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Operation, Maintenance and Monitoring Plan

M. Wallace and Son, Inc.
Scrapyard Site
Cobleskill, New York

nationalgrid

Syracuse, New York

Revised
January 2007

REPORT

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1. Introduction

1.1 General

This *Operation, Maintenance and Monitoring Plan* (OM&M Plan) presents a description of the activities required to monitor and maintain the remedial activities conducted for the M. Wallace and Son, Inc. Scrapyard Site (Site) located in Cobleskill, New York (Figure 1). This OM&M Plan has been prepared as part of the New York State Department of Environmental Conservation- (NYSDEC-) selected remedy presented in the Record of Decision (ROD) for the Site dated March 1999, which was amended by an Explanation of Significant Difference (ESD) issued by the NYSDEC in May 2000. The remedial construction activities associated with the NYSDEC-selected remedy were completed in 2001/2002 by National Grid as documented in the June 2003 *Remedial Action Report* (RA Report) that was approved by the NYSDEC in a letter dated November 4, 2003. This OM&M Plan has been prepared by ARCADIS BBL on behalf of National Grid.

This OM&M Plan was originally submitted to the NYSDEC during June 2004. NYSDEC provided comments on the June 2004 OM&M Plan to National Grid in a letter dated February 22, 2006. National Grid's response to the NYSDEC's February 22, 2006 letter was provided in a letter to the NYSDEC dated June 26, 2006. The NYSDOL provided comments to National Grid's June 26, 2006 letter in an e-mail dated October 17, 2006, which outlined changes to the June 2004 OM&M Plan that would be required prior to NYSDEC approval. Subsequently, on November 30, 2006, National Grid was provided an internal NYSDEC memorandum dated November 1, 2006 which identified proposed revised language regarding biota monitoring to be incorporated into the revised OM&M Plan. This revised OM&M Plan incorporates the comments provided in correspondence with the State agencies between February and November 2006.

This OM&M Plan addresses only those portions of the Site that are not part of the active scrapyard for M. Wallace and Son, Inc. (Wallace) operations. The active scrapyard includes the wood frame barn, concrete and metal building, and leachfield area (located south of the concrete and metal building), as well as a portion of the northwestern corner of the Site covered with crusher run (see Figure 2). The NYSDEC's decision granting Wallace use of the northwestern portion of the Site for scrapyard operations was presented in a February 13, 2004 letter, a copy of which is provided as Attachment 1.

At the request of the State of New York Office of the Attorney General and on behalf of Wallace, National Grid prepared and submitted *Maintenance and Monitoring Plan for the Northwest Portion of the M. Wallace and Son, Inc. Scrapyard Site* (NW Plan) (BBL, February 2006) to the NYSDEC. The NYSDEC approved the NW Plan in an April 14, 2006 letter to National Grid (Attachment 6). The NW Plan describes the activities required to monitor and maintain the site remedy for the northwest portion of the site. Compliance with the NW Plan is solely Wallace's responsibility and subject to NYSDEC oversight and approval.

In anticipation of Wallace's reuse of the northwest portion of the Site, as approved by the NYSDEC, National Grid installed a new chain-link fence and two gates to delineate the northwest portion. The proposed location of this new fence was presented in the OM&M Plan and subsequently agreed upon during an August 10, 2005 Site meeting attended by National Grid, Wallace, and ARCADIS BBL. The northwest portion of Site was fenced by National Grid during late August 2005, thereby separating the active scrapyard from the remainder of the Site (Figure 2). There are two common areas within the active scrapyard to provide National Grid with access to conduct NYSDEC-required OM&M activities, including those associated with the onsite quarry pond water treatment systems and light-nonaqueous phase liquid (LNAPL) recovery systems. The common areas are shown on Figure 2. National Grid maintains responsibility for the OM&M requirements associated with the remainder of Site, as detailed herein.

This OM&M Plan has been organized into the following sections:

Section	Description
Section 1 - Introduction	Provides Site background information relevant to the OM&M activities for the Site.
Section 2 - Light Non-aqueous Phase Liquid (LNAPL) Remedial Action Components	Describes the operation of the automatic LNAPL recovery systems.
Section 3 - Operation and Maintenance Activities	Identifies the operation and maintenance activities associated with the Site remedy, including the LNAPL recovery systems, the RPZ backflow prevention device, and the vegetative soil cover.
Section 4 - Monitoring Activities	Provides a description of the monitoring activities to be conducted.
Section 5 - Reporting	Provides a description of the reporting activities to be conducted.
Section 6 - Project Contact List	Presents a list of key project management personnel.
Section 7 - References	Presents a list of references cited in this OM&M Plan.

This OM&M Plan is supported by a *Field Sampling Plan* (FSP), *Quality Assurance Project Plan* (QAPP), and *Health and Safety Plan* (HASP) provided as Appendix A, Appendix B and Appendix C, respectively.

1.2 Background Information

1.2.1 Site Location and Description

The Site is located at the intersection of New York State Route 10 (Elm Street) and Settles Mountain Road (formerly West Street) in the Village of Cobleskill, Schoharie County, New York. The portion of the Wallace property located north of Route 10 is the “Site” and encompasses an area of approximately 6 acres. The Site is bordered by Settles Mountain Road to the west; Route 10 to the south; several apartments and residential housing to the east; and a high school athletic field to the north. A Site plan showing the location of features at the Site and the Site boundaries is presented on Figure 2.

1.2.2 Site History

M. Wallace and Son, Inc. (Wallace Scrapyard) is an active salvage business that recovers and resells mechanical parts and materials from various equipment and other items. During the 1950s through the early 1980s, electrical transformers were purchased by the Site operator and transported to the scrapyard. The transformers were disassembled within the electrical equipment gut area to recover copper components, which were then resold. During these scrapping operations, dielectric fluid, some of which contained polychlorinated biphenyls (PCBs) was released to the ground surface.

In June 1983, personnel from NYSDEC Bureau of Enforcement and Criminal Investigation (BECI) collected samples of soil in the electrical equipment gut area, sediment and water from the quarry pond, and sediment from the quarry pond outlet channel. The analytical results of the samples collected by BECI indicated that

PCBs were present in soil, sediment, and surface water at the Site. In response to BECI's investigation, Schoharie County Department of Health (SCDH) sampled eight residential water supply wells near the Site. Results of this groundwater sampling indicated that purgeable aromatics, purgeable hydrocarbons, and PCBs were not detected in residential water supplies sampled.

Due to the presence of PCBs at the Site, as identified by BECI's sampling, the Site was listed by the NYSDEC as a Class 2 Inactive Hazardous Waste Site (Site No. 4-48-003). In response to a lawsuit filed by the State of New York Attorney General, National Grid and M. Wallace and Son, Inc., entered into an Interim Consent Order (Case No. 85-CV-219) in December 1987 to address the presence of PCBs and other chemical constituents in environmental media at the Site.

In accordance with the Interim Consent Order, O'Brien & Gere, Inc. performed an initial Site investigation of soil, sediment, surface water and groundwater at the Site between 1987 and 1990. Based on the results of the initial Site investigation, National Grid implemented various interim remedial measures (IRMs) between the summer of 1991 and the spring of 1993, which included the following:

- Excavated and disposed offsite approximately 2,900 cubic yards (cy) of soil from the electrical equipment gut area;

- Removed and disposed offsite sediment from the quarry pond outlet channel;

- Performed a reconnaissance of the quarry pond sediments and removal of debris from the bottom of the pond;
- Cleaned and disposed or relocated scrap metal and debris from both the ground surface and the quarry pond;

- Installed a perimeter fence to restrict access to the Site and a silt fence to control migration of surface soil; and

- Initiated a bi-weekly LNAPL monitoring and recovery program in June 1993 at monitoring well locations where LNAPL had been observed. This program consists of determining the absence or presence of LNAPL in select onsite monitoring wells, measuring the depth to LNAPL and/or groundwater, determining the LNAPL thickness (where present), and removing with dedicated bailers, to the extent practicable, the LNAPL encountered. Monthly measurements of water surface elevations at all accessible monitoring wells were collected as part of this program.

A temporary 400 gallon-per-minute (gpm) water treatment system was installed in December 1992 to drain the quarry pond to facilitate removal of debris from the bottom of the quarry pond (one of the above-listed IRMs). Subsequently, New York State Department of Law (NYSDOL) and the NYSDEC required National Grid to continue operation of the quarry pond water treatment system to prevent discharge of quarry pond water containing PCBs in excess of 0.065 parts per billion (ppb) into the offsite stormwater drainage system until a final remedy for the Site is implemented. In March 1994, the temporary 400 gpm water treatment system was replaced with a permanent 100 gpm water treatment system, housed in a prefabricated building with concrete foundation located in the southwest corner of the property, to fulfill the NYSDOL and the NYSDEC's long-term treatment requirement. A temporary 300 gpm water treatment system, that is trailer mounted and housed in a sprung structure located in the lower section of the Site, was installed in March 1995 for use during periods when the recharge rate into the quarry pond exceeds the 100 gpm treatment capacity of the permanent system.

The permanent 100 gpm and temporary 300 gpm water treatment systems are operated and maintained to prevent discharge of quarry pond water containing PCBs in excess of 65 ppt into the offsite stormwater drainage system. Operation of the quarry pond water treatment systems also encourages the flow of surrounding groundwater into the quarry pond where it is pumped and treated. Each of these water treatment systems, in general, consists of a series of multi-media and carbon filtration vessels to remove PCBs from the influent quarry pond water prior to discharge into the stormwater drainage system. The 300 gpm system is connected to the 100 gpm system and uses many of the 100 gpm system's components, including process pumps, reaction tank, and backwash systems. The 100 gpm treatment system is generally operated remotely through a computer telemetry system; and operation of the 300 gpm system requires manual manipulation of equipment by a full-time onsite operator. Process and instrumentation diagrams for the 100 gpm and 300 gpm quarry pond water treatment systems are provided as Attachment 2.

During the periods of water treatment system operation, sampling of the process and discharge water for PCB analysis is conducted in accordance with the NYSDEC-approved protocols. Those protocols were outlined in an October 19, 1992 letter from the NYSDEC to National Grid and a May 5, 1993 letter from Stenger & Finnerty to the NYSDOL, and were amended by a March 28, 2001 letter from National Grid to the NYSDEC documenting the NYSDEC's approval of monthly sampling of water from the quarry pond water treatment systems for PCB analysis. Monthly sampling commenced during April 2001 and prior to that time (since 1993), sampling of the quarry pond water treatment systems was conducted on a weekly basis when either of the systems was operating in discharge mode.

Results of the water treatment samples have been reported to the NYSDEC in monthly progress reports for the Site and in periodic letters which are provided to Mr. Daniel Lightsey, P.E. of the NYSDEC. As documented in the progress reports and letters, since installation of the quarry pond water treatment system, PCBs have not been detected at a concentration greater than the 0.065 ppb laboratory detection limit in the effluent samples collected during that time.

Between 1992 and 1995, National Grid implemented a Remedial Investigation (RI) and completed a Fish and Wildlife Impact Analysis (FWIA). The RI activities were conducted to determine the concentration of PCBs and other chemical constituents in soil, sediment, surface water and groundwater at a number of locations at the Site and at specific locations downstream of the quarry pond outlet channel. A detailed description of these activities and presentation of the results is presented in the NYSDEC-approved *Remedial Investigation Report* (RI Report) (BBL, Revised 1996).

Subsequent to completing the RI Report, the NYSDEC approved implementation of additional groundwater investigation and monitoring activities to determine whether there had been impacts to groundwater quality along the western boundary of the Site. A detailed description of these additional groundwater investigation activities was presented in a June 21, 1996 letter from Mr. James F. Morgan of National Grid to Mr. Daniel Lightsey, P.E. of the NYSDEC.

Although PCBs were not detected in any of the residential water supply samples (collected west of the Site), National Grid proposed, and the NYSDEC- and New York State Department of Health- (NYSDOH-) approved, the precautionary measure of installing household activated carbon water treatment systems for the two residential water supply wells (RW-1 and RW-2) located across West Street from the active scrapyard area of the Site. These household activated carbon water treatment systems were installed in January 1997 and were maintained and sampled quarterly in accordance with the requirements specified in the NYSDEC-approved December 6, 1996 letter from Mr. James F. Morgan of National Grid to Mr. Daniel Lightsey, P.E. of the NYSDEC. The analytical results of the quarterly household water treatment system sampling events were provided to the NYSDEC in monthly progress reports for the Site and in periodic letters which are provided to Mr. Daniel Lightsey, P.E. of the NYSDEC. These systems were disconnected and removed in early December 2001 when the public waterline extension was complete, as detailed in the RA Report and further discussed below.

An LNAPL Extraction Demonstration was implemented at the Site between June 24, 1996 and August 9, 1996, in accordance with the NYSDEC-approved *LNAPL Extraction Demonstration Work Plan* (BBL, June 1996). The results of the demonstration indicated that LNAPL extraction from the subsurface at two of the coreholes and the quarry pond was feasible; these activities and results were detailed in the NYSDEC-approved *Feasibility Study Report* (FS Report) (BBL, October 1997).

The FS Report presented a detailed evaluation of potential remedial alternatives to address soil, sediment, and groundwater at the Site in a manner that is appropriate for Site-specific conditions and protective of human health and environment. The FS Report was subsequently approved by the NYSDEC. Based on the FS Report recommendations, an IRM was implemented in October 1998 to address the portions of the quarry pond outlet channel and storm water drainage system where PCBs were detected in sediment at the highest concentrations. The PCB-impacted sediment was removed from the storm water drainage system and from the quarry pond outlet channel. Confirmatory sampling was conducted to verify that the PCB-contaminated sediments were removed. Additionally, debris was removed from the soil stockpiles located in the upper portion of the Site and drainage improvement activities were conducted in the vicinity of the Site in conjunction with the Village of Cobleskill. The sediment removal activities were conducted in consultation with the NYSDEC and a representative from the NYSDEC was onsite during a portion of the removal activities. A detailed description of the sediment/debris removal and drainage improvement activities was provided in a February 12, 1999 letter from Mr. James F. Morgan of National Grid to Mr. Daniel Lightsey, P.E., of the NYSDEC. The NYSDEC acknowledged the completion of the sediment removal activities in the March 1999 ROD for the Site.

In December 1998, the NYSDEC issued their *Proposed Remedial Action Plan* (PRAP) for the Site. The PRAP generally proposed the remedial action components presented in the FS Report with the following significant differences:

- The NYSDEC selected the excavation and offsite disposal soil remedy proposed by National Grid in their March 26, 1998 letter to replace the capping soil remedy presented in the FS Report; and

- The NYSDEC required that backwash water generated by the quarry pond water treatment systems meet the discharge requirement of less than 0.065 ppb PCBs.

In response to the PRAP, National Grid further addressed the NYSDEC's concerns regarding the discharge of untreated backwash water into the quarry pond in two separate letters dated January 29, 1999. Despite National Grid's position, the NYSDEC issued the ROD for the Site in March 1999 which included the requirement of treating the backwash water generated by the quarry pond water treatment system.

At National Grid's request, a June 2, 1999 meeting was held between National Grid and the NYSDEC to discuss the backwash water treatment issue. Pursuant to a request made by the NYSDEC at this meeting, National Grid collected samples from the 100 gpm water treatment system, including samples of the filter media, influent water samples, and samples of backwash water. National Grid presented the results of the sampling activities in a June 17, 1999 letter to Mr. Daniel Lightsey, P.E. of the NYSDEC. In that letter, National Grid once again supported their position that the direct discharge of backwash water into the quarry pond is the most appropriate method to manage the backwash water for the Site.

A December 13, 1999 meeting was held between National Grid, NYSDEC, and NYSDOL to discuss the backwash water treatment issue. Based on the outcome of that meeting and numerous subsequent telephone conversations with the NYSDEC, the NYSDEC issued the ESD for the Site in May 2000, to modify the selected alternative presented in the NYSDEC ROD. The ESD defers the treatment of backwash water until the source of PCBs into the quarry pond is remediated or reduced to the maximum extent practicable, at which point the efficacy of treating the backwash water would be reevaluated.

Based on the NYSDEC's ROD and ESD, and in accordance with the Consent Decree (Case No. 85-CV-219) entered into by National Grid and the State of New York and filed by the United States District Court, Northern District of New York, on August 21, 2000, ARCADIS BBL (on behalf of National Grid) prepared the remedial design for implementing the NYSDEC-selected remedy. The remedial design was presented in the documents listed below.

- *Public Water Supply Extension Design* (BBL, June 2001), approved by the NYSDEC and the Schoharie County Department of Health (SCDH) in July 2001. The *Contractor Scope of Work* included as an appendix to the *Public Water Supply Extension Design* was stamped and signed by a ARCADIS BBL New York State Licensed Professional Engineer.

- *Draft Remedial Design* (Draft RD) (BBL, June 2000), as amended by National Grid's September 26, 2000 letter and approved by the NYSDEC in a November 7, 2000 letter.

- *Remedial Design* (RD) (BBL, September 2001), that included the NYSDEC-approved revisions was stamped and signed by an ARCADIS BBL New York State Licensed Professional Engineer.

As presented in these design documents and in the ROD, the overall remedial goals for the Site are to meet applicable standards, criteria and guidance (SCGs) and be protective of human health and the environment. The specific remedial action goals selected for the Site, as presented in the NYSDEC's ROD, are listed below.

- Eliminate, to the extent practicable, ingestion of groundwater affected by the Site that does not attain NYSDEC Class GA Ambient Water Quality Criteria.

- Eliminate, to the extent practicable, offsite migration of groundwater that does not attain NYSDEC Class GA Ambient Water Quality Criteria.

- Eliminate, to the extent practicable, migration of LNAPL through removal and hydraulic management.

- Eliminate, to the extent practicable, exposures to contaminated soils.

- Eliminate, to the extent practicable, the migration of PCBs into the drainage channel and creek via erosion of PCB-contaminated soils, transport of suspended sediment with surface water, and transport of PCBs contained in groundwater or surface water.

- Eliminate, to the extent practicable, exceeding the applicable environmental quality standards related to releases of contaminants to waters of the State.

- Eliminate, to the extent practicable, the exposure to fish and wildlife to levels of PCBs above standards/guidance values.

1.2.3 Remedial Action Components

Detailed descriptions of the NYSDEC-selected remedial action components implemented by National Grid to achieve the above remedial goals and meet the requirements of the ROD (as amended by the ESD) are presented in the RA Report. Provided below is a summary of the completed remedial activities and required OM&M

activities identified in the ROD, followed by a discussion of the institutional controls to be implemented for the Site.

1.2.3.1 ROD-Required Remedial Activities

The remedial construction activities commenced during November 2001 and were substantively complete in April 2002. The remedial action activities were observed by ARCADIS BBL, as well a NYSDEC representative. A summary of these activities is provided below.

