effects include fatigue, headache, vertigo, ataxia, euphoria, visual disturbances, dulling of auditory cues, numbness and tingling in the extremities, narcosis, unconsciousness, and death due to respiratory failure. Respiratory problems include dyspnea, asthma, and pneumonoconiosis. **Chronic Effects:** Repeated exposure has lead to liver cancer; confirmed because of the otherwise rarity of its type (angiosarcoma). Tumors in other organs have occurred in the polyvinyl chloride industry but agents other than VC may be responsible; authorities are still debating this issue. A triad of other effects are associated with VC exposure. Acro-osteolysis is associated with hand cleaning of polymerization vessels and characterized by dissolution of bone in the hands, especially when associated with resorption. Raynaud's Phenomenon is a vascular disorder marked by recurrent spasm of the capillaries and especially those of the fingers and toes on exposure to cold. This is usually accompanied by pain and in severe cases may progress to local gangrene. Sclerodermatous skin changes (affecting the dorsal hands and distal forearms) are seen and described as a slowly progressive disease marked by deposition of fibrous connective tissue in the skin. The skin becomes thickened and raised nodules appear. Arthralgias (pain in one or more joints) and blood changes with decreased platelet number and capillary abnormalities may also occur.

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. For frostbite, immerse affected area in 107.6 °F (42 °C) water until completely rewarmed. *Do not* use dry heat. **Inhalation:** Remove exposed person to fresh air and support breathing as needed. **Ingestion:** Unlikely! VC is a gas above 7 °F (-14°C). **Note to Physicians:** Endotracheal intubation may be required if significant CNS or respiratory depression occur. Diagnostic test: thiodiglycolic acid in urine (normally < 2 mg/g creatinine).

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind. If possible without risk, stop gas flow. Shut off ignition sources. Report any release > 1 lb. Follow applicable OSHA regulations (29 CFR 1910.120). **Environmental Transport:** VC reacts with hydroxyl radicals in the trophosphere with a half-life of 1.2 days. The half-life = a few hr in photochemical smog. Reaction products in the air include chloroacetaldehyde, hydrogen chloride, chloroethylene, epoxide, formaldehyde, formyl chloride, formic acid, and carbon monoxide. In soil, VC rapidly volatilizes. What does not evaporate will be highly mobile and may leach into groundwater. In water, VC is not expected to hydrolyze, bioconcentrate, or absorb to sediment. It will rapidly volatilize with an estimated half-life of 0.805 hr for evaporation from a river 1 meter deep with a current of 3 meter/sec and a wind velocity of 3 meter/sec. In waters containing photosensitizers such as humic acid, photodegradation will be rapid. **Soil Absorption/Mobility:** From an estimated solubility of 2,700 ppm, a Koc of 56 is established for VC which indicates high soil mobility and potential to leach into groundwater. **Disposal:** Dilute any waste compressed liquid to a 1% solution and remove phenol inhibitor as sodium. Pour onto vermiculite, sodium bicarbonate, or a sand & soda ash mixture (90/10). Add slaked lime if fluoride is present. Mix in paper boxes, place in incinerator, cover with scrap wood and paper, and ignite with excelsior train. Another method is to dissolve waste in a flammable solvent and spray in incinerator firebox equipped with an afterburner and alkali scrubber. 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. U043

SARA Extremely Hazardous Substance (40 CFR 355), TPQ: Not listed

Listed as a SARA Toxic Chemical (40 CFR 372.65)

Listed as a CERCLA Hazardous Substance* (40 CFR 302.4): Final Reportable Quantity (RQ), 1 lb (0.454 kg) [* per CWA, Sec. 307 (a); CAA, Sec. 112, & 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 (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. According to NIOSH[148], for any detectable concentration use a SCBA or supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode. See 29 CFR 1910.1017 for detailed OSHA respirator recommendations. 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 made of Viton or chlorinated polyethylene to prevent skin contact. **Ventilation:** Provide general and local exhaust ventilation systems to maintain airborne concentrations below the OSHA PEL's (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 work clothes from street clothes, launder before reuse 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 in clearly labeled containers. Outside or detached storage is preferred. Large amounts should be stored in steel containers under pressure. Keep separate from incompatibles (Sec. 5). Venting, under pressure should be safety relief. At atm, venting should be pressure vacuum. Regularly monitor inhibitor levels. To avoid static sparks, electrically ground and bond all equipment used with VC. Avoid open flames, spark formation and electric discharges around VC. **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. Install Class 1, Group D electrical equipment. **Administrative Controls:** Inform VC exposed personnel of hazards associated with its use. Preplacement and periodic medical exams of workers exposed above the action level is mandatory under OSHA 29 CFR (1910.1017). Monitor for liver cancer, scleroderma, pneumonitis, clotting abnormalities, and acro-osteolysis.

Transportation Data (49 CFR 172.101)

DOT Shipping Name: Vinyl Chloride
DOT Hazard Class: 2.1
ID No.: UN1086
DOT Packing Group: --
DOT Label: Flammable Gas
Special Provisions (172.102): B44

Packaging Authorizations
a) **Exceptions:** 173.306
b) **Non-bulk Packaging:** 173.304
c) **Bulk Packaging:** 173.314 & 173.315

Quantity Limitations
a) **Passenger Aircraft or Railcar:** Forbidden
b) **Cargo Aircraft Only:** 150 kg

Vessel Stowage Requirements
a) **Vessel Stowage:** B
b) **Other:** 40

MSDS Collection **References:** 26, 73, 100, 101, 103, 124, 126, 127, 132, 133, 136, 140, 148, 149, 153, 159, 162, 163, 164, 167, 168, 171, 174, 175

Prepared by: M Gannon, BA; **Industrial Hygiene Review:** PA Roy, MPH, CIH; **Medical Review:** AC Darlington, MPH, MD

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Material Safety Data Sheet

Version 4.5
Revision Date 01/17/2012
Print Date 04/18/2012

1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	Benzo[*a*]pyrene
Product Number	:	B1760
Brand	:	Sigma
Supplier	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone	:	+1 800-325-5832
Fax	:	+1 800-325-5052
Emergency Phone # (For both supplier and manufacturer)	:	(314) 776-6555
Preparation Information	:	Sigma-Aldrich Corporation Product Safety - Americas Region 1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards
Carcinogen, Respiratory sensitiser, Teratogen, Reproductive hazard, Mutagen

Target Organs

Lungs, Skin

GHS Classification
Skin irritation (Category 3)
Respiratory sensitization (Category 1)
Germ cell mutagenicity (Category 1B)
Carcinogenicity (Category 1B)
Reproductive toxicity (Category 1B)
Acute aquatic toxicity (Category 1)
Chronic aquatic toxicity (Category 1)

GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)

H316	Causes mild skin irritation.
H334	May cause allergy or asthma symptoms or breathing difficulties if inhaled.
H340	May cause genetic defects.
H350	May cause cancer.
H360	May damage fertility or the unborn child.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201	Obtain special instructions before use.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P273	Avoid release to the environment.