- Extension of the Village's public waterline to serve residences/businesses that previously obtained water from two water supply wells (RW-1 and RW-2) located just west of the Site. As mentioned above, prior to waterline extension groundwater withdrawn from these residential water supply wells was treated using activated carbon water treatment systems that were installed (in 1997) and maintained by National Grid as a precautionary measure. Following completion of public water service connections, residential water supply wells RW-1 and RW-2 were abandoned. The Wallace Scrapyard facility, which operates out of the concrete and metal building located in the southwestern corner of the Site, was also connected to the public water supply.

- Excavation, transportation, and offsite disposal of surface soils (uppermost 12 inches) that contain PCB concentrations greater than or equal to one part per million (ppm), subsurface soils (below the first 12 inches) that contain PCB concentrations greater than or equal to 10 ppm, and an area of soil previously identified to exhibit the hazardous characteristic of toxicity for lead.

- Backfilling of excavated areas with at least 12 inches of clean backfill material and appropriately restoring the Site.

- Installation and operation of automatic LNAPL recovery systems in existing onsite coreholes C-3/MW-8 and C-4 for continued collection of LNAPL observed in these coreholes. Prior to installation of these automated systems, a biweekly LNAPL monitoring and manual recovery program had been conducted by National Grid since June 1993, as part of a NYSDEC-approved IRM.

1.2.3.2 ROD-Required Monitoring and Operation

In addition to the aforementioned remedial construction components, the NYSDEC-selected remedy presented in the ROD also includes the monitoring and operation requirements identified below.

- Continuing biota monitoring in the unnamed tributary to Cobleskill Creek (unnamed tributary) and Cobleskill Creek specified in the ROD in general conformance with the procedures described in the Biota Sampling and Analysis Work Plan (BBL, 1994).

- Continuing the groundwater monitoring program which includes: obtaining groundwater elevations, monitoring for the presence/absence of LNAPL in Site monitoring wells, collecting and containerizing LNAPL from Site monitoring wells for subsequent offsite treatment/disposal, and groundwater sampling of offsite bedrock coreholes for analysis of PCBs.

- Continuing to operate the onsite quarry pond water treatment systems (the 100 gpm and 300 gpm water treatment systems). The NYSDEC-approved onsite treatment and subsequent offsite discharge of surface water from the quarry pond has been conducted by National Grid since December 1992.

- Reevaluating Site conditions on a periodic basis to confirm the effectiveness of the NYSDEC-selected remedy, and to discuss/identify the appropriate time frame for identifying and evaluating a potential remedial measure(s) to address the quarry pond sediments. As presented in the ROD, the first quarry pond sediment reevaluation will occur, at a minimum, within 3 years after the operation of the automated LNAPL recovery systems.

1.2.3.3 Institutional Controls

One additional component of the Site remedy is implementing appropriate institutional controls. These institutional controls will be detailed in a deed restriction which will (at a minimum): 1) restrict access and/or use of the Site to maintain the integrity of the soil/gravel cover, quarry pond water treatment systems, and LNAPL recovery systems; 2) prohibit the use of groundwater which has been impacted by the Site; 3) prohibit the withdrawal of groundwater at or in the vicinity of the Site if it will effect groundwater flow patterns associated with the Site and increase the potential for offsite migration of the Site-related impacted groundwater; and 4) prohibit the use of quarry pond surface water.

1.2.4 Site Characterization

1.2.4.1 Topography and Drainage

Figure 3 presents the Site surface water features and the surface water drainage pathways from the Site. The quarry pond and the quarry pond outlet channel are the only surface water features present at the Site. Water flow sources into the pond include direct precipitation, surface water runoff from the upper portion of the Site, and groundwater discharge. As discussed previously, a water treatment system to control and treat surface water discharge from the approximately 1.3 acre quarry pond was installed in 1992 as part of an IRM for the Site.

The quarry pond formerly overflowed into a small outlet channel, which flows into a culvert on the north side of Elm Street. Surface water from the quarry pond is presently treated by the water treatment system to maintain discharge of quarry pond water containing less than 0.065 ppb of PCBs into the stormwater drainage system. The treated water is discharged to a 6-inch high-density polyethylene (HDPE) pipe installed in the invert of the small outlet channel. After flowing beneath Route 10, the channel and discharge pipe traverse approximately 75 feet prior to merging with the stormwater drainage from the area immediately west of the Site and entering a culvert beneath a railroad track embankment. The drainage system re-emerges on the south side of the embankment and flows for a short distance prior to entering a below ground culvert where the flow discharges and combines with stormwater flow from the channel and from a parking lot on a neighboring property. The combined flow discharges into Cobleskill Creek, approximately two-thirds of a mile downstream from the Site.

1.2.4.2 Geology and Hydrogeology

The Site is located near the northeast limits of the Allegheny Plateau, which is characterized by a series of terraces, composed of resistant bedrock (Kastning, 1975). The bedrock immediately beneath the Site consists of the Onondaga Formation, comprised of limestones. East of the Site lay the limestones of the Helderberg Group and the Oriskany Sandstone, while west and north at higher elevations than the Site lay shales, siltstones, and sandstones of the Hamilton Group (Fisher, Isachsen, and Rickard, 1970).

Unconsolidated glacial and alluvial deposits lie above the bedrock and are generally thicker within the creek valley. The glacial deposits consist of stratified sands and gravels, lacustrine silts and clays, and lodgment and drumlin tills. The alluvial deposits consist of reworked glacial deposits associated with Cobleskill Creek and its tributaries.

Groundwater is present in both bedrock and unconsolidated deposits. Within the bedrock, groundwater is present primarily in structural features such as bedding planes, joints, and multiple vertical and horizontal fractures. Solution enlargement of these features, caused by acid/base reactions between water and limestone result in the formation of conduit and cave systems. The lacustrine silt and clay, and the lodgment and drumlin till deposits are poor water bearing formations; however, the confined glaciofluvial sand and gravel deposits beneath the till and clay beds are reportedly water-bearing.

The general groundwater flow direction in the overburden immediately south of Route 10 and east of the quarry pond is toward the north-northwest and appears to be influenced by the pumping of the quarry pond. Prior to the December 1992 installation of the quarry pond water treatment system, which reduced the quarry pond level, the general groundwater flow direction was likely toward the south-southeast in the direction of the regional groundwater discharge, Cobleskill Creek. Groundwater flow paths through the fractured bedrock beneath the Site are almost exclusively determined by the interconnectivity of the fractures. The generalized groundwater flow directions in the bedrock are towards the quarry pond. The operation of the quarry pond water treatment system lowers the quarry pond water surface elevation, thereby inducing the flow from the bedrock (as well as the overburden) groundwater flow systems into the quarry pond.

1.2.4.3 Chemical Characterization

This subsection summarizes the relevant findings of the NYSDEC-approved investigations and monitoring activities associated with the Site that have been conducted to assess the presence, and migration (where applicable) of chemical constituents and LNAPL. The results of these activities formed a basis for the remedial activities that have been completed at the Site, including removal of PCB-impacted sediment from the storm water drainage system and from the quarry pond outlet channel in 1998, and removal of surface soils (upper 12 inches) across the Site and subsurface soils containing PCB concentrations in excess of 10 ppm in 2001/2002. Post-excavation sediment/soil samples were collected after these removal activities, confirming that the PCB cleanup goals had been met.

The post-excavation PCB analytical results associated with the 2001/2002 soil removal activities specified in the ROD were presented in the NYSDEC-approved RA Report, and the PCB analytical results associated with the 1998 sediment removal were presented in a February 12, 1999 letter from Mr. James F. Morgan of National Grid to Mr. Daniel Lightsey, P.E., of the NYSDEC. The results of sampling activities conducted as part of the RI were detailed in the RI Report. Groundwater PCB analytical results generated as a result of post-RI sampling activities (from May 1996) have been reported in monthly progress reports and in letters to the NYSDEC and NYSDOH.

Based upon the activities performed and the analytical data collected, the highlights of the findings that are pertinent to the OM&M activities are provided below.

Surface and Subsurface Soils

Surface soils across the Site and subsurface soils containing PCB concentrations in excess of 10 ppm were excavated in 2001/2002, along with an area of soil previously identified to exhibit the hazardous characteristic toxicity for lead. As detailed in the RA Report, the excavated soils were treated/disposed offsite in accordance with applicable rules and regulations. Upon completion of these soil excavation activities and following receipt of satisfactory post-excavation verification sample results, a minimum of eight inches of suitable clean backfill material and four inches of topsoil were placed in the excavated areas, except as noted in the paragraph below. The backfill was obtained from Cobleskill Stone Products. The Site was generally graded to pre-excavation conditions, with additional backfill placed in some areas to promote Site drainage.

The 12-inch backfill/topsoil layer specified in the ROD and RD was modified based on Hancock & Estabrook, LLP's (Hancock & Estabrook's) January 17, 2002 letter to the NYSDEC regarding placement of crusher run (gravel) in the western section of the upper portion of the Site. That request was subsequently approved in a letter from the New York State Office of the Attorney General, dated January 30, 2002. In lieu of the nine inches of backfill material and the three inches of topsoil, as presented in the ROD, the western section of the upper portion of the Site was backfilled with twelve inches of crusher run (see Figure 2).

Quarry Pond

The results of the quarry pond sediment probing activities conducted in 1991 (as part of an IRM) indicated that the depth of the sediments in the quarry pond ranged from 1 to 4 feet and that the estimated total volume of these sediments was approximately 5,000 cy (2,900 cy of heavy mud and 2,100 cy of fine silt). During the RI 32 quarry pond locations were probed and sampled. Analytical results indicated PCBs were detected at concentrations ranging from 0.17 ppm to 63 ppm, with an average concentration of approximately 10 ppm. The total organic carbon (TOC) of these samples ranged from 0.4% to 13.1%.

PCBs have been detected in unfiltered (and untreated) quarry pond surface water samples, at concentrations ranging from 0.12 ppb to 0.72 ppb and in filtered samples at concentrations ranging from non-detect to 0.07 ppb. Since December 1992, the quarry pond water treatment system has been operating to prevent discharge from the Site into the stormwater drainage system of quarry pond surface water containing PCBs in excess of 0.065 ppb.

One the remedial requirements specified in the ROD is reevaluating Site conditions on a periodic basis to discuss/identify the appropriate time frame for identifying and evaluating a potential remedial measure(s) to address the quarry pond sediments. As presented in the ROD and noted above, the first quarry pond sediment reevaluation will occur, at a minimum, within 3 years after the operation of the automated LNAPL recovery systems.

Quarry Pond Outlet Channel and Unnamed Tributary

During the RI, three quarry pond outlet channel locations and eleven locations within the unnamed tributary were probed and sampled. Analytical results indicated PCBs were detected at concentrations ranging from 0.84 ppm to 8.2 ppm in the outlet channel. PCB concentrations in the samples collected from the unnamed tributary ranged from non-detect to 4.3 ppm. PCBs were not detected in six surface water samples collected from the unnamed tributary. Two of these samples were collected in November 1992, and four were collected in May 1993 during the RI.

The PCB-impacted sediments in the quarry pond outlet channel and unnamed tributary were removed and disposed offsite during an October 1998 IRM conducted by National Grid. As identified in Subsection 1.2.2, confirmatory sampling was conducted to verify that the PCB-impacted sediments were removed and a detailed description of the sediment removal activities was provided in a February 12, 1999 letter from Mr. James F. Morgan of National Grid to Mr. Daniel Lightsey, P.E., of the NYSDEC. The NYSDEC acknowledged the completion of these sediment removal activities in the March 1999 ROD for the Site.

Groundwater

Most of the groundwater monitoring and investigation activities were associated with the RI, and therefore the results were presented in the RI Report. The results of the activities conducted subsequent to completion of the RI Report have been provided to the NYSDEC in monthly progress reports and letters as the results became available, as well as in the RA Report. A summary of the results of the groundwater investigation and monitoring activities is presented below. Monitoring well locations are shown on Figure 2.

- Groundwater samples were collected from monitoring wells during both phases of the RI, between June 1993 and April 1995. PCBs were detected at concentrations of 0.72 ppb and 0.10 ppb in the unfiltered RI groundwater samples collected at bedrock coreholes (constructed and developed as monitoring wells) C-9 and C-16, respectively. As presented in the NYSDEC-approved RI Report, the detection of PCBs in C-9 appeared to be related to sediments that were flushed into the corehole from surface water runoff. PCBs were not detected in subsequent samples collected from bedrock coreholes C-9 and C-16 during the RI (i.e., prior to May 1996). PCBs were not detected in any of the other groundwater samples collected during the RI from Site monitoring wells.

- Results of RI groundwater sampling indicated that volatile organic compounds (VOCs) were detected at levels exceeding NYSDEC Class GA Groundwater Quality Standards only in groundwater samples collected in the leach field area of the active scrapyard for Wallace operations. As stated in NYSDEC's ROD, the VOCs detected in the leach field area are not addressed in the NYSDEC's ROD because they are unrelated to the scope of the remedy to be implemented by National Grid. Oversight of activities associated with the leach field area has been transferred to the NYSDEC's Spill Response Division.

- Five residential water supply wells, located between approximately 150 feet and 600 feet from the western Site boundary, were sampled during the RI (July/August 1993 and September 1994) to assist in determining whether groundwater quality at these locations had been impacted by Site conditions. PCBs were not detected in any of the samples from these five residential wells.

- In May 1996, groundwater samples were collected for PCB analysis from four bedrock monitoring wells (C-11, C-15, C-16 and C-18) located along the western Site boundary. During this sampling event, LNAPL was observed coating the bailer at C-11 and light sheens were observed on the surface of purge water collected from monitoring wells C-15 and C-16. Based on these observations, and on the detections of PCBs in each of the unfiltered samples collected from these four onsite monitoring wells (concentrations ranging from 0.16 ppb to 52 ppb), a confirmatory round of groundwater sampling at these four monitoring wells was conducted. The results of the confirmatory sampling event indicated similar PCB concentrations in the four onsite monitoring wells. Groundwater samples were also collected from the five residential water supply wells previously sampled during the RI and located west of the Site. PCBs were not detected in samples collected from the five residential water supply wells.

- In response to the May 1996 groundwater sampling events discussed above, offsite bedrock monitoring wells C-20, C-21 and C-22 were installed and developed in July/August 1996 on private property on the west side of Settles Mountain Road. In September 1996, a one-year quarterly PCB sampling program was initiated for these three wells and the four onsite monitoring wells located along the western Site boundary (C-11, C-15, C-16 and C-18).

- In March 1998, National Grid proposed, and the NYSDEC subsequently approved, the semi-annual collection of groundwater samples from offsite monitoring wells C-20, C-21 and C-22 for filtered and unfiltered PCB analysis. This program is ongoing. PCBs have been detected periodically in unfiltered groundwater samples collected from the offsite monitoring wells at concentrations less than 5 ppb since December 1996, the USEPA Maximum Contaminant Level (MCL) for public water systems.

LNAPL

LNAPL has infiltrated the fractured and jointed bedrock at the Site where it appears to exist in discrete quantities, adhered to rock surfaces by surface tension forces, or sorbed to sediment within the fractures. Fluctuations in the water table, caused by seasonal variations or hydraulic manipulations (e.g., operation of the quarry pond water treatment systems), would be expected to increase the fraction of residual LNAPL by increasing the surface area that free LNAPL (if present) would be exposed.

LNAPL has been observed in onsite monitoring wells/coreholes located west-northwest of the quarry pond. However, since implementation of the biweekly LNAPL monitoring and removal program in June 1993, the amounts of LNAPL measured and removed has decreased significantly. LNAPL has consistently been observed only at coreholes C-3/MW-8 and C-4 in measurable thickness. At these locations, automatic LNAPL recovery systems were installed in 2002 for the continued collection of LNAPL. Prior to installation of these automated systems, a biweekly LNAPL monitoring and manual recovery program had been conducted by National Grid since June 1993 as part of a NYSDEC-approved IRM.

Since November 2002 (after completing the soil remedial activities), NAPL has not been detected/observed during the biweekly monitoring activities in any of the Site monitoring wells/coreholes, except coreholes C-3/MW-8 and C-4 where the belt skimmers are installed and operated to remove LNAPL and corehole C-10 where a trace quantity of LNAPL was observed on January 28, 2004. The LNAPL from C-10 was removed using an oil sorbing sock. Previously, LNAPL had not been observed in this corehole since December 11, 1996, and has not been observed since that one occasion on January 28, 2004. At coreholes C-4 and C-3/MW-8 only trace quantities of LNAPL have been collected since operation of the belt skimmers in July 2002. The declining LNAPL quantities and thicknesses of LNAPL observed at individual monitoring locations may be due to LNAPL removal (by bailing/skimming/adsorbing); LNAPL discharge into the quarry pond; and/or an increase, over time, in the fraction of residual LNAPL.

As noted in Section 1.2.2, the Site is listed as a Class 2 site. The NYSDEC will begin the process to change the site classification to a Class 4 site upon approval of the OM&M Plan, along with filing of a NYSDEC-approved restrictive covenant in the chain of title, as identified in NYSDEC's February 13, 2004 letter to Green & Seifter (copy provided as Attachment 1). A Class 4 site is one that has been properly closed but that requires continued operation, maintenance, and/or monitoring (6 NYCRR Part 375.1.8).

2. LNAPL Remedial Action Components

2.1 General

This section describes the automatic LNAPL recovery systems installed and operated as part of the NYSDEC-required Site remedy presented in the ROD. Continued operation and quarry pond water treatment system is also an LNAPL remedial action component. A brief description of the quarry pond water treatment system was presented in Section 1.2.2 and process and instrumentation diagrams are provided in Attachment 2. Operation and maintenance of the quarry pond water treatment systems is presently conducted by National Grid's contractor, CDM. The details of those activities are presented in the *Contractor Scope of Work* (BBL, 2001). The NYSDEC-required monitoring activities associated with the quarry pond water treatment system are detailed in Subsection 4.5.

2.2 Enhanced Automatic LNAPL Recovery Systems Description

Each of the automatic LNAPL recovery systems consists primarily of an in-well belt oil skimmer, a LNAPL collection drum, a secondary spill containment unit, an equipment enclosure building, and associated electrical and control equipment. The equipment enclosure building locations and associated electrical conduit location are shown on Figure 2. Details and specifications for the system components are provided on Figures 4 and 5. Details regarding the belt skimmers and equipment enclosure buildings are discussed below.

2.2.1 Equipment Enclosure Building

An Easi-Set pre-cast concrete building manufactured by Kistner Concrete Products, Inc. houses each of the recovery systems. The buildings are 8 feet wide by 8 feet long by 8 feet high and were placed on a 4-inch compacted gravel base. Each building includes two 3-foot wide, 18-gauge steel security doors with tamper proof hinges and dead bolt locks. Each building is equipped with a wall-mounted space heater, thermostat, and exhaust fan.

2.2.2 Belt Skimmers

Petroextractor Model PX-A oil belt skimmers manufactured by Abanaki Corporation were installed in each recovery well. The hydrophobic skimmer belts are 40 feet in length and one inch wide. Each belt skimmer is equipped with a 4-foot mounting stand, an on/off timer (with 15-minute increments), and a 30-gallon drum shut-off switch. The installation and maintenance instructions for the belt skimmers are included as Attachment 3.

Based on observations of the amount of LNAPL that had accumulated in the recovery well, the on-off timer has been programmed to periodically operate the belt skimmers, as necessary, to remove any LNAPL accumulating in the recovery wells and transfer the LNAPL and any water removed from the wells into a 30-gallon drum located in the equipment enclosure buildings. The operational period may be modified manually at any time, as appropriate. The LNAPL drum shut-off switch can automatically terminate operation of the skimmer when the capacity of the drum has been reached. Full (near capacity) drums will be periodically replaced with empty drums, as necessary, as part of the operation and maintenance activities discussed in Section 3.

3. Operation and Maintenance Activities

3.1 General

This section identifies the operation and maintenance activities associated with the Site remedy, including the LNAPL recovery systems, the RPZ backflow prevention device, and the vegetative soil cover. The health and safety procedures to be followed are presented in Appendix C (HASP).

3.2 LNAPL Recovery System Operation and Maintenance

The LNAPL recovery systems (belt skimmers) will be operated and maintained year round. The frequency of maintenance and monitoring activities associated with the LNAPL recovery systems currently consist of bimonthly Site visits. The frequency of future monitoring will be dependent on conditions encountered, including the amount and rate of LNAPL recovery. Maintenance activities will be performed in conjunction with the post-remediation monitoring activities described in Section 4.

Maintenance of the LNAPL recovery systems will be conducted in accordance with the manufacturer's installation and maintenance instructions provided as Attachment 3, including, at a minimum, the following activities:

- Cleaning the head pulleys and wipers;
- Manually running each system for a period of approximately ten minutes to verify that the system is operating without deficiencies or malfunctions;
- Checking and inspecting miscellaneous parts (e.g., float-switch, head pulley, trough, hose, etc.), adjusting and/or cleaning components as necessary;
- Replacing the LNAPL drums that are near capacity with empty 30-gallon drums; and
- Maintaining the buildings housing the LNAPL recovery systems. These maintenance activities may include, but not be limited to, checking/repairing heaters, thermostats and exhaust fans.

Any deficiencies or malfunctions observed during the system monitoring will be reported and repaired/replaced as necessary. Any LNAPL recovered by the systems will be properly labeled and stored onsite in a secure area pending appropriate treatment/disposal in accordance with applicable rules and regulations.

3.3 RPZ Backflow Prevention Device

As one of the remedial components specified in the ROD, the existing Village water supply line was extended and residential water service connections were installed at properties that previously obtained water from residential groundwater supply wells RW-1 and RW-2 located just west of the Site. Subsequently, pursuant to the NYSDEC's August 22, 2000 letter to National Grid and subsequent discussion between National Grid, the

NYSDEC, and the NYSDOH, the waterline extension also included connecting the Wallace facility to the public water supply extension.

At the Wallace facility, a 1-inch Watts 909 RPZ backflow prevention device was installed after the newly installed water meter. After installation, the backflow prevention device was tested by a certified backflow prevention tester. The completed "Report on Test and Maintenance of Backflow Prevention Device", certified by a ARCADIS BBL professional engineer licensed in the State of New York, is provided as Attachment 4. ARCADIS BBL transmitted this completed report to the SCDH on August 6, 2002, with copies to the NYSDEC and Village. A copy of this report was also provided in the RA Report.

In accordance with NYSDOH requirements presented to Wallace in the NYSDOH's January 5, 2004 *Approval of Completed Works for Public Water Supply Improvement* (provided as Attachment 5), the backflow prevention device is to be tested every three years (at a minimum) as long as the Wallace establishment remains essentially as an office. Should the activity change, annual testing will be required. This condition has been approved by the Village of Cobleskill Water Superintendent, Mr. Jeffery Pangman. The testing must be conducted by a NYSDOH certified backflow prevention tester, and the results submitted to the Village (i.e., water supplier).

The backflow prevention device was tested by a certified backflow prevention tester on June 16, 2005 and the results were transmitted to the Village of Cobleskill in a letter dated September 2, 2005 (provided as Attachment 4). As presented in Section 2.3 of the NYSDEC-approved NW Plan, as long as the Wallace establishment remains essentially as an office, the next scheduled certification would need to be conducted by Wallace during the 2008 calendar year.

3.4 Maintenance of Vegetative Soil Cover

As presented in the RA Report, the 12-inch backfill/topsoil layer specified in the ROD and RD was modified based on Hancock & Estabrook, LLP's (Hancock & Estabrook's) January 17, 2002 letter to the NYSDEC regarding placement of crusher run (gravel) in the western section of the upper portion of the Site. That request was subsequently approved in a letter from the New York State Office of the Attorney General, dated January 30, 2002. These letters were provided in the RA Report as Attachment 11 and Attachment 12, respectively. In lieu of the nine inches of backfill material and the three inches of topsoil, as presented in the ROD, the western section of the upper portion of the Site was backfilled with 12 inches of crusher run. The limits of the crusher run/gravel are shown on Figure 2. As previously identified, Wallace will be responsible for conducting OM&M activities within the active scrapyard area of the Site.

Maintenance and repair of the vegetative soil cover will be conducted by National Grid to maintain the 12-inch backfill/topsoil layer. Maintenance and repair activities may include placement of additional topsoil in areas of excessive settlement and/or erosion, ruts (as a result of vehicle/equipment tracking), within animal burrows and repair of vegetation not sufficiently established. Topsoil shall be unfrozen, friable natural loam and shall be free of clay lumps, brushweeds, litter, stones, and other extraneous matter. Topsoil shall be placed in loose lifts, and heaped to match surrounding grade following settlement. Vegetation shall be established as soon as practicable following placement of topsoil and/or when vegetation is not sufficiently established to mitigate erosion. The use of erosion control mat shall be used in areas of persistent erosion. These activities will be conducted as needed, based on conditions observed during the semi-annual monitoring activities presented in Subsection 4.6.

4. Monitoring Activities

4.1 General

The monitoring program consists of the components listed below.

- Monthly monitoring of the LNAPL recovery systems (belt skimmers) installed at monitoring well/coreholes C-3/MW-8 and C-4, consisting of estimating and recording the amount of LNAPL that has accumulated in the 30-gallon drums.

- Semi-annual groundwater sampling of offsite bedrock coreholes C-20, C-21 and C-22 for filtered and unfiltered PCBs.

- Sampling of the quarry pond water treatment systems for PCBs. Sampling activities are conducted on a monthly basis for the 100 gpm system when operating in discharge mode and once per operation event (or weekly) for the 300 gpm system when operating in discharge mode.

- Semi-annual visual review verifying that the 12-inch vegetative soil cover is in-place and competent.

- Biota Sampling and Analysis Program for Cobleskill Creek and unnamed tributary.

Descriptions of these long-term monitoring activities are provided in the following subsections. During the onsite monitoring activities, the applicable health and safety procedures presented in Appendix CHASP will be followed.

4.2 Onsite LNAPL Monitoring

Onsite LNAPL monitoring will consist of estimating and recording the amount of LNAPL accumulated in the drums associated with the LNAPL recovery systems at monitoring well/coreholes C-3/MW-8 and C-4. Currently these activities are conducted monthly. The frequency of future maintenance and monitoring will be dependent on the conditions encountered including the amount and rate of LNAPL recovery. Based on these observations, the on-off timer is programmed to periodically operate the belt skimmers that remove LNAPL accumulating in these monitoring well/coreholes and transfer the LNAPL removed from each well/corehole into the adjacent 30-gallon drum. Only trace quantities of LNAPL/water have been observed in the collection trough and recovery drums since operation of the recovery systems began on July 18, 2002.

4.3 Offsite Groundwater Monitoring Activities

Offsite bedrock monitoring wells C-20, C-21 and C-22 will be evaluated for the presence of LNAPL or sheens and sampled for filtered and unfiltered PCB analysis. A quantitation limit of 0.05 ppb will be required for the analyses by a NYSDOH-certified laboratory, and the results will be validated in accordance with the QAPP. The validated PCB analytical results of the groundwater sampling activities will be reported to the NYSDEC through periodic letters as they become available. Currently this sampling is conducted semi-annually. The frequency of the groundwater sampling and analysis may be modified based on the results obtained, and with approval from the NYSDEC. Offsite groundwater sampling and analysis activities shall be conducted in accordance with the FSP (Appendix A) and the QAPP (Appendix B).

4.4 Quarry Pond Water Treatment System Monitoring Activities

The purpose of the quarry pond water treatment system sampling and analysis activities is to confirm that the concentration of PCBs (if any) in the treated quarry pond water being discharged into the offsite stormwater drainage system is less than 0.065 ppb. The sampling activities will be conducted only when the water treatment system is operating in discharge mode.

When the permanent 100 gpm water treatment system is operating in discharge mode, samples will be collected monthly for PCB analysis from the following locations:

- Between the carbon vessels of the permanent 100 gpm water treatment system; and
- Effluent water from the permanent 100 gpm water treatment system.

When both the permanent 100 gpm and the temporary 300 gpm water treatment systems are operating in discharge mode, samples will be collected once per operation period (or weekly) for PCB analysis from the following locations:

- Between the carbon vessels of the permanent 100 gpm water treatment system;
- Between the carbon vessels of the temporary 300 gpm water treatment system; and
- Effluent water from the combined discharge of the permanent 100 gpm and temporary 300 gpm water treatment systems.

The water treatment sampling activities described above are conducted once a month during the operation of the 100 gpm system in discharge mode and once per operation period (or weekly) for the 300 gpm system. The samples are submitted for laboratory analysis for PCBs using USEPA Method 608. A quantitation limit of 0.05 ppb is required for the analyses by the NYSDOH-certified laboratory. The sampling results will be transmitted to the NYSDEC in periodic letters. Quarry pond water treatment system sampling and analysis activities shall be conducted in accordance with the FSP (Appendix A) and the QAPP (Appendix B).

In the event that PCBs are detected at a concentration exceeding 0.065 ppb in any of the samples collected from the above identified locations during a sampling event, weekly sampling of the system(s) will be initiated. Weekly sampling will involve the same sample collection protocols as described above for the monthly sampling events. Weekly sampling will continue until PCBs are not detected in any of the samples collected at a concentration greater than 0.065 ppb during two consecutive weekly sampling events.

The water treatment system sampling also includes collecting duplicate samples for both the between-carbon and effluent samples collected during each sampling event. In the event that PCBs are detected in a water treatment sample, in addition to the initiation of weekly sampling as discussed above, the laboratory will be directed to analyze the duplicate of that sample. If PCBs are not detected in the duplicate sample, the water treatment system will be resampled to confirm the presence or absence of PCBs, or potential laboratory error in the initial analysis. If PCBs are detected in the duplicate sample, the water treatment system will be evaluated to determine the cause for the PCB detection, and the appropriate corrective measures and sampling will be implemented.

4.5 Vegetative Soil Cover Monitoring

The purpose of the vegetative soil cover monitoring activities is to verify that the 12-inch vegetative soil cover is in place and competent. Monitoring will consist of, at a minimum, semi-annual visual review of the subject areas and will be documented in a field log. At a minimum, these visual reviews will include identifying areas of excessive settlement, excessive amounts of erosion, condition of vegetation, presence of unauthorized excavation, or animal burrows. Areas identified where the soil cover is breached, based on the visual review, will be restored as soon as practicable, in general conformance with Section 3.4. The subject area to be monitored/maintained in accordance with this OM&M Plan is the area of the Site which is not part of the active scrapyard for Wallace operations, as shown on Figure 2.

4.6 Biota Sampling and Analysis Program

A Biota Sampling and Analysis Program will be implemented to determine if PCB uptake is occurring in fish found in the unnamed tributary and in the Cobleskill Creek downstream of the confluence with this tributary. The Biota Sampling and Analysis Program will consist of fish sampling and analysis in general conformance with the NYSDEC-approved Biota Sampling and Analysis Plan (BBL, 1994). Fish sampling will be performed at the same two general locations that were sampled in 1994 and 2003. (i.e., one location in the Cobleskill Creek, and one location in the unnamed tributary). (Figure3).

At both of these proposed locations, sampling efforts will target two fish species; a forage species and a sport species, if available. The two target fish species will be selected in the field based upon availability and abundance at the sampling locations. Specific sample locations will be selected in the field so that similar species can be collected from both locations, to the extent practical.

The fish will be collected at each of the sampling locations using electrofishing techniques. During the collection activities, fish will be identified and separated by species and by sample location and retained on ice. From both of the proposed sampling locations, three samples of the target forage species and up to three samples of edible size sport fish (if available) will be prepared for laboratory analysis in accordance with the procedures described in the FSP (Appendix A).

Fish sampling will be conducted every other year for a period of up to 30 years, with the exception that if the results of any two consecutive sampling periods show decreases in PCB concentrations, or a value of 0.1 ppm PCB in fish tissue is achieved, then sampling will occur in a geometric progression where each successive sampling is increased by one year (For example, if two consecutive decreases are recorded by year 5, successive sampling would be in years 8, 12, 17, 23, 30). If at anytime the results of two consecutive sampling periods show increases in PCB concentrations in fish tissue, sampling reverts to every other year and a new sampling progression will be developed by National Grid and NYSDEC.

5. Reporting

A description of the OM&M activities to be conducted by (on behalf of) National Grid, as well as the associated results will be transmitted to the NYSDEC in a standardized annual report. These reports will include (but may not be limited to) the following information:

- A summary of the OM&M activities conducted during the reporting period;
- Analytical results and data generated during the reporting period;
- Planned activities for the next reporting period; and
- Anticipated schedule for upcoming activities.

6. Project Contact List

The OM&M activities for the Site, including the LNAPL recovery systems and post-remediation monitoring activities, require integration of key project management personnel from the organizations identified below:

Project Title	Company/Organization	Name	Phone Number
NYSDEC Project Manager	New York State Department of Environmental Conservation	Daniel Lightsey, P.E.	(518) 357-2045
NYSDOH	New York Sate Department of Health	To be determined	(518) 402-7860
Public Health Director	Schoharie County Department of Health	Carl J. Stefanik, P.E.	(518) 295-8365
Project Manager	National Grid,	James F. Morgan	(315) 428-3101
OM&M Project Manager	National Grid,	Steven P. Stucker, CPG	(315) 428-5652

7. References

Blasland, Bouck & Lee, Inc. (BBL, now known as ARCADIS U.S., Inc. [ARCADIS BBL]). 1994. Letter dated September 16, 1994 from Niagara Mohawk to NYSDEC.

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NYSDEC. 1999. *Record of Decision, M. Wallace & Son, Incorporated Site, Cobleskill, Schoharie County, Site Number 4-48-003.*

NYSDEC. 2000. *Explanation of Significant Difference, M. Wallace & Son, Incorporated Site, Cobleskill, Schoharie County, Site Number 4-48-003.*

NYSDEC. Letter dated February 13, 2004 from NYSDEC to Green & Seifter.

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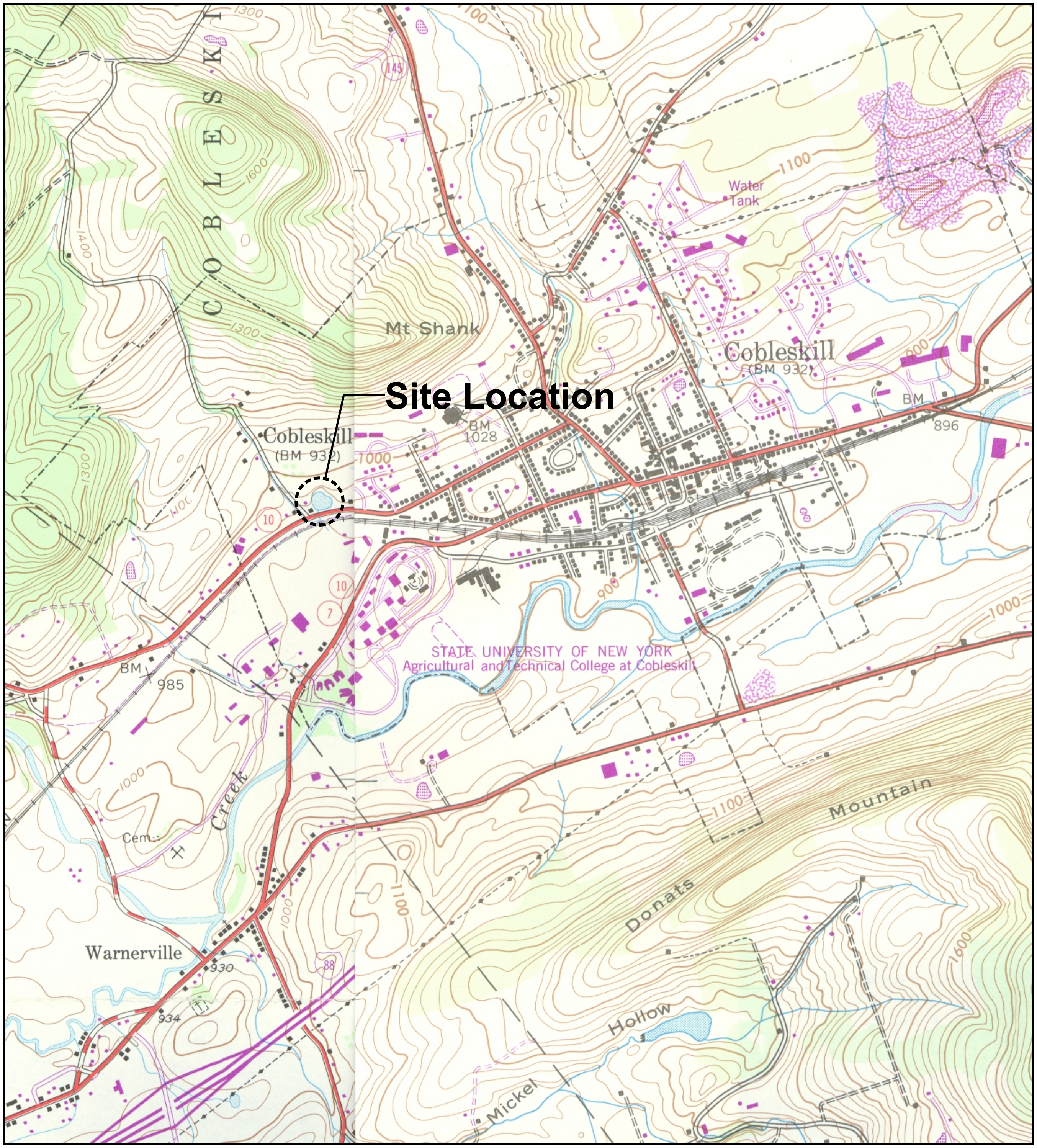
Niagara Mohawk Power Corporation (NMPC). Letter dated June 21, 1996 from NMPC to NYSDEC.

NMPC. Letter dated June 17, 1999 from NMPC to NYSDEC.

Stenger & Finnerty. 1993. Letter dated May 5, 1993 from Stenger & Finnerty to the New York State Department of Law.

United States District Court Northern District of New York. 2000. *Consent Decree*. The State of New York, Plaintiff, -against- Niagara Mohawk Power Corporation and M. Wallace and Son, Inc.