P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P501	Dispose of contents/ container to an approved waste disposal plant.

HMIS Classification

Health hazard:	3
Chronic Health Hazard:	*
Flammability:	0
Physical hazards:	0

NFPA Rating

Health hazard:	3
Fire:	0
Reactivity Hazard:	0

Potential Health Effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.
Ingestion	May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

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

Formula : $C_{20}H_{12}$
Molecular Weight : 252.31 g/mol

Component		Concentration
Benzo[a]pyrene		
CAS-No.	50-32-8	-
EC-No.	200-028-5	
Index-No.	601-032-00-3	

4. FIRST AID MEASURES

General advice
Consult a physician. Show this safety data sheet to the doctor in attendance.Move out of dangerous area.

If inhaled
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

If swallowed
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability
Not flammable or combustible.

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products
Hazardous decomposition products formed under fire conditions. - Carbon oxides

6. ACCIDENTAL RELEASE MEASURES

Personal precautions
Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

Environmental precautions
Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up
Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.

Conditions for safe storage
Keep container tightly closed in a dry and well-ventilated place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Basis
Remarks	Cancer Substances for which there is a Biological Exposure Index or Indices (see BEI® section), see BEI® for Polycyclic Aromatic Hydrocarbons (PAHs) Exposure by all routes should be carefully controlled to levels as low as possible. Suspected human carcinogen			
Benzo[a]pyrene	50-32-8	TWA	0.2 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.2 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	0.2 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	0.2 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants

Personal protective equipment

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection
Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection
Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection
Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	solid
Colour	no data available

Safety data

pH	no data available
Melting point/freezing point	Melting point/range: 177 - 180 °C (351 - 356 °F) - lit.
Boiling point	495 °C (923 °F) - lit.
Flash point	no data available
Ignition temperature	no data available
Autoignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	1.35 g/cm3
Water solubility	no data available
Partition coefficient: n-octanol/water	log Pow: 5.97
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability
Stable under recommended storage conditions.

Possibility of hazardous reactions
no data available

Conditions to avoid
no data available

Materials to avoid
Strong oxidizing agents

Hazardous decomposition products
Hazardous decomposition products formed under fire conditions. - Carbon oxides
Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50
no data available

Inhalation LC50
no data available

Dermal LD50
no data available

Other information on acute toxicity
LD50 Subcutaneous - rat - 50 mg/kg

Skin corrosion/irritation
Skin - mouse - Mild skin irritation

Serious eye damage/eye irritation
no data available

Respiratory or skin sensitization
Chronic exposure may cause dermatitis.

May cause sensitization by inhalation.

Germ cell mutagenicity
May alter genetic material.
In vivo tests showed mutagenic effects

Carcinogenicity

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

Possible human carcinogen

IARC:	1 - Group 1: Carcinogenic to humans (Benzo[a]pyrene)
NTP:	Reasonably anticipated to be human carcinogens. (Benzo[a]pyrene)
	Reasonably anticipated to be a human carcinogen (Benzo[a]pyrene)

Reproductive toxicity

May cause reproductive disorders.

Teratogenicity

May cause congenital malformation in the fetus.

Presumed human reproductive toxicant

Specific target organ toxicity - single exposure (Globally Harmonized System)
no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)
no data available

Aspiration hazard
no data available

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure
burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting

Synergistic effects
no data available

Additional Information
RTECS: DJ3675000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.25 mg/l - 48 h
Toxicity to algae	EC50 - Pseudokirchneriella subcapitata (green algae) - 0.02 mg/l - 72 h

Persistence and degradability
no data available

Bioaccumulative potential

Bioaccumulation	Lepomis macrochirus (Bluegill) - 48 h Bioconcentration factor (BCF): 3,208

Mobility in soil
no data available

PBT and vPvB assessment
no data available

Other adverse effects
An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Benzo[a]pyrene)
Reportable Quantity (RQ): 1 lbs
Marine pollutant: No
Poison Inhalation Hazard: No

IMDG
UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Benzo[a]pyrene)
Marine pollutant: No

IATA
UN number: 3077 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Benzo[a]pyrene)

Further information
EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

OSHA Hazards
Carcinogen, Respiratory sensitiser, Teratogen, Reproductive hazard, Mutagen

SARA 302 Components
SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

New Jersey Right To Know Components

	CAS-No.	Revision Date
Benzo[a]pyrene	50-32-8	2007-03-01

California Prop. 65 Components

	CAS-No.	Revision Date
WARNING! This product contains a chemical known to the State of California to cause cancer. Benzo[a]pyrene	50-32-8	1990-01-01

16. OTHER INFORMATION

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

SUPELCO

Supelco is a Member of the Sigma-Aldrich Family
Providing Chromatography Products for Analysis and Purification.

Material Safety Data Sheet

Date Printed: 12/06/2005
Date Updated: 10/28/2004

Section 1 - Product and Company Information

Catalog Number:	R430720 (Reorder Product by this No.)
Product Name:	BENZO (A) ANTHRACENE
Street Address:	595 North Harrison Road
City, State, Zip, Country:	Bellefonte, PA 16823-0048 USA
Fax (MSDS Dept.):	814-359-5930
Emergency Phone:	800-521-8956 EXT 2143
CHEMTREC:	800-424-9300

Section 2 - Composition/Information on Ingredient(s)

Substance Name:	BENZO(A)ANTHRACENE
CAS#:	56-55-3
SARA 313:	No

Ingredients:

Formula: $C18H12$

Chemical Name:
BENZ{A}ANTHRACENE

Synonym(s):
1,2-BENZANTHRACENE

RTECS Number: CV9275000

MSDS Dictionary:
CAS=Chemical Abstract Service; %=Percentage of Composition; TLV=Threshold Limit Value; SARA=Superfund Amendments and Reauthorization Act of 1986; TSCA=Toxic Substances Control Act; N/A=Not Available.

Section 3 - Hazards Identification

Emergency Overview:
Stable.
Reported mutagen.
Reported animal carcinogen.
Reported cancer hazard.
To the best of our knowledge, the chemical, physical, & toxicological properties have not been thoroughly investigated.
See Section 11 for toxicological data.

Section 4 - First Aid Measures

Oral Exposure:
Contact a physician.
Inhalation Exposure:
Immediately move to fresh air.
Contact a physician.
Give oxygen if breathing is labored.
If breathing stops, give artificial respiration.
Dermal Exposure:
Remove contaminated clothing and shoes.

Section 4 - First Aid Measures

Flush skin with large volumes of water.

Eye Exposure:

Flush eyes with water for 15 minutes.

Additional Information:

Contact a physician.

Section 5 - Fire Fighting Measures

Flammable Hazards:
Explosion Hazards:
Thermal Decomposition Components:

N/A

Extinguishing Media:

Suitable:

CO_2.
Foam.
Dry chemical.