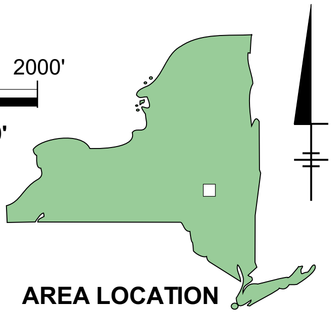
Figures



REFERENCE: Base Map Source USGS 7.5 Minute Quads. Series Cobleskill, New York, 1943, Photorevised 1980, and Richmondville, New York, 1944, Photorevised 1982.

2000' 0 2000'

Approximate Scale: 1" = 2000'


AREA LOCATION

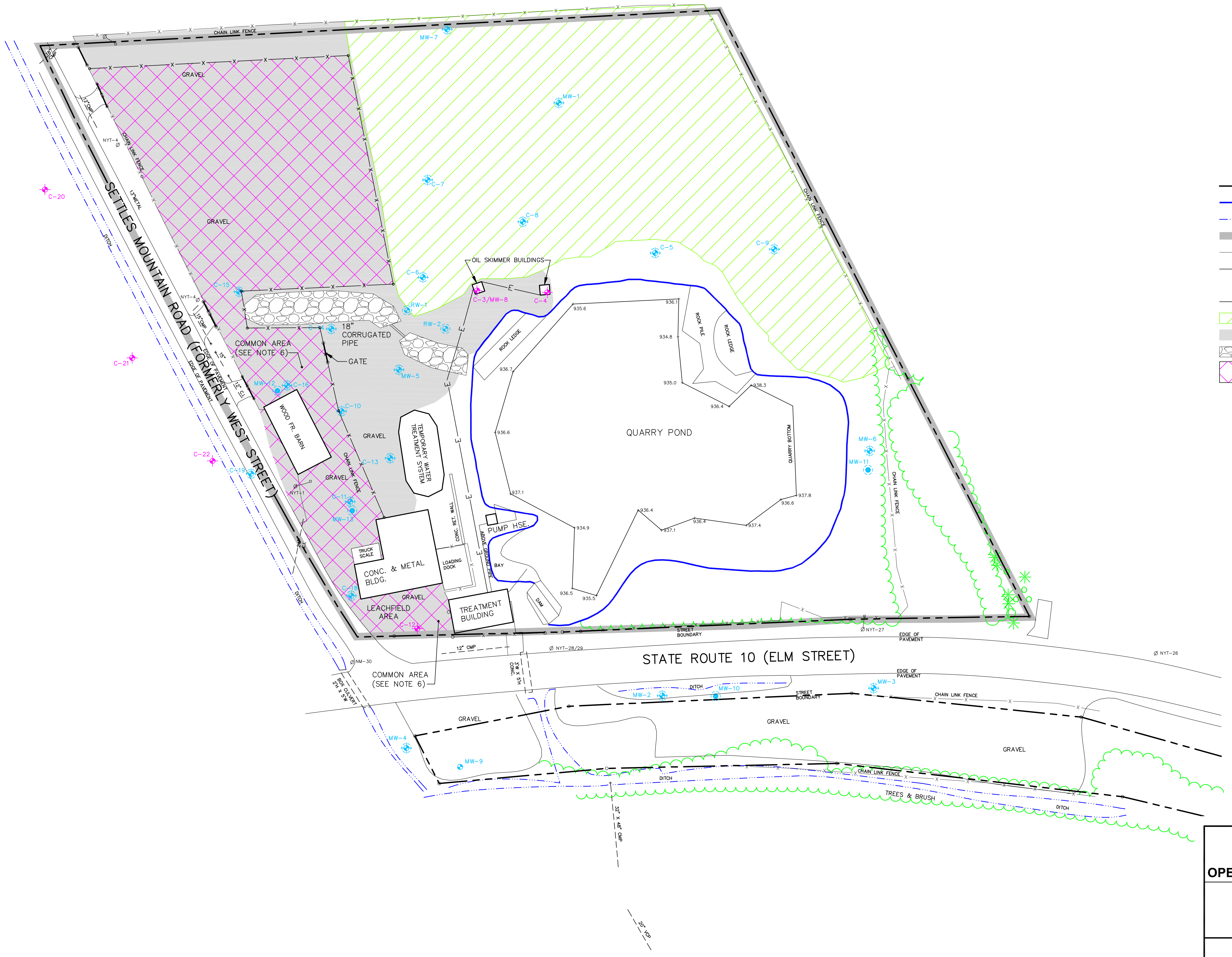
NATIONAL GRID
M. WALLACE AND SON, INC. SCRAPYARD SITE
COBLESKILL, NEW YORK
OPERATION, MAINTENANCE AND MONITORING PLAN

SITE LOCATION MAP

ARCADIS BBL
Infrastructure, environment, facilities

FIGURE
1

01/12/07 SYR-D85 KLS
36417390/36417n01.cdr



LEGEND:

╿	GUY ANCHOR
⌀	UTILTY POLE
✦	BEDROCK COREHOLE MONITORING WELL LOCATION
●	OVERBURDEN MONITORING WELL LOCATION
●	OVERBURDEN MONITORING WELL LOCATION (DECOMMISSIONED)
●	BEDROCK COREHOLE MONITORING WELL (DECOMMISSIONED)
●	RECOVERY WELL LOCATION (DECOMMISSIONED)
— — —	PROPERTY LINE
——	APPROXIMATE LIMIT OF QUARRY
-··-	DITCH
▬	SITE BOUNDARY
—x—x—	CHAIN LINK FENCE
—x—x—	CHAIN LINK FENCE INSTALLED AUGUST 2005
•—•	FENCE GATE
—E—	BURIED ELECTRICAL LINE
▨	SOIL COVER
▭	GRAVEL
▨	RIP-RAP
▨	LIMITS OF ACTIVE SCRAPYARD AREA

GENERAL NOTES:

1. SITE SURVEY CONDUCTED BY BLASLAND & BOUCK ENGINEERS, P.C., OCTOBER 1992.
2. PROPERTY BOUNDARY, LIMITS OF GRAVEL, RIP-RAP, AND SOIL COVER LOCATED IN THE FIELD BY JOANNE DARCY CRUM, L.S., COBLESKILL, N.Y. DURING SURVEY ACTIVITIES CONDUCTED ON 6/7/02.
3. THE LOCATION OF THE CHAIN-LINK FENCE INSTALLED IN AUGUST 2005 WAS SURVEYED BY JOANNE DARCY CRUM, L.S. IN SEPTEMBER 2005. LOCATIONS OF GATES ARE APPROXIMATE.
4. LOCATION OF UNDERGROUND UTILITIES AND OTHER UNDERGROUND STRUCTURES LOCATED BY FIELD MEASUREMENTS WHERE POSSIBLE, OTHERWISE OBTAINED FROM OTHER SOURCES AND MAY BE APPROXIMATE. OTHER UNDERGROUND UTILITIES AND STRUCTURES MAY EXIST, THE LOCATIONS OF WHICH ARE PRESENTLY UNKNOWN.
5. THE ACTIVE SCRAPYARD AREA IS THE AREA OF THE SITE WHICH M. WALLACE AND SON, INC. WILL USE FOR SCRAPYARD OPERATIONS.
6. COMMON AREAS WITHIN THE ACTIVE SCRAPYARD AREA ARE REQUIRED TO PROVIDE NATIONAL GRID ACCESS TO CONDUCT NYSDEC-REQUIRED OM&M ACTIVITIES.

0 40' 80'
GRAPHIC SCALE

NATIONAL GRID
M. WALLACE & SON, INC. SCRAPYARD
COBLESKILL, NEW YORK
OPERATION, MAINTENANCE AND MONITORING PLAN

SITE PLAN

ARCADIS BBL
infrastructure, environment, facilities

FIGURE
2

SYR-85-RCA GMS KLS LAYER: ON=*, OFF=*REF*
F:\ACTIVE\-DWG\ACT\36417390\36417B01.DWG SAVED:1/12/2007 10:01 AM LAYOUT:DL PAGESETUP:---- PENTABLE:PLTFULL.CTB PRINTED:1/12/2007 10:02 AM BY:KSARTORI
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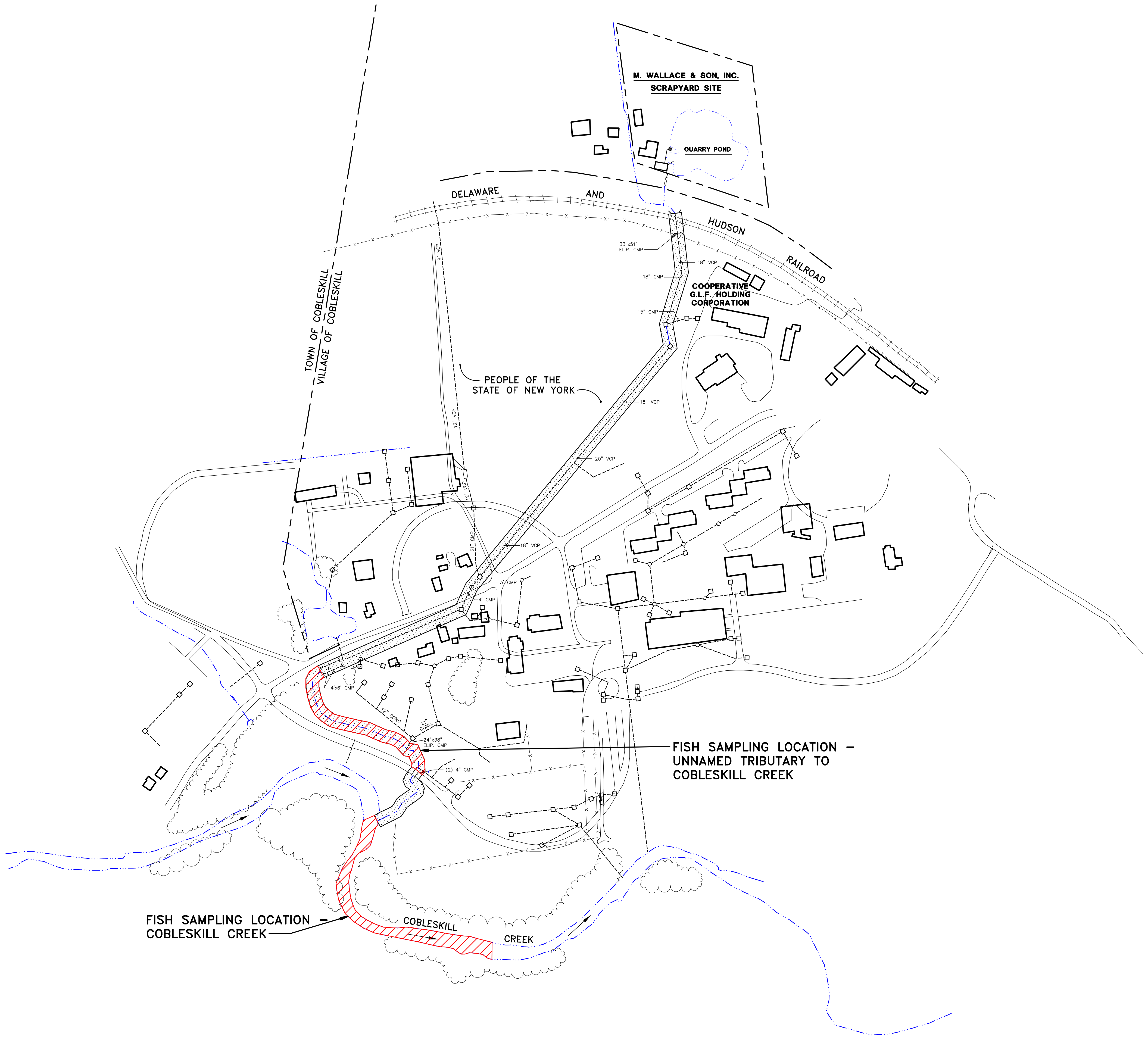

LEGEND:

▨	STORM WATER DRAINAGE SYSTEM
🟥	FISH SAMPLING LOCATIONS
— ℙ — —	PROPERTY LINE
- - - - - -	STORM SEWER PIPE ROUTE
—·—·—	DRAINAGE DITCH
—·—·—	SURFACE WATER FEATURE
—x—x—	FENCE
MH ○	STORM SEWER MANHOLE
CB □	STORM SEWER CATCH BASIN
▭	BUILDINGS
→	DIRECTION OF SURFACE WATER FLOW

0 200' 400'
GRAPHIC SCALE

GENERAL NOTES:

1. THIS SHEET WAS DEVELOPED FROM THE VILLAGE OF COBLESKILL, NEW YORK, STORM SEWER SYSTEM MAP. THIS SHEET HAS BEEN UPDATED UNDER HC 7525 DATED FEBRUARY 1965.

NATIONAL GRID
M. WALLACE & SON, INC. SCRAPYARD
COBLESKILL, NEW YORK
OPERATION, MAINTENANCE AND MONITORING PLAN

UNNAMED TRIBUTARY TO COBLESKILL CREEK AND COBLESKILL CREEK SAMPLING LOCATIONS

ARCADIS BBL
infrastructure, environment, facilities

FIGURE
3

SYR-85-DMW DJP KLS LAYER: ON=*, OFF=*REF*
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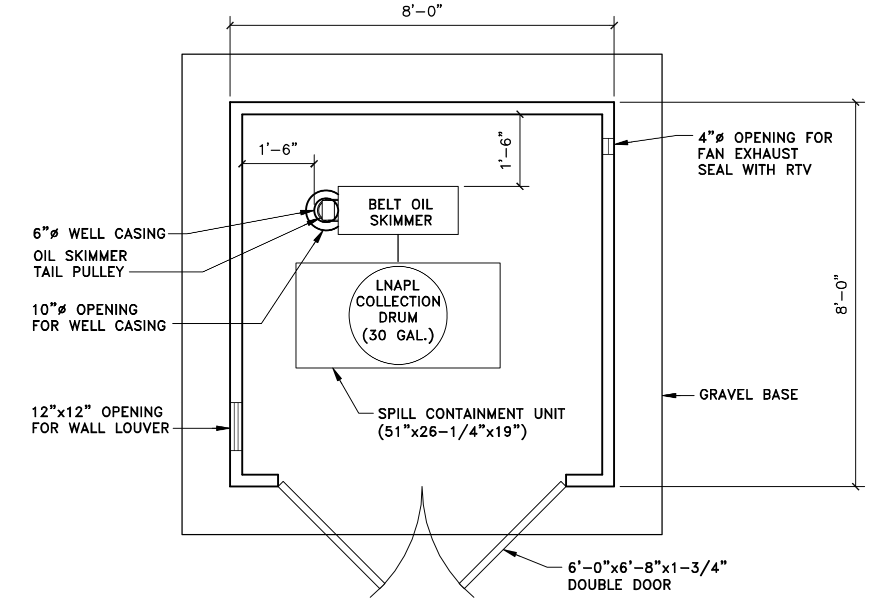
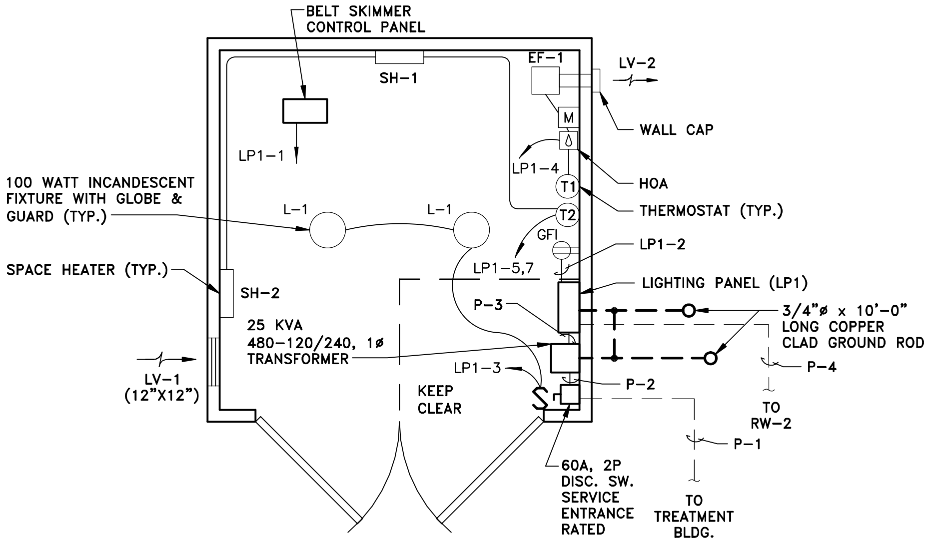


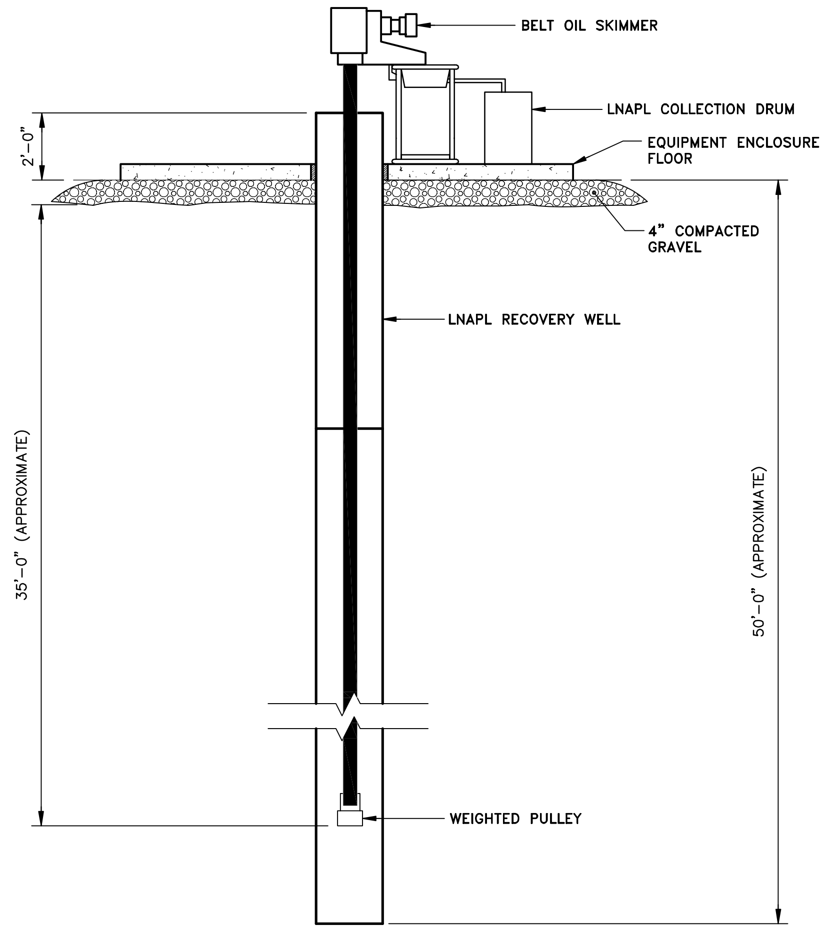
RECOVERY WELL NO. 1 & 2
EQUIPMENT ENCLOSURE FLOOR PLAN

SCALE: 1/2"=1'-0"



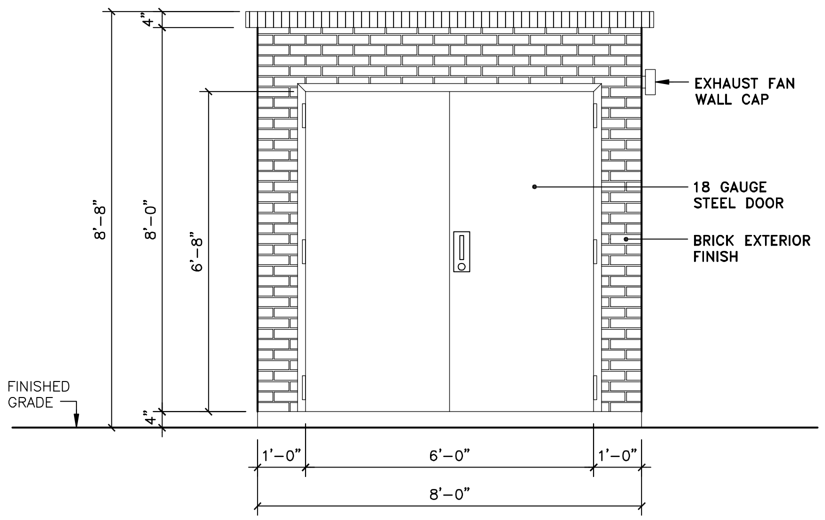
RECOVERY WELL NO. 1
ELECTRICAL PLAN

SCALE: 1/2"=1'-0"



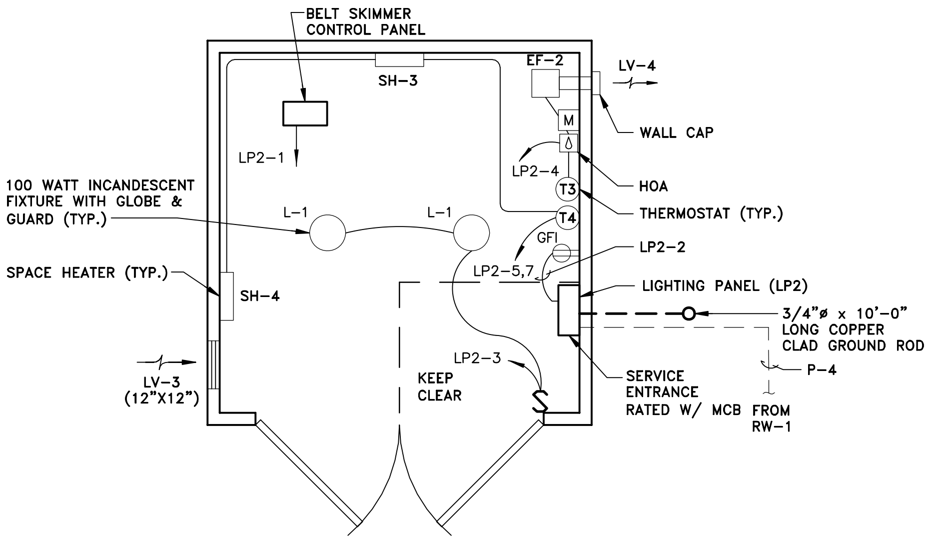
RECOVERY WELL DETAIL

NOT TO SCALE



RECOVERY WELL NO. 1 & 2
EQUIPMENT ENCLOSURE ELEVATION

SCALE: 1/2"=1'-0"



RECOVERY WELL NO. 2
ELECTRICAL PLAN

SCALE: 1/2"=1'-0"

ELECTRICAL & HVAC LEGEND:

┤├	NORMALLY OPEN CONTACT (N.O.)
	CIRCUIT BREAKER (C.B.)
⏚	GROUND
	TRANSFORMER
	MOTOR OVERLOAD HEATER
M	MANUAL MOTOR STARTER
GFI	GROUND FAULT INTERUPTER RECEPTACLE
○ L-1	100W INCANDESCENT LIGHT FIXTURE
S	SINGLE POLE LIGHT SWITCH
T	THERMOSTAT
	HOMERUN
HOA	HAND-OFF-AUTOMATIC

NATIONAL GRID
M. WALLACE & SON, INC. SCRAPYARD
COBLESKILL, NEW YORK
OPERATION, MAINTENANCE AND MONITORING PLAN

RECOVERY WELL PLANS, ELEVATION, AND DETAIL

ARCADIS BBL
infrastructure, environment, facilities

FIGURE
4

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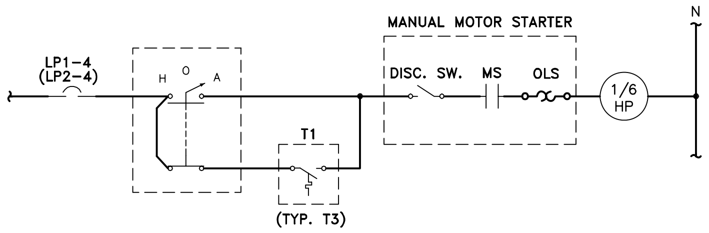
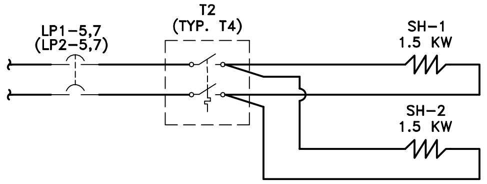


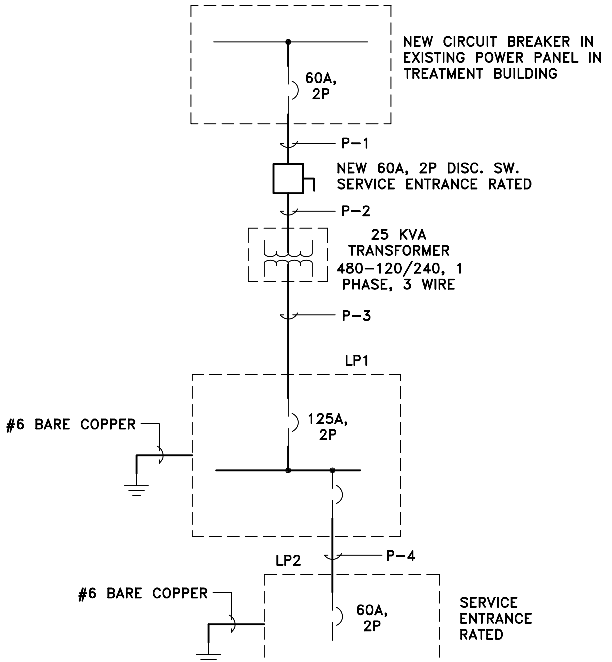
EXHAUST FAN EF-1

(TYPICAL FOR EF-2)
NOT TO SCALE



STRIP HEATER SH-1 & 2

(TYPICAL FOR SH-3 & 4)
NOT TO SCALE



ONE-LINE DIAGRAM

NOT TO SCALE

MECHANICAL SPECIFICATIONS:

LNAPL BELT SKIMMER

BELT OIL SKIMMER SHALL BE PETROXTRACTOR MODEL PX-A AS MANUFACTURED BY ABANAKI CORPORATION – OIL SKIMMER DIVISION WITH THE FOLLOWING:

- PX-A WITH TAIL WEIGHTED PULLEY, TAIL PULLEY SAFETY CABLE, PERFORATED HEAD PULLEY WITH SINGLE PHASE TEFC GEAR MOTOR
- 40' OF 1" WIDE OIL SKIMMING BELT (REACHES 35' DEEP)
- CERAMIC IMPREGNATED WIPER BLADES
- 4' MOUNTING STAND
- ON-OFF TIMER (WITH 1 HOUR INCREMENTS)
- PAD HEATERS FOR PX-A UNIT
- DRUM SHUT OFF SWITCH
- DRY RUN CONTACT FROM SKIMMER MOTOR

PRE-FABRICATED EQUIPMENT ENCLOSURES

PRE-FABRICATED ENCLOSURE SHALL BE OF THE FOLLOWING DIMENSIONS:

- RECOVERY WELLS NO. 1 & NO. 2 ENCLOSURES SHALL BE 8'-0" WIDE X 8'-0" LONG X 8'-0" HIGH

THE PRE-FABRICATED BUILDINGS SHALL BE EASI-SET PRECAST CONCRETE BUILDINGS FROM KISTNER CONCRETE PRODUCTS, INC. OF EAST PEMBROKE, NEW YORK COMPLETE WITH:

- 6'-0" WIDE, 18 GAUGE SECURITY DOOR WITH TAMPER PROOF HINGES, DEAD BOLT LOCKS
- AIR DUCT AND FLOOR PENETRATIONS AS SHOWN ON DRAWINGS
- RED BRICK EXTERIOR FINISH

SPILL CONTAINMENT UNIT

UNIT SHALL BE HEAVY-DUTY POLYETHYLENE CORROSION RESISTANT EAGLE HAZ-MAT SPILL CONTROL PALLET (51"x26-1/4"x19"), OR EQUAL, WITH 68 GALLON SPILL CAPACITY.

HVAC SPECIFICATIONS:

EF-1 & EF-2

CABINET EXHAUST FAN, 50 CFM @ 1/8" S.P., 120 VOLTS, SINGLE PHASE (0.8A), 30 WATTS, CARNES, VCDC005

SH-1 – SH-4

WALL MOUNTED SPACE HEATER, 1.5 KW, 240, SINGLE PHASE, CHROMALOX, TYPE H

LV-1 & LV-3

LOUVER, 12" X 12", RUSKIN, MODEL ELF211

LV-2 & LV-4

VENT LOUVER, 3" DIA., SEIHO, MODEL SFX

T1 & T3

THERMOSTAT, 120 VOLTS, SINGLE PHASE, HONEYWELL, MODEL T631A113

T2 & T4

THERMOSTAT, 240 VOLTS, SINGLE PHASE, HONEYWELL, MODEL T631A113

ELECTRICAL SPECIFICATIONS:

LP1

120/240 VAC, SINGLE PHASE, PANELBOARD, 225A BUS, 30 SPACE SURFACE MOUNTED, NEMA 4 ENCLOSURE, COVER, 125A MAIN, BRANCH BREAKERS AS SCHEDULED ON DRAWING, GENERAL ELECTRIC AQF 1302 AB, AB43 & AF43F, S

LP2

120/240 VAC, SINGLE PHASE PANELBOARD 100A BUS, 12 SPACE SURFACE MOUNTED, NEMA 4, ENCLOSURES, COVER, 60A MAIN, BRANCH BREAKERS AS SCHEDULED ON DRAWING, GENERAL ELECTRIC AQF 1121 AB, AB25 & AF25F, S

L-1

ENCLOSED AND GASKETED, CEILING MOUNTED, INCANDESCENT 120V WITH 100 WATT MEDIUM BASE LAMP, CLEAR GLOBE AND GUARD, GENERAL ELECTRIC H7115F3CDD

WIRE

600V, COPPER, 90øC DRY, 75øC WET, WITH PVC INSULATION AND NYLON JACKET, TYPE THHN/THWN

MANUAL MOTOR STARTER

MANUAL MOTOR STARTER, NEMA 4, SQUARE D TYPE KWIA CLASS 2510

SWITCHES

20A, 120V – 277V TOGGLE OPERATED SINGLE POLE. PASS & SEYMOUR LEGRAND MODEL 20ACI

GFI RECEPTACLE

20A GFI – PASS & SEYMOUR LEGRAND MODEL 2091-S

HOA

HEAVY-DUTY NON-ILLUMINATED SELECTOR SWITCH, 3 POSITION, GENERAL ELECTRIC CR104P MODEL SG34B91 WITH XN1BP070 NAME PLATE

CONDUIT (RGS)

RIGID GALVANIZED STEEL (RGS) TO BE USED OUTDOORS. ALLIED TUBE & CONDUIT CORPORATION, OR EQUAL.

CONDUIT (PVC)

POLYVINYL CHLORIDE (PVC) SCHEDULE 80, TO BE USED INDOORS, MINIMUM SIZE 3/4", SUPPORT EVERY 3 FEET. CARLON MODEL EPC-80 OR EQUAL

CIRCUIT BREAKER PANELBOARD – LP1								SCHEDULE			
LOCATION:			RECOVERY WELL NO. 1					FEED FROM		TREATMENT BUILDING	
MAIN BUS RATING:			225 AMPERES					120/240 VOLTS		1 PHASE, 3 WIRE	
MINIMUM SHORTCIRCUIT:			10,000 AMPERES					FEEDER CABLE		3 #1, 1 #6G, 1-1/2" C	
MAIN BREAKER TRIP:			125 AMPERES					SURFACE MTD		NEMA 4	
ESTIMATED CONNECTED LOAD:			9.17 KVA								
CIRCUIT	DESCRIPTION	C/B AMPS/ POLES	LOAD TYPE	KVA	PH-A	PH-B	KVA	LOAD TYPE	C/B AMPS/ POLES	DESCRIPTION	CIRCUIT
1	BELT SKIMMER	20/1P	MOTOR	1.176	1.356		0.180	RECPT	20/1P	RECEPTACLE	2
3	LIGHTS	20/1P	LIGHTS	0.200		0.230	0.030	MOTOR	20/1P	EXHAUST FAN	4
5	SPACE HEATERS	20A	HEAT	1.500	1.500				20A	SPARE	6
7	SPACE HEATERS	2P	HEAT	1.500		1.500			2P	SPARE	8
9	SUB-PANEL	60A	LP2	1.880	1.880				20/1P	SPARE	10
11	SUB-PANEL	2P	LP2	2.706		2.706			20/1P	SPARE	12
LOAD SUMMARY				8.962	4.736	4.436	0.210				

NOTE:

ALL CONDUCTORS TO BE #12 IN 3/4 INCH CONDUIT UNLESS OTHERWISE INDICATED

CIRCUIT BREAKER PANELBOARD – LP2								SCHEDULE			
LOCATION:			RECOVERY WELL NO. 2					FEED FROM		LP1	
MAIN BUS RATING:			100 AMPERES					120/240 VOLTS		1 PHASE, 3 WIRE	
MINIMUM SHORTCIRCUIT:			10,000 AMPERES					FEEDER CABLE		3 #6, 1 #8G, 1-1/2"C	
MAIN BREAKER TRIP:			60 AMPERES					SURFACE MTD		NEMA 4	
ESTIMATED CONNECTED LOAD:			4.586 KVA					SERVICE ENTRANCE RATED			
CIRCUIT	DESCRIPTION	C/B AMPS/ POLES	LOAD TYPE	KVA	PH-A	PH-B	KVA	LOAD TYPE	C/B AMPS/ POLES	DESCRIPTION	CIRCUIT
1	BELT SKIMMER	20/1P	MOTOR	1.176	1.356		0.180	RECPT	20/1P	RECEPTACLE	2
3	LIGHTS	20/1P	LIGHTS	0.200		0.230	0.030	MOTOR	20/1P	EXHAUST FAN	4
5	SPACE HEATERS	20A	HEAT	1.500	1.500				20A	SPARE	6
7	SPACE HEATERS	2P	HEAT	1.500		1.500			2P	SPARE	8
9	SPARE	20A							20/1P	SPARE	10
11	SPARE	2P							20/1P	SPARE	12
LOAD SUMMARY				4.376	1.88	1.730	0.210				

NOTE:

ALL CONDUCTORS TO BE #12 IN 3/4 INCH CONDUIT UNLESS OTHERWISE INDICATED

CONDUIT SCHEDULE

CONDUIT NUMBER	SIZE AND NO. CONDUCTOR	SIZE CONDUIT
P-1	2 #4, 1 #8G	1-1/2" RGS
P-2	2 #4, 1 #8G	1-1/2" RGS
P-3	3 #1, 1 #6G	1-1/2" PVC
P-4	3 #6, 1 #8G	1-1/2" RGS

NATIONAL GRID
M. WALLACE & SON, INC. SCRAPYARD
COBLESKILL, NEW YORK
OPERATION, MAINTENANCE AND MONITORING PLAN

ONE-LINE DIAGRAM, DETAILS, SPECIFICATIONS, AND CONDUIT SCHEDULE

ARCADIS BBL
infrastructure, environment, facilities

FIGURE
5

SYR-85-RCA LAF KLS LAYER: ON=*, OFF=*REF*
F:\ACTIVE\-DWG\ACT\36417390\36417E01.DWG SAVED:1/12/2007 10:02 AM LAYOUT:DL PAGESETUP:---- PENTABLE:PLTFULL.CTB PRINTED:1/12/2007 10:02 AM BY:KSARTORI
PROJECTNAME:----
XREFS: IMAGES:

Attachments

Attachment 1

New York State Department of Environmental Conservation February 13, 2004 Letter To Green & Seifter

New York State Department of Environmental Conservation
Division of Environmental Remediation, 12th Floor
625 Broadway, Albany, New York 12233-7011
Phone: (518) 402-9706 · **FAX:** (518) 402-9020
Website: www.dec.state.ny.us

Erin M. Crotty
Commissioner

February 13, 2004

Via Fax and Regular Mail

Douglas H. Zamelis, Esq.
Green & Seifter
One Lincoln Center
Syracuse, NY 13202-1387

Re: M. Wallace & Son, Inc. Site
Site No. 4-48-003

Dear Mr. Zamelis:

This letter is in response to your petition on behalf of M. Wallace and Son Inc., to modify the boundaries of the Inactive Hazardous Waste Disposal Site known as the M. Wallace and Son site (hereinafter the "Site"). The Site is currently listed as a class "2" site on New York's *Registry of Inactive Hazardous Waste Disposal Sites*.

Initially, it should be noted that while your petition requests a modification of the boundary of the Site (petition, paragraph 3), a boundary modification has the effect to exclude certain areas of the Site from the *Registry*. The request is, therefore, properly a request for deletion from the *Registry* pursuant to 6 NYCRR 375-1.9(b). Accordingly, the Department will treat your petition as such.

In support of your petition you rely on the fact that the Site has been remediated under the Department's Superfund Program with all significant threats having been eliminated. Completion of a remedy at a class "2" site is grounds for a re-classification, but not necessarily a deletion from the *Registry*. In some instances, site remedial programs require continued maintenance and long term monitoring of the Site to ensure that the remedy remains in place and effective. In such cases, site reclassification from "2" to "4" is appropriate. A class "4" site is defined in the regulations as "a site... that requires continued operation, maintenance and/or monitoring." See 6 NYCRR 375-1.8(a)2.

The remedy selected in the Record of Decision for the Wallace Site requires significant long term operation and maintenance. Specifically, the remedy includes the long term recovery of light non-aqueous phase liquid (LNAPL) from the groundwater together with a 300 gallon per minute water treatment system. Certain groundwater recovery wells, pump houses and treatment systems are located on or immediately adjacent to the area sought to be excluded. Due to the required access to, and operation of, this system, the Department must deny your request to delete a portion of the property from the Site. Please be advised, however, that upon approval by the Department of the operation, maintenance and monitoring plan for the Site, along with the filing of a Department approved restrictive covenant in the chain of title, the Department will begin the process to change the site classification to a class "4" site.