Firefighting

Protective Equipment:

Wear self-contained breathing apparatus when fighting a chemical fire.

Specific Hazard(s):

	Value:	Method:
Flash Point (F):	N/A	
Autoignition Temperature:		
	Lower:	Upper:
Explosion Limits:	N/A	

Additional Information:

Section 6 - Accidental Release Measures

Procedure to be followed in case of Leak or Spill:

Ventilate area.
Sweep up material.
Avoid generating dust.

Procedure(s) of Personal Precaution(s):

Wear dust mask.
Avoid generating dust.
Avoid eye or skin contact.
Wear protective glasses.
Wear rubber gloves.

Methods for Cleaning Up:
Additional Information:

Section 7 - Handling and Storage

Handling

User Exposure:

Avoid generating dust.
Avoid eye or skin contact.

Storage

Suitable:

Keep away from oxidizers.
Store in sealed container in cool, dry location.

Additional Information:

Reported cancer hazard.

Section 8 - Exposure Controls/PPE

Engineering Controls:
Use only in well-ventilated area.
Personal Protective Equipment
Respiratory:
Hand:
Wear rubber gloves.
Eye:
Wear dust mask.
Wear protective glasses.
Additional Equipment:
General Hygiene Measures:
Avoid eye or skin contact.
Additional Information:

Section 9 - Physical and Chemical Properties

Appearance:
Colorless to liqht yellow crystals
Odor:

Molecular Weight:	228	
pH:		
	Value:	Method:
Boiling Point Range:	438° C	N/A
Melting Point Range:	157° C	
Vapor Pressure:	N/A	
Vapor Density:	N/A	
Volatile %:	N/A	
Specific Gravity/Density:	N/A	
Evaporation Rate:	N/A	
	Value:	Method:
Flash Point (F):	N/A	
	Lower:	Upper:
Explosion Limits:	N/A	
Solubility in Water:	N/A	
Refractive Index:		
Autoignition Temperature:		
Additional Information:		

N/A = Not Available

Section 10 - Stability and Reactivity

Stability:
Stable:
Stable.
Materials to Avoid:
Oxidizing agents.
Conditions to Avoid:
N/A
Hazardous Decomposition Products:
N/A
Hazardous Polymerization:
Will not occur.
Additional Information:

Section 11 - Toxicological Information

Route of Exposure
Skin Contact:
Skin Absorption:
Eye Contact:
Inhalation:
Ingestion:
Critical Effects:

Section 11 - Toxicological Information

Reported mutagen.
Reported animal carcinogen.
Additional Possible Effects:
Target Organ(s) or System(s):
Signs and Symptoms of Exposure:
Conditions Aggravated by Exposure:
Additional Information:
Reported cancer hazard.

Toxicity Data (LD50):	>200 mg/kg Limit	Intravenous Rat Range
TLV:	N/A	
PEL:	N/A	

Section 12 - Ecological Information

Ecotoxicity:
No Data Available.

Section 13 - Disposal Information

Appropriate Method of Disposal of Substance or Preparation:
Comply with all applicable federal, state, or local regulations.
Contact a licensed professional waste disposal service to dispose of this material.

Section 14 - Transport Information

DOT	
Proper Shipping Name:	N/A
UN#:	N/A
Class:	N/A
Packing Group:	N/A
Hazard Label:	N/A
PIH:	N/A
IATA	
Proper Shipping Name:	N/A
IATA UN Number:	N/A
Hazard Class:	N/A
Packing Group:	N/A
Hazard Label:	N/A
PIH:	N/A

Section 15 - Regulatory Information

EU Directives Classification
Symbol of Danger: T
Indication of Danger:
Toxic
Risk Statements: R: 45
May cause cancer.
Safety Statements: S: 45 53
In case of accident or if you feel unwell, seek medical advice immediately.
Avoid exposure - obtain special instructions before use.
US Classification and Label Text
Indication of Danger:
Risk Statements:
Safety Statements:
US Statements:
United States Regulatory Information
SARA Listed: No

Section 15 - Regulatory Information

Deminimis:
Notes:
Classified by IARC as a Class 2A carcinogen.
Classified by NTP as a Group B carcinogen.
TSCA Inventory Item: Yes
United States - State Regulatory Information
California Prop-65:
Contains material(s) known to the state of California to cause cancer.
Contains material(s) known to the state of California to cause cancer.
Canada Regulatory Information
WHMIS Classification:
Carcinogenicity (CPR 48).
Class D - Division 1 - Poisonous and infectious materials.
DSL:
NDSL:
Additional Information:
Reported cancer hazard.

Section 16 - Other Information

Disclaimer:
For R&D use only. Not for drug, household or other uses.
Warranty:
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Supelco, shall not be held liable for any damage resulting from handling or from contact with the above product. Copyright 2005 Supelco. License granted to make unlimited paper copies for internal use only.

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Schenectady, NY 12304-4690
(518) 377-8854

Material Safety Data Sheet Collection

Mercury **MSDS No. 26**

Date of Preparation: 1/77 Revision: D, 6/94

Section 1 - Chemical Product and Company Identification

Product/Chemical Name: Mercury
Chemical Formula: Hg
CAS No.: 7439-97-6
Synonyms: colloidal mercury, hydrargyrum, liquid silver, Quicksilver
Derivation: Obtained by roasting cinnabar (mercury sulfide) and purified by distillation, or as a by-product of gold mining.
General Use: Used in agricultural poisons, anti-fouling paint, dental amalgams, mining amalgamation (to remove gold and other metals from ore), thermometers, barometers, dry cell batteries, chlorine and caustic soda production, electrical apparatus, and as a neutron absorber in nuclear power plants.
Vendors: Consult the latest *Chemical Week Buyers' Guide.* [73]

Section 2 - Composition / Information on Ingredients

Mercury, ca 100 %wt

OSHA PEL
Ceiling: 0.1mg/m^3 (vapor and inorganic Hg)
8-hr TWA: 0.05 mg/m^3 (vapor), skin; (Vacated 1989 Final Rule Limit)

ACGIH TLVs
TWA: 0.025 mg/m^3 (inorganic compounds), skin

NIOSH REL
10-hr TWA: 0.05 mg/m^3 (vapor), skin

DFG (Germany) MAK
TWA: 0.01 ppm (0.1 mg/m^3)
Category III: Substances with systemic effects
Onset of Effect: > 2 hr
Half-life: > shift length (strongly cumulative)

Peak Exposure Limit:
0.1 ppm (1 mg/m^3), 30 min. average value, 1/shift

IDLH Level
28 mg/m^3

Section 3 - Hazards Identification

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Mercury exists as a heavy, odorless, silver-white liquid metal. It is highly toxic by both acute and chronic exposure. Exposure can cause corrosion of the eyes, skin, and respiratory tract and may result in irreversible nervous system damage. It readily forms amalgamations with most metals except iron.