Finally, the petition and supporting affidavit indicate that the underlying reason for seeking to modify the Site boundary is so that the owner may reuse the northwest portion of the Site for storage of materials. I will accept the petition and supporting papers as a request for a change of use of the Site pursuant to 6 NYCRR 375-1.6. Upon review of these documents as well as the Record of Decision and approved final remedial action report, the Department consents to the proposed change of use of this portion of the Site consistent with local laws and ordinances, and in such a manner as will not impede or interfere with the operation and maintenance of the remedy.

In summary, your petition to modify has been deemed a petition to delist, which has been denied. However, the Department has accepted your petition as a request for a change of use for the northwest portion of the site which request is granted subject to the conditions noted above.

Very truly yours,

Dale A. Desnoyers

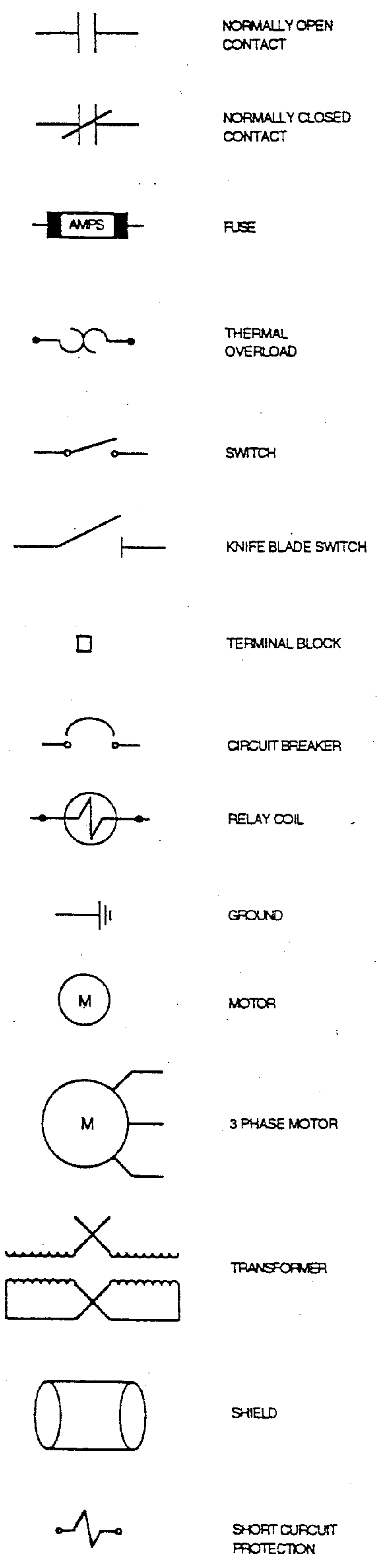
Dale A. Desnoyers
Director
Division of Environmental Remediation

Attachment 2

100 gpm and 300 gpm Quarry Pond Water Treatment Systems Process and Instrumentation Diagrams

BBL®
an ARCADIS company

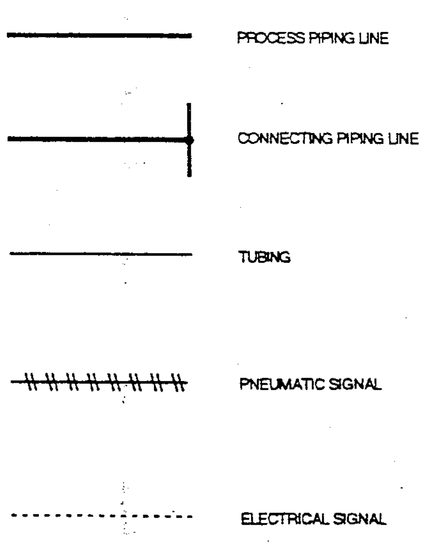
ELECTRICAL SYMBOLS



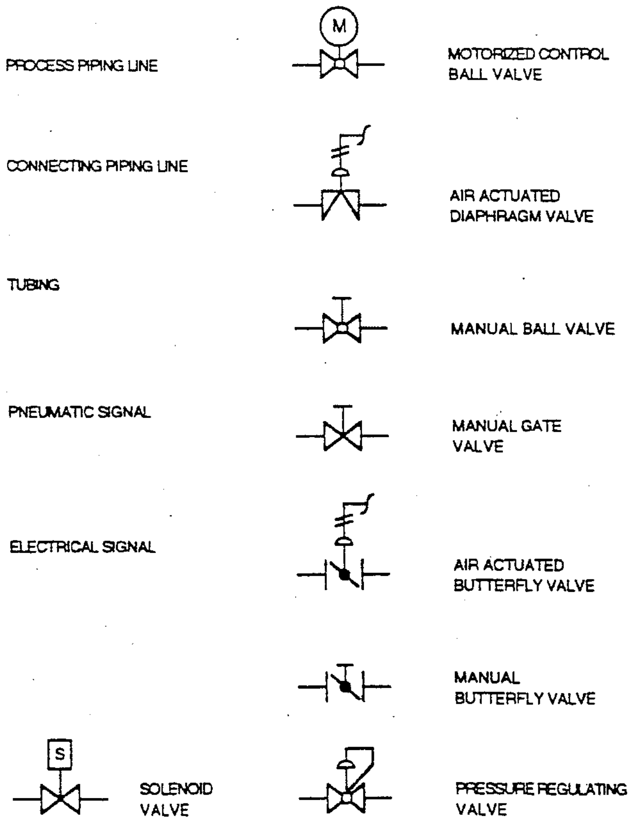
IDENTIFICATION LETTERS

LETTER	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		REJECT	USER'S CHOICE	USER'S CHOICE
C	CONDUCTIVITY			CONTROL	
D	SAMPLE	DIFFERENTIAL			
E	VOLTAGE		SENSOR PRIMARY ELEMENT		
F	FLOW RATE	RATIO (FRACTION)			
G	PILOT		GLASS VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	SCAN			
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT (PILOT)		LOW
M	MOTOR	MOMENTARY			MIDDLE, INTERMEDIATE
O	TIE-IN		ORIFICE, RESTRICTION		
P	PRESSURE AND VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE			
R	RADIATION		RECORD		
S	SOLENOID	SAFETY		SWITCH	
T	TEMPERATURE			TRANSMIT	
U	MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION			VALVE, DAMPER, LOUVER	
W	WEIGHT, FORCE		WELL		
Y	EVENT, STATE	Y-AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z-AXIS		DRIVER, ACTUATOR	

LINE DESIGNATION



VALVE SYMBOLS



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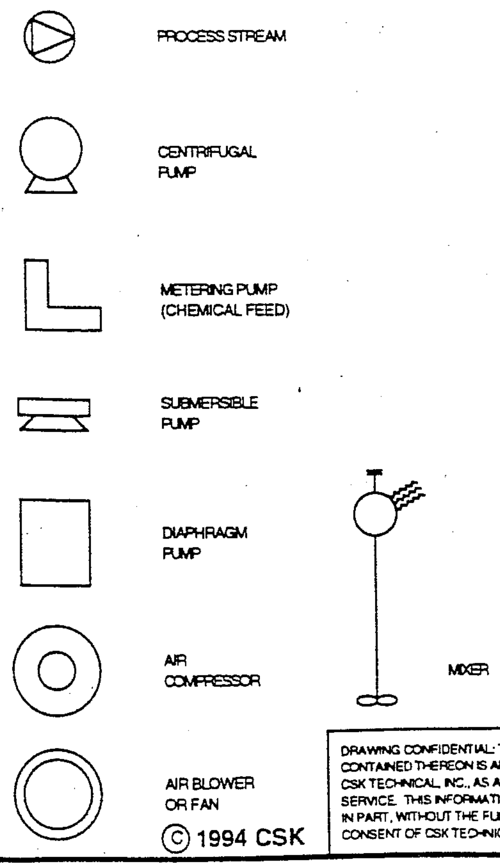

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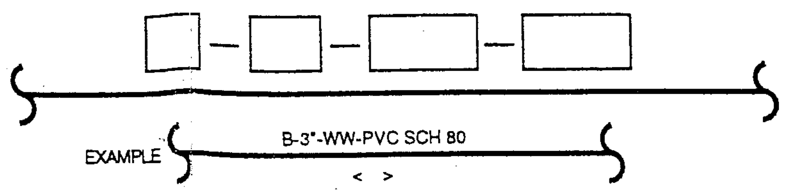
PIPING NOMENCLATURE

(SEE OTHER PIPING SPECIFICATIONS FOR FLUID & MATERIAL SYMBOLS)



INSULATION		
B	=	BARE (NOT INSULATED)
I	=	INSULATED
T(S)	=	INSULATED & STEAM TRACED
T(E)	=	INSULATED & ELECTRIC TRACED
I(P)	=	INSULATED FOR PERSONNEL PROTECTION
< >	=	INSULATION THICKNESS AND TYPE

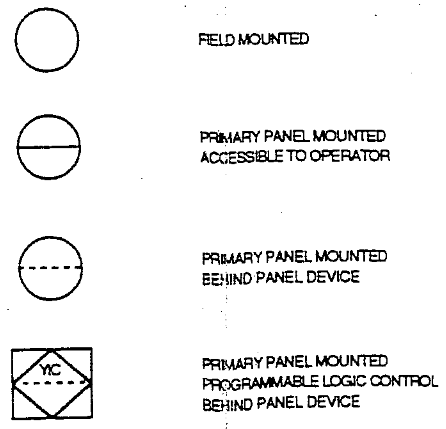
LINE SIZE

ANY SIZE PIPING

FLUID SYMBOL		
W	=	WATER
WW	=	WASTE WATER
CHEM	=	CHEMICAL
CW	=	CLEAN WATER
TW	=	TREATED WATER

PIPE MAT'L SYMBOL		
HDPE	=	HIGH DENSITY POLYETHYLENE
PVC	=	POLYVINYLCHLORIDE
SS	=	STAINLESS STEEL
BP	=	BLACK IRON PIPE
PE	=	POLYETHYLENE
SCH 40	=	STANDARD PIPE
SCH 80	=	EXTRA STRONG PIPE

INSTRUMENTATION SYMBOLS



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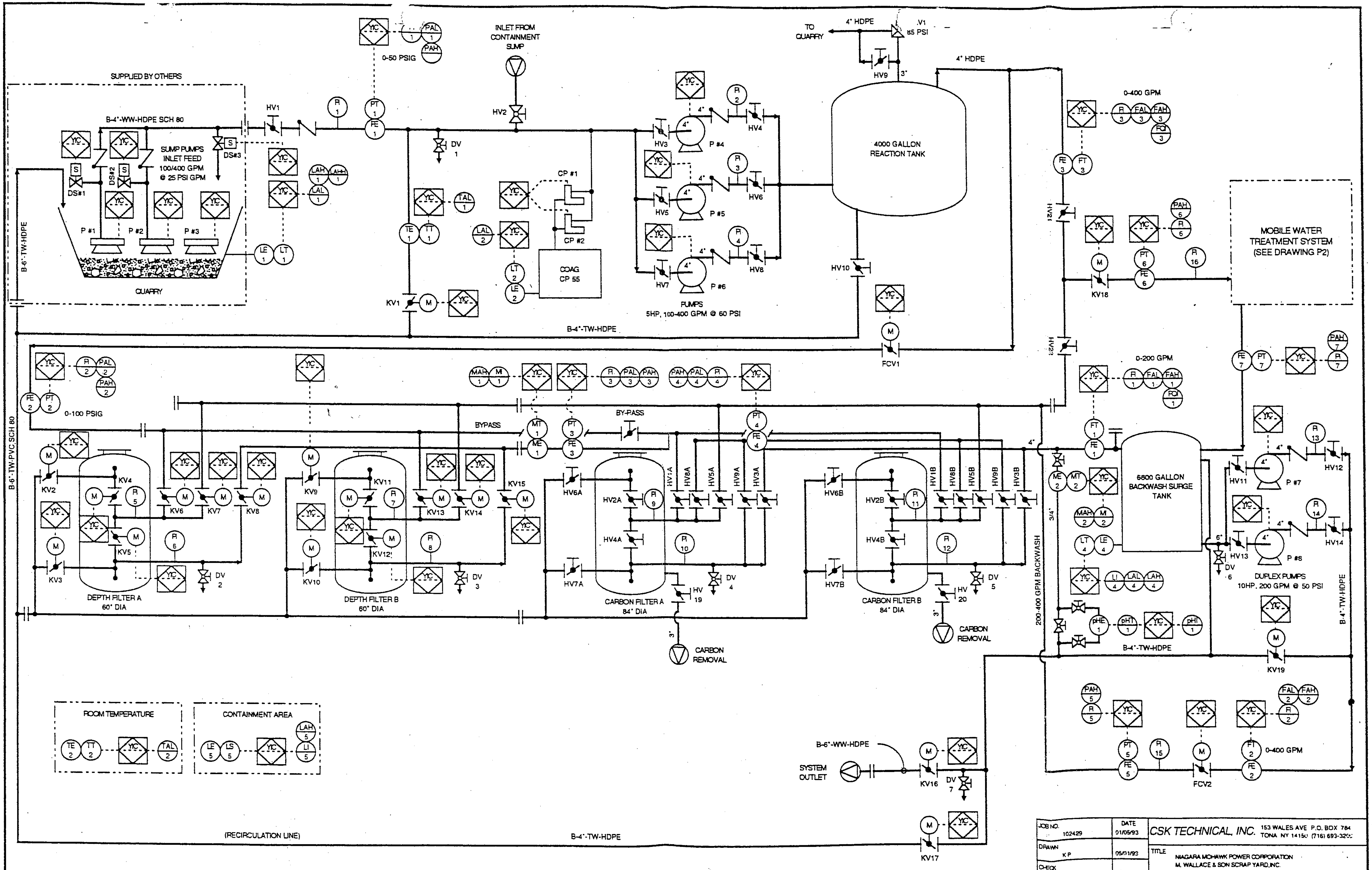
JOB NO. 102429	DATE 01/05/93	CSK TECHNICAL, INC. 153 WALES, P.O BOX 784 TONA NY 14150 (716) 893-3200
DRAWN KP	05/01/93	TITLE NIAGARA MOHAWK POWER CORPORATION M. WALLACE & SON SCRAP YARD, INC. COBLESKILL, NEW YORK 100 GPM QUARRY WATER TREATMENT AND PCB REMOVAL SYSTEM LETTER AND SYMBOL IDENTIFICATION CHART
CHECK RP	05/04/93	
ENGINEERING		SIZE D | FSCM NO. | DWG NO. TS1
PRODUCTION		
REVISION NO		SCALE NTS | RELEASE DATE | SHEET 1 OF 1



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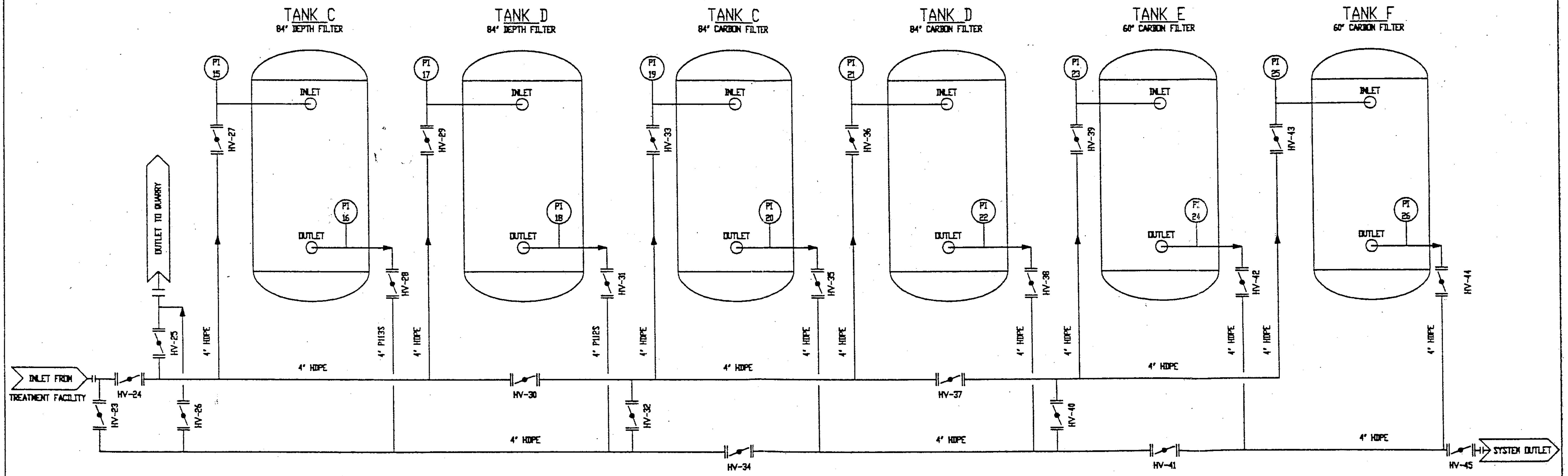
JOB NO.	102429	01/05/93
DRAWN	K P	05/01/93
CHECK	RP	05/04/93
ENGINEERING	S.K	05/01/93
PRODUCTION		
REVISION NO	10	11/10/94

CSK TECHNICAL, INC. 153 WALES AVE P.O. BOX 784
TONA NY 1415[illegible] (716) 693-32[illegible]

TITLE
NIAGARA MOHAWK POWER CORPORATION
M. WALLACE & SON SCRAP YARD, INC.
COBLESKILL NEW YORK
100 GPM QUARRY WATER TREATMENT AND PCB
REMOVAL SYSTEM PROCESS AND INSTRUMENTATION DIAGRAM

SIZE D | FSCM NO. | DWG NO P1
SCALE NTS | RELEASE DATE | SHEET 1 of 1



DRAWN K.D.P	DATE 01-25-05	CSK TECHNICAL, INC. 183 WALES AVE. P.O. BOX 794 TONAWANDA, NEW YORK 14150	
APPROVED	DATE	TITLE CSK TECHNICAL, INC. NIAGARA MOHAWK POWER CORPORATION N. WALLACE SITE, COBLESKILL, NEW YORK 300 GPM MOBILE WATER TREATMENT SYSTEM	
PROJECT ENGINEER W.J.B & T.A	DATE 12-15-04		
PROJECT MANAGER T.A	DATE 12-15-04	SIZE D | DWG NO. 102429-01-P2-00 | REV #	VERSION # 00
		SCALE: NTS | CSK REF. NO. P0000000	