Wilson Risk Scale
R 1
I 4
S 2*
K 1
*Skin absorption

HMIS
H 4*
F 0
R 0
*Chronic effects
PPE†
†Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, eye and skin contact/absorption.
Target Organs: Central nervous system, eyes, skin, respiratory system, liver, kidneys.
Acute Effects
Inhalation: Exposure to high vapor concentrations can cause severe respiratory damage. Other symptoms include wakefulness, muscle weakness, anorexia, headache, ringing in the ear, headache, diarrhea, liver changes, fever, gingivitis, chest pain, difficulty breathing, cough, inflammation of the mouth (stomatitis), salivation, bronchitis, and pneumonitis. Acrodynia (pink or Swifts disease), characterized by redness and peeling of the skin on the toes and fingers, was commonly seen in children in the 1950s and is still *infrequently* seen in workers.
Eye: Irritation and corrosion.
Skin: Skin can become severely irritated if allowed to remain in contact with mercury. Skin absorption will occur at 2.2% of the rate of absorption through the lungs.
Ingestion: Mercury generally passes through the digestive tract uneventfully. However, large amounts may get caught up in the intestine and require surgical removal. If an abscess or other perforation is present along the digestive tract, absorption into the blood stream with subsequent mercury poisoning is possible.
Carcinogenicity: IARC, NTP, and OSHA do not list mercury as a carcinogen.
Medical Conditions Aggravated by Long-Term Exposure: Central nervous system disorders.
Chronic Effects: Chronic exposure appears more common than acute and is primarily associated with central nervous system damage which can be permanent (ex. paresthesia of the hands, lips, feet). Early signs of toxicity include weakness, fatigue, anorexia, weight loss, and gastrointestinal disturbances. If exposure levels are high, characteristic tremors of the fingers, eyelids, and lips occur with progression to generalized tremors of the entire body. Psychic disorders are noticeable and characterized by behavior and personality changes, increased excitability, memory loss, insomnia, and depression. In severe cases, delirium and hallucinations may occur. Kidney damage is observed with oliguria (decreased urine output) progressing to anuria (urine cessation) and may require dialysis. The cornea and lens of the eyes may take on a brownish discoloration and the extraocular muscles may be damaged. This syndrome has been termed *Asthenic-Vegetative Syndrome* or *Micromercurialism.* Chronic symptoms occur increasingly with exposures to 0.1 mg/m^3 or higher. *Mutation:* Aneuploidy and other chromosomal aberrations

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have been observed in the lymphocytes from whole blood cultures in workers exposed to mercury. *Reproductive:* Mercury has been detected in stillborn babies of women treated with mercury for syphilis. In a study of six men acutely exposed (occupationally) to mercury levels as high as 44 mg/m^3, all suffered impaired sexual function. Repeated skin contact may cause allergic dermatitis in some individuals.

NOTE: Spilled mercury will release sufficient vapor over time to produce chronic poisoning.

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 with flooding amounts of water and then wash exposed area with soap. For reddened or blistered skin, consult a physician.

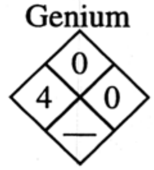
Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. In general, mercury will pass through the digestive tract uneventfully.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: BEI: *blood* (15 μg/L), *urine*: (35 μg/g creatinine). Extremely high urine levels of 0.5 to 0.85 mg Hg/L are indicative of polyneuropathy. 0.4 to 22 μg/L is reported to be the human lethal blood level. Obtain urinalysis including at a minimum: albumin, glucose, and a microscopic examination of centrifuged sediment. Use BAL or 2, 3-dimercaptosuccinic acid as chelators. *Do not* use calcium sodium EDTA because of nephrotoxicity. An electromyograph may determine extent of nerve dysfunction. It has been noted that exposure to mercury may predispose persons to development of carpal tunnel syndrome.

Section 5 - Fire-Fighting Measures

Genium



Flash Point: Nonflammable

Autoignition Temperature: Nonflammable

LEL: None reported.

UEL: None reported.

Extinguishing Media: Use agents suitable for surrounding fire.

Unusual Fire or Explosion Hazards: None reported.

Hazardous Combustion Products: Toxic mercury vapor and mercuric oxide.

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: Keep a mercury spill kit readily available in areas where mercury is used. Notify safety personnel, isolate and ventilate area, deny entry, and stay upwind.

Small and Large Spills: Follow instructions on mercury spill kit. Most kits come with an aspiration-driven vacuum trap with a mercury "sweeper" (copper or copper-plated brush). Wash spill area with a dilute calcium sulfide or nitric acid solution. If spill cannot be taken up readily, dust the top of the spill with flowers of sulfur or preferably, calcium polysulfide. This will produce a surface coating of mercury sulfide which will reduce mercury vapor dispersion into the air.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use appropriate PPE when working with mercury. *Do not* use on porous work surfaces (wood, unsealed concrete, etc.) to prevent spills from lodging in cracks.

Storage Requirements: Store in a cool, dry, well-ventilated area away from heat and incompatibles (Sec. 10). Store on non-porous floors and wash them regularly with a dilute calcium sulfide solution. Because mercury will form amalgamations with most metals except iron, metal shelves should be painted with a sufficiently thick coating to prevent this from happening.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Wherever possible, enclose processes to prevent mercury vapor dispersion into work area.

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 pre-placement and periodic medical exams of exposed workers with emphasis on the skin, eyes, central nervous system, liver, and kidneys.

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 ≤ 0.5 mg/m^3, use any chemical cartridge respirator with cartridges providing protection against mercury and equipped with an ESLI (end of service life indicator), any SCBA, or any SAR (supplied-air respirator). For ≤ 1.25 mg/m^3, use any SAR operated in continuous-flow mode, any PAPR (powered, air-purifying respirator) with an ESLI. For ≤ 2.5 mg/m^3, use any SCBA or SAR with a full facepiece, any SAR with a tight-fitting facepiece and operated in continuous-flow mode, or any chemical cartridge respirator with a full facepiece, chemical

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cartridges providing protection against mercury, and equipped with an ESLI. For ≤28 mg/m^3, use any SAR operated in pressure-demand or other positive-pressure mode. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA with full facepiece and operated in pressure-demand or other positive pressure mode. *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 made of butyl rubber, nitrile rubber, fluorocarbon rubber, neoprene rubber, polyvinyl chloride, chlorinated polyethylene, or polycarbonate 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: Liquid metal
Appearance and Odor: Silvery-white, odorless
Vapor Pressure: 0.0018 mm Hg at 77 °F (25 °C)
Formula Weight: 200.59
Density (H_2O=1): 13.534 g/cm^3 at 77 °F (25 °C)
Boiling Point: 674.09 °F (356.72 °C)
Freezing Point: -37.97 °F (-38.87 °C)
Viscosity: 15.5 mP at 77 °F (25 °C)
Electrical Resistivity: 95.76 μohm at 68 °F (20 °C)
Water Solubility: 0.28 μmol/L at 77 °F (25 °C)
Other Solubilities: Soluble in boiling sulfuric acid, nitric acid (reacts); slightly in lipids, and 2.7 mg/L in pentane. Insoluble in alcohol, ether, cold sulfuric acid, hydrogen bromide, and hydrogen iodide.
Surface Tension: 484 dyne/cm at 77 °F (25 °C)
Critical Temperature: 2664 °F (1462 °C)
Critical Pressure: 1587 atm

Section 10 - Stability and Reactivity

Stability: Mercury does not tarnish at ordinary temperatures but when heated to near its boiling point, it slowly oxidizes to mercuric oxide.

Polymerization: Hazardous polymerization does not occur.

Chemical Incompatibilities: Mercury forms alloys (amalgamates) with most metals except iron. It is incompatible with oxidizers such as bromine, 3-bromopropyne, methylsilane + oxygen, chlorine, chlorine dioxide, nitric acid, or peroxyformic acid; tetracarbonyl nickel + oxygen, alkynes + silver perchlorate, ethylene oxide, acetylenic compounds (explosive), ammonia (explosive), boron phosphodiiodide, methyl azide, nitromethane, and ground sodium carbide.

Conditions to Avoid: Exposure to high temperatures, metal surfaces or incompatibles.

Hazardous Decomposition Products: Thermal oxidative decomposition of mercury can produce mercuric oxide.

Section 11- Toxicological Information

Toxicity Data:*

Reproductive:
Rat, inhalation: 890 ng/m^3/24 hr for 16 weeks prior to mating had an effect on spermatogenesis.

Acute Dermal Toxicity:
Man, skin, TD_{Lo}: 129 mg/kg for 5 continuous hours caused ringing in the ears, headache, and allergic dermatitis.

Acute Oral Toxicity:
Man, oral, TD_{Lo}: 43 mg/kg caused tremor and jaundice or other liver changes.

Acute Inhalation Effects:
Woman, inhalation, TC_{Lo}: 150 $\mu g/m^3$/46 days caused anorexia, diarrhea, and wakefulness.
Man, inhalation, TC_{Lo}: 44300 $\mu g/m^3$/8 hr caused muscle weakness, liver changes, and increased body temperature.

Chronic Effects:
Rat, inhalation: 1 mg/m^3/ 24 hr for 5 continuous weeks caused proteinuria.

* See NIOSH, *RTECS* (OV4550000), for additional toxicity data.

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Section 12 - Ecological Information

Ecotoxicity: Catfish, LC_{50} = 0.35 mg/L/96 hr; mollusk (*Modiolus carvalhoi*), LC_{50} = 0.19 ppm/96 hr: tadpole (*Rana hexadactyla*), LC_{50} = 0.051 ppm/96 hr. Mercury is transformed to methyl mercury by bacteria in the environment and undergoes bioaccumulation readily. BCF for freshwater fish = 63,000; for saltwater fish = 10,000; and for marine and freshwater invertebrates = 100,000.

Environmental Degradation: Mercury is expected to volatilize rapidly when deposited on soil surfaces. Once in the air, it can be transported long distances before being redeposited on soil or in water. In water, mercury appears to bind to particulates where it eventually becomes deposited on the bed sediment. In general, mercury entering the environment can be deposited and revolatilized several times.

Section 13 - Disposal Considerations

Disposal: Incineration is *not* an appropriate disposal method. Wastewater may be treated by addition of chlorine to oxidize the mercury to its ionic state. The water can then be passed through an absorbent (an activated charcoal concentrate with a sulfur coating or peanut shell charcoal) to collect the ionic mercury, followed by distillation to recover the mercury. Sodium borohydride, a reducing agent, can be used to precipitate mercury from waste solutions. Bioremediation, using *Pseudomonas putida*, has also been suggested. 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: Mercury
Shipping Symbols: A, W
Hazard Class: 8
ID No.: UN2809
Packing Group: III
Label: Corrosive
Special Provisions (172.102): –

Packaging Authorizations
a) Exceptions: 173.164
b) Non-bulk Packaging: 173.164
c) Bulk Packaging: 173.240

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 35 kg
b) Cargo Aircraft Only: 35 kg

Vessel Stowage Requirements
a) Vessel Stowage: B
b) Other: 40, 97

Section 15 - Regulatory Information

EPA Regulations:
Listed as a RCRA Hazardous Waste (40 CFR 261.33): U151
Listed as a CERCLA Hazardous Substance (40 CFR 302.4) per RCRA, Sec. 3001; CWA, Sec. 307(a), CAA, Sec. 112
CERCLA Reportable Quantity (RQ), 1 lb (0.454 kg)
SARA 311/312 Codes: 1, 2
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, 148, 149, 159, 167, 176, 187, 189

Prepared By .... M Gannon, BA
Industrial Hygiene Review .... RE Langford, PhD, CIH
Medical Review .... T Thoburn, MD, MPH

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Material Safety Data Sheets Collection:

Sheet No. 713
Lead (Inorganic)

Issued: 8/90

Section 1. Material Identification

32

Lead (Inorganic) (Pb) Description: Exists widely throughout the world in a number of ores. Its main commercial source is galena (lead sulphide). Lead mineral is separated from crude ores by blast-furnace smelting, drossing, or electrolytic refining. Lead is used mostly in manufacturing storage batteries. Other uses are in manufacturing tetraethyllead and both organic and inorganic lead compounds in ceramics, plastics, and electronic devices; in producing ammunition, solder, cable covering, sheet lead, and other metal products (brass, pipes, caulking); in metallurgy; in weights and as ballast; as a chemical intermediate for lead alkyls and pigments; as a constuction material for the tank linings, piping, and equipment used to handle the corrosive gases and liquids used in sulfuric acid manufacturing, petroleum refining, halogenation, sulfonation, extraction, and condensation; and for x-ray and atomic radiation protection.
Other Designations: CAS No. 7439-92-1, lead oxide; lead salts, inorganic; metallic lead; plumbum.
Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*(73) for a suppliers list.

R	0
I	4
S	-
K	0

Genium: 1, 3, 0, -

HMIS	
H	3
F	1
R	0
PPG*	

* Sec. 8

Cautions: *Inorganic lead is a potent systemic poison.* Organic lead (for example, tetraethyl lead) has severe, but different, health effects. Occupational lead poisoning is due to inhalation of dust and fumes. Major affected organ systems are the nervous, blood, and reproductive systems, and kidneys. Health impairment or disease may result from a severe acute short- or long-term exposure.