Attachment 3

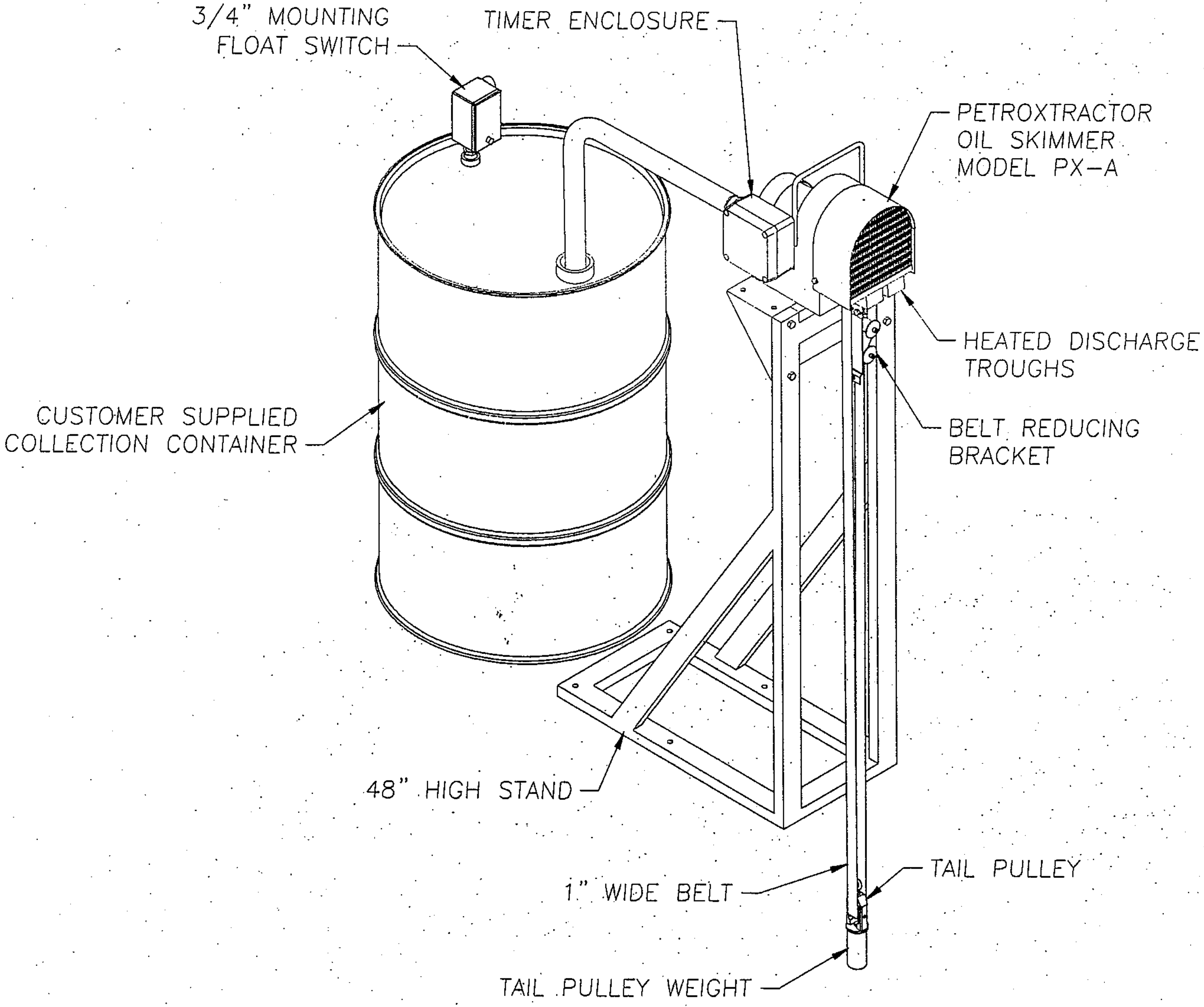
Belt Skimmer Installation and Maintenance Instructions

ABANAKI

PETROXTRACTOR® WELL OIL SKIMMER

MODEL PX-A

Installation and Maintenance Instructions



Your Abanaki PetroXtractor® Well Oil Skimmer has been manufactured and packaged to rigorous standards of design and service. Proper installation and maintenance of the unit is essential for efficient oil removal and long lasting use.
We have tried to make these instructions as clear as possible. If you have any questions, please call: 1-800-358-7546

ABANAKI
CORPORATION
OIL SKIMMER DIVISION

17387 Munn Road
Chagrin Falls, OH 44023
Telephone: 800-358-7546
Fax: 440-543-7404

PetroXtractor® PX-A
Installation and Maintenance Instructions

Your Abanaki PetroXtractor® PX-A is shipped with these items:
1. Base Unit.
2. 4' High Stand with Mounting Bracket.
3. Float Switch, Timer Enclosure w/Bracket.
4. Tether, Tail Pulley & Weight.
5. Belt.

Step 1. Mount the PetroXtractor® on the Mounting Bracket which is attached to the top of the stand. Use 3/8"-16 x 1" bolts with washers and nuts. (Mount in the direction shown on cover page.) Position the stand in the desired location and fasten to floor.

Step 2. Remove the cover by unbolting the two 1/4-20 bolts, one on each side, and lift off.

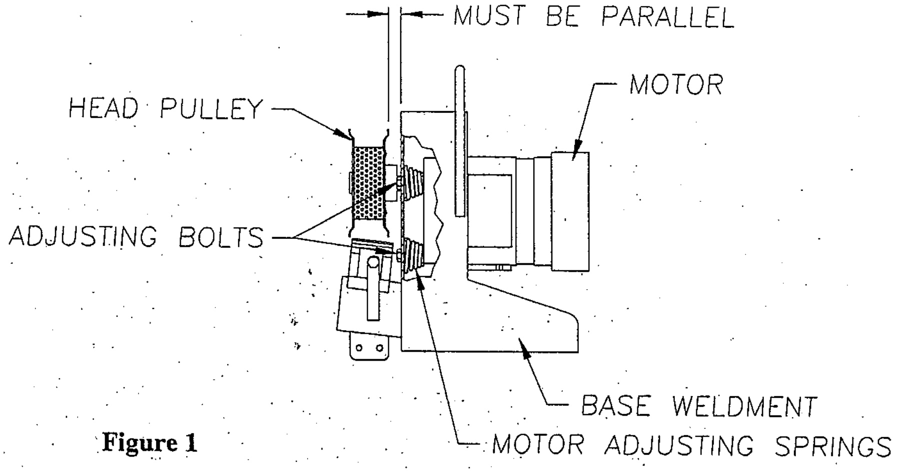


Figure 1

Step 3. Make sure head pulley is parallel to base weldment. **(See Fig. 1)** To adjust, loosen or tighten the three bolts behind head pulley. These bolts are attached to the motor with adjusting springs between them.

Step 4. Loop the belt over the head pulley, threading one side between the wiper blades. After threading through wiper blades and down between troughs, thread belt through the belt reducing bracket.
(See Fig. 2 & 3). (If belt is marked on the inside with direction arrows, make sure arrows face in the direction of travel.)

Step 5. Attach the 1-1/4" I.D. discharge hose onto the coupling on the back of the unit, underneath the motor. Connect sufficient length of hose from discharge pipe to customer oil drum.

Step 6. Lower the belt into the well. Allow 6"-12" above the bottom. **The belt should <u>NOT</u> bottom out in the well.**

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Step 7. After tail pulley with belt is lowered into well and **ALL** weight is on the belt, hook the tail pulley retaining cable to the bottom of the belt reducing bracket with slack in the cable. **(See Fig. 2)**

Step 8. Adjustable wiper blade should just make contact with the belt. Carefully adjust the wiper adjusting bolt on the outside wiper blade so that both blades are gently wiping the belt. **(See Fig. 4)**

Step 9. Plug unit into a grounded outlet.

Step 10. To replace the cover, stand in front of unit with belt towards you. Be sure pressure wheel rolls to the right of head pulley centerline, push the cover straight down, bolt into place.

Step 11. Install Float Switch into drum using the supplementary instructions enclosed.

Step 12. Set timer in timer control box to the times operation of skimmer is desired.

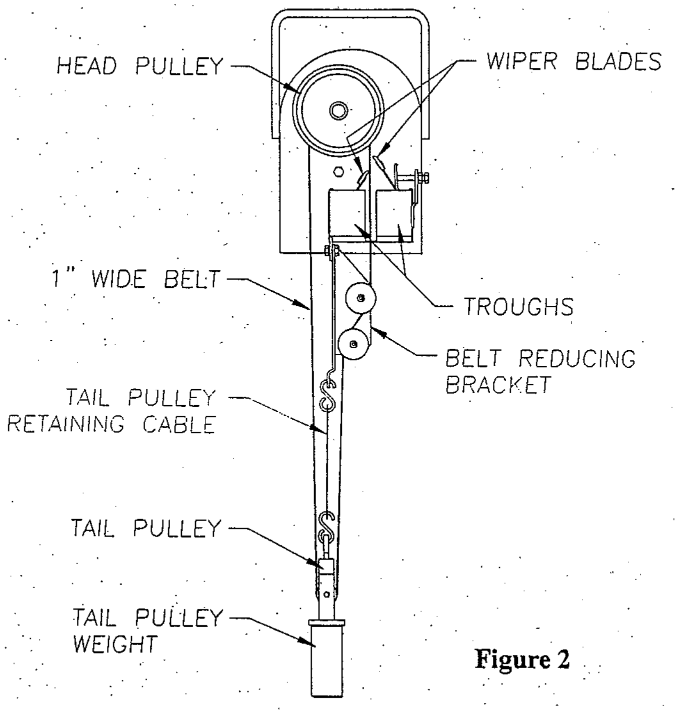

Figure 2

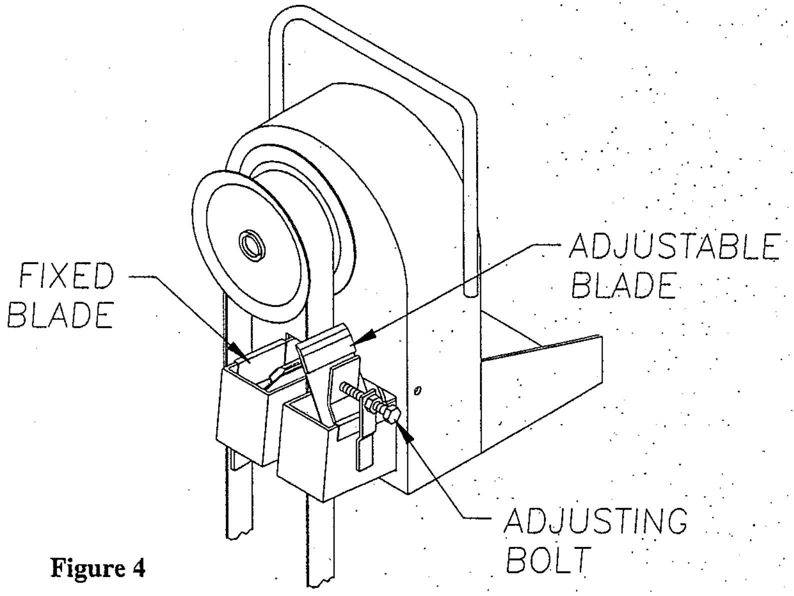

Figure 4

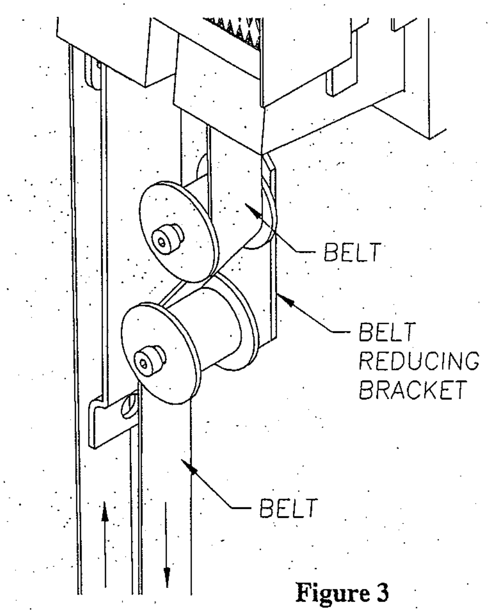

Figure 3

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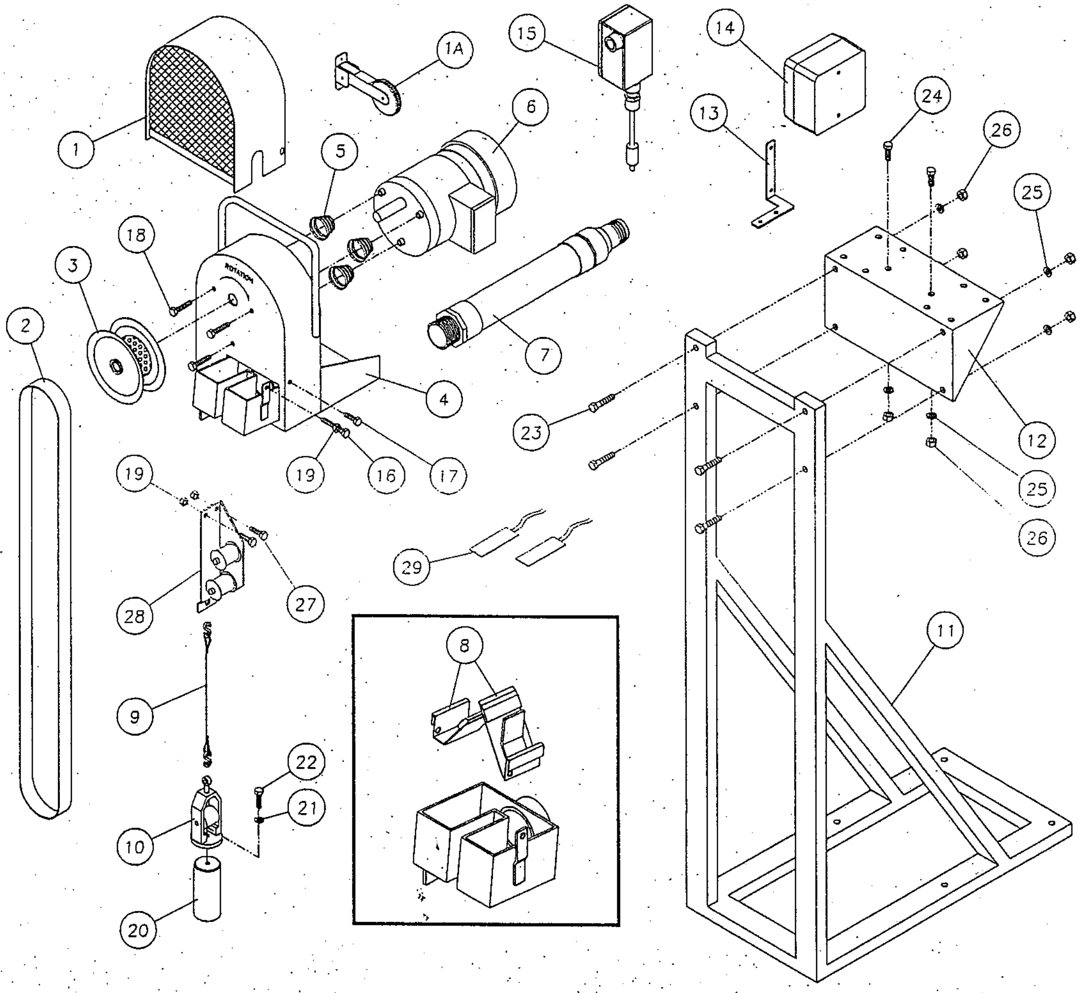
ABANAKI
CORPORATION
OIL SKIMMER DIVISION

17387 Munn Road
Chagrin Falls, OH 44023
Telephone: 800-358-7546
Fax: 440-543-7404

PetroXtractor® PX-A
Installation and Maintenance Instructions



Item	Qty	Part Name	Part Number	Item	Qty	Part Name	Part Number
1	1	Cover	PT1HPCO	15	1	Float Switch ¾" Dia.	EFLOATSW00
1A	1	Pressure Wheel	PMWPRESWHEELASY	16	1	1/4-20 x 1-1/2" Full Thd Bolt	N/A
2	1	1" LFO Fuzzy Belt	BT1F-0000	17	2	1/4-20 x 5/8" Hex Bolt	N/A
3	1	Perforated Head Pulley	PPXAHP-PER	18	3	1/4-20 x 3/4" Hex Bolt	N/A
4	1	Base Weldment	WT1C0000	19	3	1/4-20 Hex Nut	N/A
5	3	Motor Adjusting Springs	PSPRING02	20	1	Weight	VMWCTNWTS
6	1	30RPM Gear Motor w/plug	MGG128M30	21	1	1/4" Lockwasher	N/A
7	1	Discharge Pipe	Call Factory	22	1	1/4-20 x 1" Hex Bolt	N/A
8	1	Hybrid UHC Wiper Set	PT1WBUHC	23	4	3/8-16 x 1-3/4" Lg. Hex Bolt	N/A
9	1	Retaining Cable	V3691T122	24	2	3/8-16 x 1" Lg. Hex Bolt	N/A
10	1	Tail Pulley	PPXATP	25	6	3/8" Lockwasher	N/A
11	1	48" High Stand	OSTANDTI	26	6	3/8-16 Hex Nut	N/A
12	1	Skimmer Mounting Bracket	Call Factory	27	2	1/4-20 x 1/2" Hex Bolt	N/A
13	1	Timer Enclosure Mtg. Bracket	Call Factory	28	1	Belt Reducing Bracket	PPXABELTREDASSY
14	1	Timer Enclosure	OETIME4PLAS	29	1	Trough Heater Set	OHEAT2"TOTE-IT

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PETROXTRACTOR MAINTENANCE

1. Belt is shipped on tail pulley. If it becomes necessary to remove, or to replace the belt, simply follow the steps below: **(See Fig. 5)**

A. If tail pulley has weight attached to bottom side, remove and set aside.
B. Remove one of the screws on tail pulley bottom, and loosen second screw.
C. Rotate bottom and either remove or replace belt.
D. Rotate bottom back. Tigthen the loose screw, and replace the screw removed.
E. Re-attach weight.

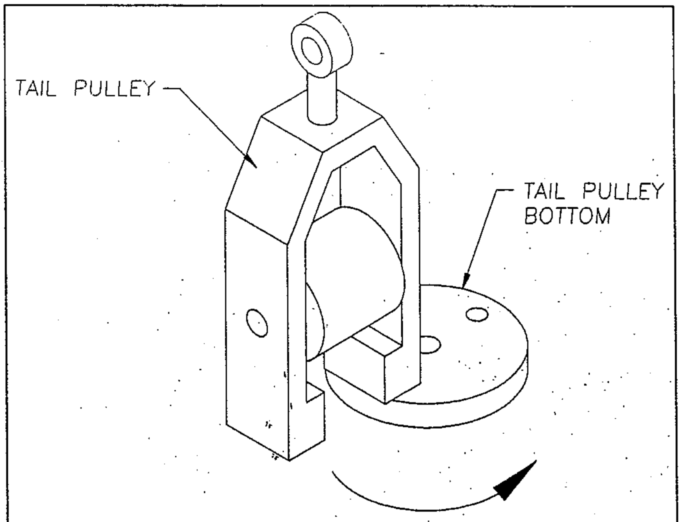

Figure 5

2. Check and clean head pulley. Particles embedded in wheel could damage the belt.

3. Check and adjust time setting on timer.

4. Inspect discharge troughs and hose, cleaning if necessary.

5. Inspect drum float switch, cleaning if necessary.

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Attachment 4

Backflow Prevention Device Test Results

BBL®
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NEW YORK STATE DEPARTMENT OF HEALTH
Bureau of Public Water Supply Protection

Report on Test and Maintenance of Backflow Prevention Device

Part A

Please use a separate form for each device.