Section 2. Ingredients and Occupational Exposure Limits

Lead (inorganic) fumes and dusts, as Pb, ca 100%

1989 OSHA PELs (Lead, inorganic compounds)
8-hr TWA: 50 μg/m³
Action Level TWA*: 30 μg/m³

29 CFR 1910.1025 Lead Standard
Blood Lead Level: 40 μg/100 g

1989-90 ACGIH TLV (Lead, inorganic, fumes and dusts)
TLV-TWA: 150 μg/m³

1988 NIOSH REL
10-hr TWA: <100 μg/m³

1985-86 Toxicity Data†
Human, inhalation, TC_{Lo}: 10 μg/m³ affects gastrointestinal tract and liver
Human, oral, TD_{Lo}: 450 mg/kg ingested over 6 yr affects peripheral and central nervous systems
Rat, oral, TD_{Lo}: 790 mg/kg affects multigeneration reproduction

* Action level applies to employee exposure without regard to respirator use.
† See NIOSH, *RTECS* (OF7525000), for additional mutative, reproductive, and toxicity data.

Section 3. Physical Data

Boiling Point: 3164 °F (1740 °C)
Melting Point: 621.3 °F (327.4 °C)
Vapor Pressure: 1.77 mm Hg at 1832 °F (1000 °C)
Viscosity: 3.2 cp at 621.3 °F (327.4 °C)
Molecular Weight: 207.20
Specific Gravity (20 °C/4 °C): 11.34
Water Solubility: Relatively insoluble in hot or cold water*

Appearance and Odor: Bluish-white, silvery, gray, very soft metal.

* Lead dissolves more easily at a low pH.

Section 4. Fire and Explosion Data

Flash Point: None reported	**Autoignition Temperature:** None reported	**LEL:** None reported	**UEL:** None reported

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, or foam to extinguish fire.
Unusual Fire or Explosion Hazards: Flammable and moderately explosive in the form of dust when exposed to heat or flame.
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. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Lead is stable at room temperature in closed containers under normal storage and handling conditions. It tarnishes on exposure to air. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Mixtures of hydrogen peroxide + trioxane explode on contact with lead. Lead is incompatible with sodium azide, zirconium, disodium acetylide, and oxidants. A violent reaction on ignition may occur with concentrated hydrogen peroxide, chlorine trifluoride, sodium acetylide (with powdered lead), ammonium nitrate (below 200 °C with powdered lead). Lead is attacked by pure water and weak organic acids in the presence of oxygen. Lead is resistant to tap water, hydrofluoric acid, brine, and solvents.
Conditions to Avoid: Rubber gloves containing lead may ignite in nitric acid.
Hazardous Products of Decomposition: Thermal oxidative decomposition of lead can produce highly toxic fumes of lead.

Section 6. Health Hazard Data

Carcinogenicity: Although the NTP and OSHA do not list lead as a carcinogen, the IARC lists it as probably carcinogenic to humans, but having (usually) no human evidence. However, the literature reports instances of lead-induced neoplasms, both benign and malignant, of the kidney and other organs in laboratory rodents. Excessive exposure to lead has resulted in neurologic disorders in infants. Experimental studies show lead has reproductive and teratogenic effects in laboratory animals. Human male and female reproductive effects are also documented.
Summary of Risks: Lead is a potent, systemic poison that affect a variety of organ systems, including the nervous system, kidneys, reproductive system, blood formation, and gastrointestinal (GI) system. The most important way lead enters the body is through inhalation, but it can also be ingested when lead dust or unwashed hands contaminate food, drink, or cigarettes. Much of ingested lead passes through feces without absorption into the body. Adults may absorb only 5 to 15% of ingested lead; children may absorb a much larger fraction. Once in the body, lead enters the bloodstream and circulates to various organs. Lead concentrates and remains in bone for many years. The amount of lead the body stores increases as exposure continues, with possibly cumulative effects. Depending on the dose entering the body, lead can be deadly within several days or affect health after many years. Very high doses can cause brain damage (encephalopathy).
Medical Conditions Aggravated by Exposure: Lead may aggravate nervous system disorders (e.g., epilepsy, neuropathies), kidney diseases, high blood pressure (hypertension), infertility, and anemia. Lead-induced anemia and its effect on blood presssure can aggravate cardiovascular disease.

Continue on next page

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Section 6. Health Hazard Data, *continued*

Target Organs: Blood, central and peripheral nervous systems, kidneys, and gastrointestinal (GI) tract.
Primary Entry Routes: Inhalation, ingestion.
Acute Effects: An acute, short-term dose of lead could cause acute encephalopathy with seizures, coma, and death. However, short-term exposures of this magnitude are rare. Reversible kidney damage can occur from acute exposure, as well as anemia.
Chronic Effects: Symptoms of chronic long-term overexposure include appetite loss, nausea, metallic taste in the mouth, lead line on gingival (gum) tissue, constipation, anxiety, anemia, pallor of the face and the eye grounds, excessive tiredness, weakness, insomnia, headache, nervous irritability, fine tremors, numbness, muscle and joint pain, and colic accompanied by severe abdominal pain. Paralysis of wrist and, less often, ankle extensor muscles may occur after years of increased lead absorption. Kidney disease may also result from chronic overexposure, but few, if any, symptoms appear until severe kidney damage has occurred. Reproductive damage is characterized by decreased sex drive, impotence, and sterility in men; and decreased fertility, abnormal menstrual cycles, and miscarriages in women. Unborn children may suffer neurologic damage or developmental problems due to excessive lead exposure in pregnant women. Lead poisoning's severest result is encephalopathy manifested by severe headache, convulsions, coma, delirium, and possibly death.
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. Consult a physician if any health complaints develop.
Inhalation: Remove exposed person to fresh air and support breathing as needed. Consult a physician.
Ingestion: Never give anything by mouth to an unconscious or convulsing person. If large amounts of lead were ingested, induce vomiting with Ipecac syrup. Consult a physician immediately.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: For diagnosis, obtain blood pressure, blood lead level (PbB), zinc protoporphyrin (ZPP), complete blood count for microcytic anemia and basophilic stippling, urinalysis, and blood urea nitrogen (BUN) of creatinine. Examine peripheral motor neuropathy, pallor, and gingival lead line. Use Ca-EDTA to treat poison, but *never* chelate prophylactically. Consult an occupational physician or toxicologist.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel and evacuate all unnecessary personnel immediately. Cleanup personnel should protect against inhalation of dusts or fume and contact with skin or eyes. Avoid creating dusty conditions. Water sprays may be used in large quantities to prevent the formation of dust. Cleanup methods such as vacuuming (with an appropriate filter) or wet mopping minimizes dust dispersion. Scoop the spilled material into closed containers 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, Appendix II—EP Toxicity Test Procedures)
Listed as a CERCLA Hazardous Substance* (40 CFR 302.4), Reportable Quantity (RQ): 1 lb (0.454 kg) [* 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).
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. Protective clothing made of man-made fibers and lacking turn-ups, pleats, or pockets retain less dust from lead.
Ventilation: Provide general and local 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: 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 washing hands 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 incompatible materials, direct sunlight, and heat and ignition sources.
Engineering Controls: Educate worker about lead's hazards. Follow and inform employees of the lead standard (29 CFR 1910.1025). Avoid inhalation of lead dust and fumes and ingestion of lead. Use only with appropriate personal protective gear and adequate ventilation. Institute a respiratory protection program that includes regular training, maintenance, inspection, and evaluation. Avoid creating dusty conditions. Segregate and launder contaminated clothing. Take precautions to protect laundry personnel. Practice good personal hygiene and housekeeping procedures. For a variety of reasons, the lead concentration in workroom air may not correlate with the blood lead levels in individuals.
Other Precautions: Provide preplacement and periodic medical examinations which emphasize blood, nervous system, gastrointestinal tract, and kidneys, including a complete blood count and urinalysis. Receive a complete history including previous surgeries and hospitalization, allergies, smoking history, alcohol consumption, proprietary drug intake, and occupational and nonoccupational lead exposure. Maintain records for medical surveillance, airborne exposure monitoring, employee complaints, and physician's written opinions for at least 40 years or duration of employment plus 20 years. Measurement of blood lead level (PbB) and zinc protoporphyrin (ZPP) are useful indicators of your body's lead absorption level. Maintain worker PbBs at or below 40 μg/100 g of whole blood. To minimize adverse reproductive health effects to parents and developing fetus, maintain the PbBs of workers intending to have children below 30 μg/100 g. Elevated PbBs increase your risk of disease, and the longer you have elevated PbBs, the greater your chance of substantial permanent damage.

Transportation Data (49 CFR 172.102)
IMO Shipping Name: Lead compounds, soluble, n.o.s.
IMO Hazard Class: 6.1
ID No.: UN2291
IMO Label: St. Andrews Cross (**X**, Stow away from foodstuffs)
IMDG Packaging Group: III

MSDS Collection **References:** 26, 38, 73, 84, 85, 88, 89, 90, 100, 101, 103, 109, 124, 126, 132, 133, 134, 136, 138, 139, 142, 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. 296
Arsenic and Compounds

Issued: 4/90

Section 1. Material Identification

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Arsenic Description: Obtained from flue dust of copper and lead smelters as white arsenic (arsenic trioxide). Reduction with charcoal and sublimation in an N_2 current yields pure arsenic. Metallic arsenic is used for hardening copper, lead, and alloys; as a doping agent in germanium and silicon solid-state products, special solders, and medicine; and to make gallium arsenide for dipoles and other electronic devices. Arsenic compounds are used in manufacturing certain types of glass; in textile printing, tanning, taxidermy, pharmaceuticals, insecticides and fungicides, pigment production, and antifouling paints; and to control sludge formation in lubricating oils. Arsenic trioxide is the source for 97% of all arsenic products.

Other Designations: CAS No. 7440-38-2; arsen; arsenic black; As; gray arsenic; metallic arsenic.

Manufacturer: Contact your supplier or distributor. Consult the latest *Chemicalweek Buyers' Guide*[73] for a suppliers list.

R 1
I 4
S 2
K 0

Genium
3
3 2
-

HMIS
H 3
F 2
R 2
PPG*
* Sec. 8

Section 2. Ingredients and Occupational Exposure Limits

Arsenic and soluble compounds, as As

OSHA PEL
8-hr TWA: 0.5 mg/m³,* 0.01 mg/m³†

ACGIH TLV, 1989-90
TLV-TWA: 0.2 mg/m³

NIOSH REL, 1987
Ceiling: 0.002 mg/m³

Toxicity Data‡
Man, oral, TD_{Lo}: 76 mg/kg administered intermittently over a 12-year period affects the liver (tumors) and blood (hemorrhage)
Man, oral: 7857 mg/kg administered over 55 years produces gastrointestinal (in the structure or function of the esophagus), blood (hemorrhage), and skin and appendage (dermatitis) changes
Rat, oral, TC_{Lo}: 605 µg/kg administered to a 35-week pregnant rat affects fertility (pre- and post-implantation mortality)

* Organic compounds.
† Inorganic compounds.
‡ See NIOSH, *RTECS* (CG0525000), for additional mutative, reproductive, tumorigenic, and toxicity data.

Section 3. Physical Data*

Boiling Point: sublimes at 1134 °F/612 °C
Melting Point: 1497 °F/814 °C
Vapor Pressure: 1 mm at 702 °F/372 °C (sublimes)

Atomic Weight: 74.92
Density: 5.724 at 57 °F/14 °C
Water Solubility: Insoluble†

Appearance and Odor: A brittle, crystalline, silvery to black metalloid. Odorless.

* This data pertains to arsenic only.
† Arsenic is soluble in nitric acid (HNO_3).

Section 4. Fire and Explosion Data

Flash Point: None reported	**Autoignition Temperature:** None reported	**LEL:** None reported	**UEL:** None reported

Extinguishing Media: Use dry chemical, CO_2, water spray, or foam to fight fires.
Unusual Fire or Explosion Hazards: Flammable and slightly explosive in the form of dust when exposed to heat or flame.
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. Be aware of runoff from fire control methods. Do not release to sewers or waterways.

Section 5. Reactivity Data

Stability/Polymerization: Arsenic is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur.
Chemical Incompatibilities: Arsenic can react vigorously on contact with powerful oxidizers such as bromates, peroxides, chlorates, iodates, lithium, silver nitrate, potassium nitrate, potassium permanganate, and chromium (VI) oxide. This material is also incompatible with halogens, bromine azide, palladium, dirubidium acetylide, zinc, and platinum.
Hazardous Products of Decomposition: Thermal oxidative decomposition of arsenic and its compounds produces irritating or poisonous gases.

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Section 6. Health Hazard Data

Carcinogenicity: The IARC, NTP, and OSHA list arsenic as a human carcinogen (Group 1). This evaluation applies to arsenic and arsenic compounds as a whole, and not necessarily to all individual chemicals within the group. Studies report that both the trivalent and pentavalent compounds are strongly implicated as causes of skin, lung, and lymphatic cancers. Experimental studies have shown that arsenic has tumorigenic and teratogenic effects in laboratory animals.
Summary of Risks: Arsenic compounds are irritants of the skin, mucous membranes, and eyes. The moist mucous membranes are most sensitive to irritation. Prolonged contact results in local hyperemia (blood congestion) and later vesicular or pustular eruption. Epidermal carcinoma is a reported risk of exposure. Peripheral neuropathy (degenerative state of the nervous system) is common after acute or chronic arsenic poisoning. Symptoms include decreased sensation to touch, pinprick, and temperature; loss of vibration sense; and profound muscle weakness and wasting. Other complications of acute and chronic arsenic poisoning are encephalopathy (alterations of brain structure) and toxic delirium.
Medical Conditions Aggravated by Long-Term Exposure: Damage to the liver, nervous, and hematopoietic (responsible for the formation of blood or blood cells in the body) system may be permanent. Pulmonary and lymphatic cancer may also occur.
Target Organs: Liver, kidneys, skin, lungs, lymphatic system.
Primary Entry Routes: Inhalation, ingestion of dust and fumes, via skin absorption.
Acute Effects: Acute industrial intoxication is more likely to arise from inhalation of arsine. However, with corrosive arsenical vapors, conjunctivitis, eyelid edema, and even corneal erosion may result. Inhalation may result in nasal irritation with perforation of the septum, cough, chest pain, hoarseness, pharyngitis, and inflammation of the mouth. If ingested, metallic or garlic taste, intense thirst, nausea, vomiting, abdominal pain, diarrhea, and cardiovascular arrhythmias (heartbeat irregularities) may occur. Symptoms generally occur within 30 minutes, but may be delayed for several hours if ingested with food. Acute poisoning may result in acute hemolysis (breakdown of red blood cells).
Chronic Effects: Chronic symptoms include weight loss, hair loss, nausea, and diarrhea alternating with constipation, palmar and plantar hyperkeratoses (thickening of the corneous layer of skin on palms and soles of feet), and skin eruptions, and peripheral neuritis (inflammation of the nerves). Leukemia, bone marrow depression, or aplastic anemia (dysfunctioning of blood-forming organs) may occur after chronic exposure.

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 water, then induce repeated vomiting until vomit is clear.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Physician's Note: If emesis is unsuccessful after two doses of Ipecac, consider gastric lavage. Monitor urine arsenic level. Alkalinization of urine may help prevent disposition of red cell breakdown products in renal tubular cells. If acute exposure is significant, maintain high urine output and monitor volume status, preferably with central venous pressure line. Abdominal X-rays should be done routinely for all ingestions. Chelation therapy with BAL, followed by n-penicillamine is recommended, but specific dosing guidelines are not clearly established.

Section 7. Spill, Leak, and Disposal Procedures

Spill/Leak: Notify safety personnel of spill, evacuate all unnecessary personnel, remove all heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against dust inhalation and contact with skin and eyes. Use nonsparking tools. With a clean shovel scoop material into a clean, dry container and cover. Absorb liquid material with sand or noncombustible inert material and place in disposal containers. Do not release to sewers, drains, or waterways. 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): 1 lb (0.454 kg) [† per Clean Water Act, Sec. 307(a); per Clean Air Act, Sec. 112]
SARA Extremely Hazardous Substance (40 CFR 355): Not listed
Listed as a SARA Toxic Chemical (40 CFR 372.65)

OSHA Designations‡
Air Contaminant (29 CFR 1910.1000, Subpart Z): Not listed

* Designations for arsenic only.
‡ Listed as arsenic organic compounds (as As).

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 PELs, ACGIH TLVs, and NIOSH REL (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, properly labeled, containers in a cool, well-ventilated area away from all incompatible materials (Sec. 5) and heat and ignition sources. Protect containers from physical damage.
Engineering Controls: Avoid inhalation or ingestion of dust and fumes, and skin or eye contact. Practice good personal hygiene and housekeeping procedures. Use only with adequate ventilation and appropriate personal protective gear. Institute a respiratory protection program with training, maintenance, inspection, and evaluation. All engineering systems should be of maximum explosion-proof design and electrically grounded and bonded. Provide preplacement and annual physical examination with emphasis on the skin, respiratory system, and blood.

Transportation Data (49 CFR 172.101, .102)

DOT Shipping Name: Arsenic, solid
DOT Hazard Class: Poison B
ID No.: UN1558
DOT Label: Poison
DOT Packaging Requirements: 173.366
DOT Packaging Exceptions: 173.364

IMO Shipping Name: Arsenic, metallic
IMO Hazard Class: 6.1
IMO Label: Poison
IMDG Packaging Group: II
ID No.: UN1558

MSDS Collection **References:** 7, 26, 38, 53, 73, 85, 87, 88, 89, 100, 103, 109, 123, 124, 126, 127, 130, 136, 138
Prepared by: MJ Allison, BS; **Industrial Hygiene Review:** DJ Wilson, CIH; **Medical Review:** MJ Hardies, MD M4

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APPENDIX E

COMMUNITY AIR MONITORING PLAN (CAMP)

APPENDIX E
Community Air Monitoring Plan (CAMP)

A. Introduction

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection because the staff are covered by project-specific health and safety plans. Rather, its intent is to provide a measure of protection for the downwind community from potential airborne contaminant releases as a direct result of investigative and remedial work activities. Since the former Roth Steel site is vacant, potential receptors are off-site commercial workers and their customers. 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 did not spread contamination off-site through the air.

B. Proposed Monitoring

Based on an extensive environmental sampling database, elevated VOCs have not been detected in site soil. To be conservative, VOC monitoring will still be performed for certain activities. Site investigation activities subject to this CAMP include drilling, soil sampling and groundwater sampling.

Continuous VOC monitoring will be done during the installation of soil borings or monitoring wells, which are minimally invasive activities.

Periodic VOC monitoring **w**ill also be performed during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. Periodic monitoring during sample collection will consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location.

C. VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) will be monitored at the immediate work area on a continuous basis while drilling is ongoing. The monitoring work will be performed using a hand-held PID meter, properly calibrated in accordance with instrument requirements. The equipment will be calibrated at least daily using an appropriate surrogate. The equipment will be capable of providing real-time instantaneous readings and calculating 15-minute running average concentrations, which will be compared to the levels specified below.

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

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

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

4. All 15-minute readings will be recorded and be available for NYSDEC and NYSDOH personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.

D. Particulate Monitoring, Response Levels, and Actions

The remedial investigation drilling activities will be primarily accomplished with a Geoprobe rig which is the least intrusive drilling method. Two shallow monitoring wells, each about 15 ft. deep, will be drilled with a small hollow-stem auger rig. Since these activities will not generate significant dust, particulate monitoring will utilize visual observations.

During drilling activities and movement of the drill rig around the site, visual monitoring will be performed by the oversight staff. As necessary, the following techniques will be utilized for controlling the generation and migration of dust during drilling activities:

a) Applying water on access roads near the site perimeter that could generate dust;

b) Restricting vehicle speeds to 10 mph; and

c) Cleaning/removing excess dirt from heavy-equipment tires before leaving the site.

The evaluation of weather conditions will also be considered for fugitive dust control. When extreme wind conditions make dust control ineffective, drilling may need to be suspended.

E. Particulate Action/Response

1. If dust is observed leaving the site perimeter or fence line and into public areas, then dust controls must be implemented.

2. If dust controls fail to prevent visible dust emissions from leaving the site, then **STOP** work.

3. Review, evaluate, and implement additional techniques or controls.

4. Notify the Project Manager.

5. Re-start work when additional dust control measures have been implemented.