For the year 2002
☒ Initial test - Complete entire form
☐ Annual test - Complete Part A only

Public Water Supply Cobleskill	Account No.	County Schoharie	Block	Lot

Facility Name Wallace Scrap yard
Address Elm St. Cobleskill 12043 (street, city, zip)
Location of Device Rest Room ..

Device information	Manufacturer watts.	Type ☒ RPZ ☐ DCV	Model 909	Size (in inches) 1"	Serial Number 520299

	Check Valve No. 1	Check Valve No. 2	Differential Pressure Relief Valve	Line Pressure 75 psi
Test before repair	Leaked ☐ Closed tight ☒ Pressure drop across first check valve 2.6 psid	Leaked ☐ Closed tight ☒	Opened at 3.4 psid	Date 05 20 02 (m d y)
Describe repairs and materials used	Unit Relocated Higher			Repaired by Name Contractor Lic # Date repaired 05 17 02 (m d y)
Final test	Closed tight ☐ Pressure drop across first check valve ____ psid	Closed tight ☐	Opened at ____ psid	Date ☐☐ ☐☐ ☐☐ (m d y)

Water Meter Number No. Number	Meter Reading 94	Type of Service: (check one) ☒ Domestic ☐ Fire ☐ Other

Remarks (Describe deficiencies; bypasses, outlets before the device, connections between the service and point of entry, missing or inadequate airgap, etc.)

Certification: This device ☒ meets, ☐ does NOT meet, the requirements of an acceptable containment device at the time of testing. I hereby certify the foregoing data to be correct.

Robert Kenyon	4729	Robert J. Kenyon	11/30/03
Print Name	Certified Tester No.	Signature	Expiration Date

Property owner's (or owner's agent) certification that test was performed:

Arthur Wallace	Pres.	Art Wallace	(518) 234-2591
Print Name	Title	Signature	Telephone

Part B Certification that installation is in accordance with the approved plans. (To be completed by the design engineer or architect or water supplier.)

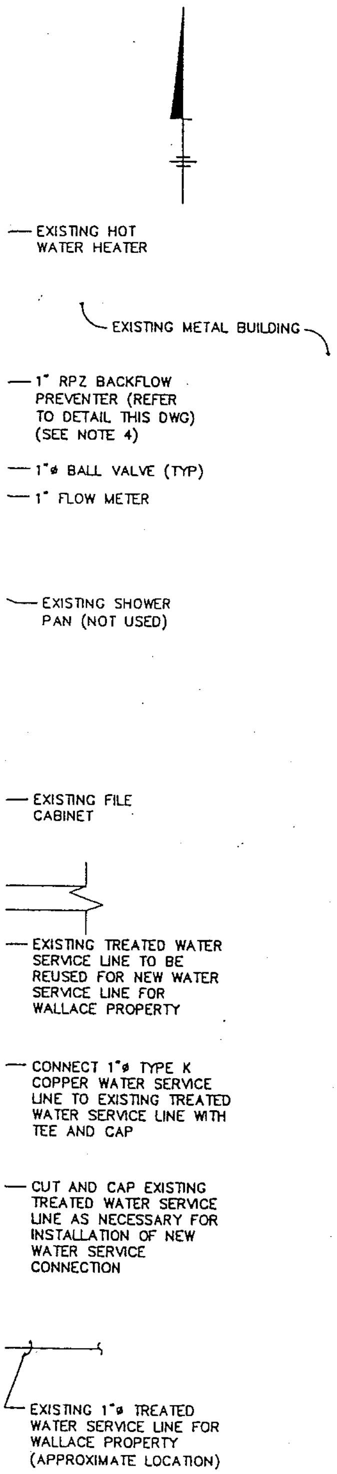
I hereby certify that this installation has been made in accordance with the approved plans.

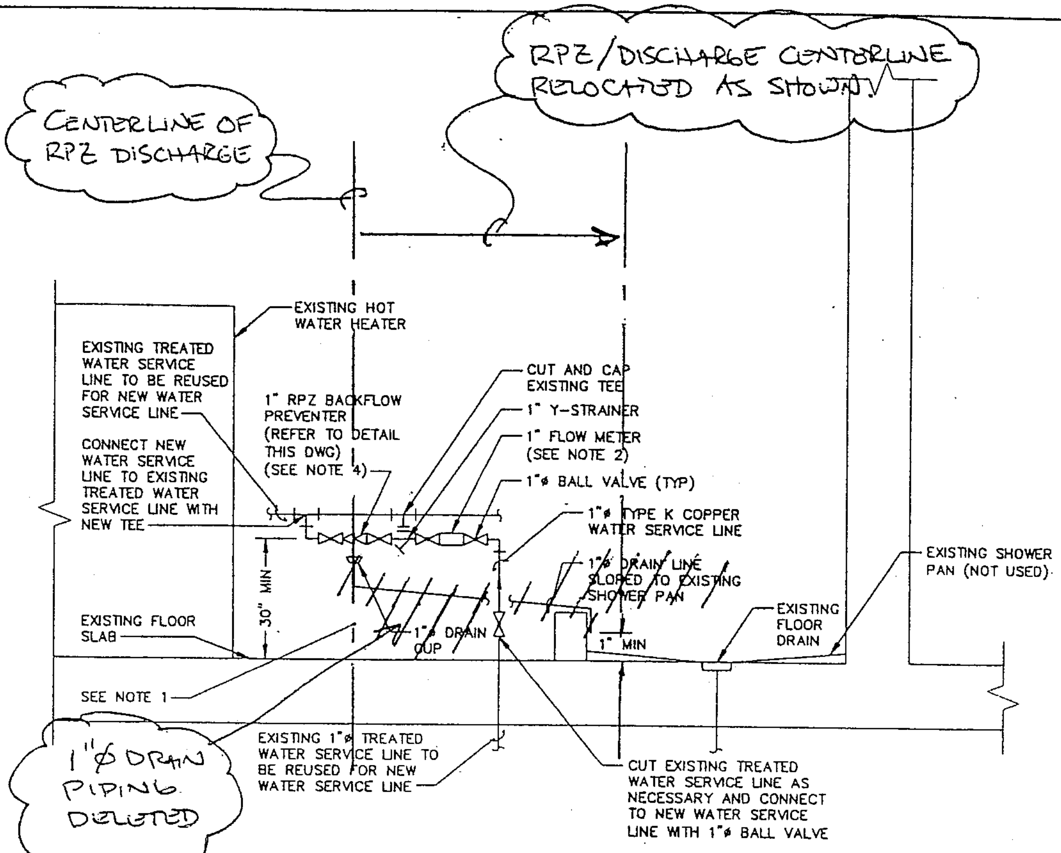
Name DONALD F. GEISSER
Title VICE PRESIDENT
License Number 57879
Phone (315) 446-9120
Date ☐☐ ☐☐ ☐☐ (m d y)
NYS DOH Log #
Representing BLASLAND, BOUCK & LEE, INC.
Address 6723 TOWPATH ROAD, P.O. BOX 66
City SYRACUSE State NY Zip 13214
Signature Donald G

Describe minor installation changes
MINOR HORIZONTAL RELOCATION SO THAT RPZ DISCHARGE IS DIRECTED TO AN EXISTING FLOOR DRAIN W/O THE NEED FOR A SEPARATE DRAIN PIPE. (SEE ATTACHED SKETCH 1).

NOTE: Send one completed copy to the designated health department representative and one copy to the water supplier within 30 days of testing of the device.

DOH-1013 (9/91) Notify owner and water supplier immediately if device fails test and repairs cannot immediately be made.



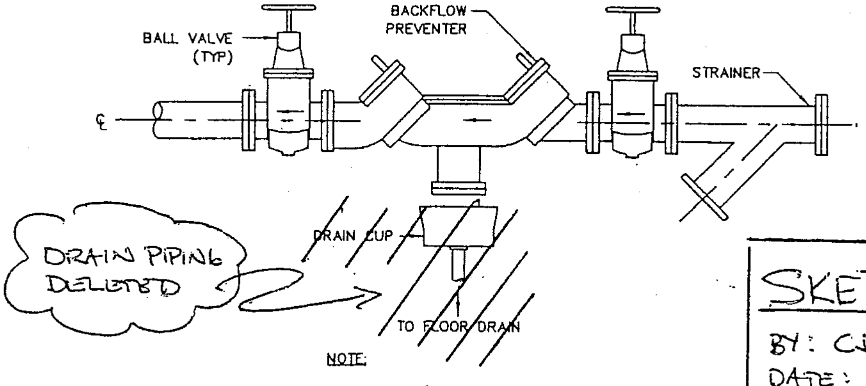


ELEVATION A-A

NOT TO SCALE

NOTES:

1. EXISTING WATER PUMP (NOT IN SERVICE) AND ASSOCIATED ABOVE GRADE PIPING TO BE REMOVED AND TURNED OVER TO OWNER.
2. BACKFLOW PREVENTER, FLOW METER AND ASSOCIATED PIPING TO BE MOUNTED NO HIGHER THAN 3'-6" A.F.F. AND AT LEAST 8" FROM BACK WALL.
3. ALL PIPING, VALVES, FIXTURES, BACKFLOW PREVENTER AND METER SHALL BE SECURELY SUPPORTED TO WALL.
4. CONTRACTOR SHALL INSTALL RPZ BACKFLOW PREVENTER IN ACCORDANCE WITH MP SECTION 02661.



NOTE:

1. PROVIDE A 2" AIR GAP BETWEEN DRAIN CAP AND BACKFLOW PREVENTER.

SKETCH 1
BY: CJL
DATE: 7/29/02

TYPICAL BACKFLOW PREVENTER DETAIL

NOT TO SCALE

BL
JCK & LEE, INC.
& scientists

NIAGARA MOHAWK POWER CORPORATION • M. WALLACE AND SON, INC. SCRAPYARD SITE • COBLESKILL, NEW YORK
VILLAGE OF COBLESKILL PUBLIC WATER SUPPLY EXTENSION

WALLACE PROPERTY PARTIAL PLAN, ELEVATION AND DETAIL

File Number
364.17.XXF

Date
SEPTEMBER 2001

Blasland, Bouck & Lee, Inc.
Corporate Headquarters
6723 Towpath Road
Syracuse, NY 13214
315-446-9120

8

Attachment 5

New York State Department of Health January 5, 2004 Letter to M. Wallace & Son, Inc.

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NEW YORK STATE DEPARTMENT OF HEALTH
Bureau of Public Water Supply Protection

Approval of Completed Works for Public Water Supply Improvement

This approval is issued under provisions of 10 NYCRR, Part 5

Applicant Name M. Wallace & Son, Inc.

(city, town, village)
Location of Works Elm Street Cobleskill, NY

County Schoharie

(specific area served)
Water District Cobleskill Village

Mo Day Yr
Plans for the construction of this project were approved on November 29, 2001 .

This approval for completed works is issued subject to the following conditions:

That all conditions of the November 30, 2001 approval letter be met, except that testing the device is required every three years (next due in calendar year 2005) as long as the establishment remains essentially as an office. Should the activity change, annual testing will be required. This condition has been approved by the Water Superintendent for the Village of Cobleskill.

The "as built" plans show that the device has been moved horizontally toward the existing floor drain eliminating the need for a separate drain pipe.

ISSUED FOR THE STATE COMMISSIONER OF HEALTH

, P.E.
Designated Representative

Mo Day Yr
January 5, 2004
Date

Please Print

Name Carl J. Stefanik

Title Public Health Director

cc: Jeff Pangman, Water Superintendent
Blasland Bouck & Lee, Inc. -Engineers
Niagara Mohawk, James F. Morgan

DOH-1032 (4/92)

Attachment 6

NYSDEC's April 14, 2006 Letter to National Grid

BBL®
an ARCADIS company

New York State Department of Environmental Conservation
Office of Environmental Quality, Region 4
1150 North Westcott Road, Schenectady, New York 12306-2014
Phone: (518) 357-2045 • **FAX:** (518) 357-2398
Website: www.dec.state.ny.us

Denise M. Sheehan
Commissioner

April 14, 2006

Mr. James Morgan
National Grid
300 Erie Boulevard West
Syracuse, NY 13202

Re: Approval of the Operation, Maintenance, and Monitoring Plan for the Northwest Portion of the M. Wallace and Son site (#448003)

Dear Mr. Morgan:

The New York State Department of Environmental Conservation has reviewed the "Maintenance and Monitoring Plan for the Northwest Portion of the M. Wallace and Son, Inc. Scrap Yard Site" (dated February 2006), for that portion of the remediated site to be used by Art Wallace. That operation, maintenance, and monitoring (OM&M) plan is approved.

Please contact me at (518) 357-2374 with any questions or comments.

Sincerely,

Daniel Lightsey

Daniel Lightsey, P.E.
Environmental Engineer 2
Region 4

ec: E. Belmore
A. Geisendorfer
C. O'Neill
S. Madden
M. VanValkenburg - NYSDOH
D. Munro, Esq. - NYSDOL
D. Zamelis, Esq. - Green & Seifter, One Lincoln Center, Syracuse, New York 13202

DL/co James Morgan - National Grid 4-14-06

Appendices

Field Sampling Plan

nationalgrid

Operation, Maintenance and Monitoring Plan
M. Wallace and Son, Inc. Scrapyard Site
Cobleskill, New York

Revised
January 2007

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Field Sampling Plan

nationalgrid

Operation, Maintenance and Monitoring Plan
M. Wallace and Son, Inc. Scrapyard Site
Cobleskill, New York

Revised
January 2007

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Table of Contents

Acronyms and Abbreviations

Tables

Exhibits

1. Introduction

1.1 General

This *Field Sampling Plan* (FSP) supports the *Operation, Maintenance and Monitoring Plan* (OM&M Plan) for the M. Wallace and Son, Inc. Scrapyard Site (Site) located in Cobleskill, New York. The OM&M Plan provides the details and information necessary for the OM&M activities to be conducted by ARCADIS BBL, on behalf of National Grid, in association with the New York State Department of Environmental Conservation- (NYSDEC-) selected remedy.

This FSP presents the field procedures and sample collection methods to be followed during implementation of the field monitoring and sampling activities presented in the OM&M Plan. Related documents include the *Quality Assurance Project Plan* (QAPP) and the *Health and Safety Plan* (HASP), which are included as Appendix B and Appendix C, respectively, of the OM&M Plan.

1.2 Overview of the Operation, Maintenance and Monitoring Activities

The following sampling/monitoring activities will be conducted as part of the OM&M activities at the Site:

- Collect water samples from the quarry pond water treatment system(s) and measure the pH (Exhibit C); and
- Collect groundwater samples from offsite coreholes (Exhibit B) and monitor for absence/presence of light nonaqueous phase liquid (LNAPL).
- Collect fish samples from offsite locations in Cobleskill Creek and the unnamed tributary to Cobleskill Creek (unnamed tributary).

This FSP also provides procedures to be followed for the activities identified below to be conducted during the OM&M activities:

- The packing, handling, and shipping procedures for laboratory analytical samples (Exhibit A);
- The calibration, operation and maintenance of field measurement/monitoring equipment (Exhibit D); and
- The decontamination and cleaning procedures for non-dedicated equipment (Exhibit E).

The rationale for each sampling/monitoring activity detailed in this FSP has been provided in the OM&M Plan.

2. Field Sampling Activities

2.1 General

This section presents the details associated with implementing the groundwater, quarry pond water treatment system and fish sampling activities to be conducted as part of the OM&M activities. The following information is provided for each sampling/monitoring activity:

- Proposed sample type;
- Procedures for sampling activities, measuring field parameters (i.e., pH, conductivity, dissolved oxygen, temperature), and monitoring groundwater elevations and LNAPL thickness (if present); and
- A summary of the data to be generated during OM&M activities.

Detailed information regarding the frequency of environmental and quality control samples to be collected and the corresponding parameters to be analyzed during the OM&M activities is presented in Table 1. Information regarding the sample containers, preservation, and holding times for samples is presented in Table 2. Detailed sample collection procedures are provided in the exhibits to this FSP.

2.2 Groundwater Sampling Activities

The groundwater sampling activities to be conducted as part of the OM&M activities include:

- Collecting groundwater samples from offsite coreholes.

The groundwater sampling field activities are described below.

2.2.1 Offsite Groundwater Sampling

Offsite groundwater samples will be collected from select monitoring wells (C-20, C-21, and C-22) as described in the OM&M Plan using the procedures presented in Exhibit B. Prior to collecting samples, each monitoring well will be checked for the absence/presence of LNAPL with an oil/water interface probe. If a separate phase is present, the thickness will be measured with the probe and subsequently removed with a bailer or alternate method (oil sorbing sock). Three well volumes will then be purged (or field parameters have stabilized as noted in Exhibit B) from each well using low-flow pumping methods or disposable bailers. Following purging, groundwater samples will be collected from each well and submitted for laboratory analysis for filtered and unfiltered polychlorinated biphenyl (PCB) analyses using United States Environmental Protection Agency (USEPA) SW-846 Method 8082. Field parameters for groundwater will be obtained and documented from each well at the time of sampling, including pH, turbidity, conductivity, dissolved oxygen, and temperature.

Quality assurance/quality control (QA/QC) groundwater samples will be collected as described in Section 5 and in the QAPP. QA/QC samples will be collected at the frequencies presented in Table 1.

Groundwater samples will be placed into the appropriate sample containers, preserved as described in Section 4, and labeled as described in Section 3. Groundwater samples will be handled, packaged, and shipped following the procedures in Section 4 and Exhibit A.

2.3 Quarry Pond Water Treatment System Sampling/Monitoring Activities

When the permanent 100- gallon per minute (gpm) water treatment system is operating in discharge mode, samples will be collected monthly for PCB analysis from the following locations:

- Between the carbon vessels of the permanent 100 gpm water treatment system; and
- Effluent water from the permanent 100 gpm water treatment system.

When both the permanent 100 gpm and the temporary 300 gpm water treatment systems are operating in discharge mode, samples will be collected once per operation period (or weekly) for PCB analysis from the following locations:

- Between the carbon vessels of the permanent 100 gpm water treatment system;
- Between the carbon vessels of the temporary 300 gpm water treatment system; and
- Effluent water from the combined discharge of the permanent 100 gpm and temporary 300 gpm water treatment systems.

2.3.1 Quarry Pond Water Treatment System Sampling

The water treatment sampling activities described above are conducted once a month during the operation of the 100 gpm system in discharge mode and once per operation period (or weekly) for the 300 gpm system, as described in the OM&M Plan. The samples will be collected following the procedures presented in Exhibit D and submitted for laboratory analysis for PCBs using USEPA Method 608. Turbidity of the process flow will be recorded from the appropriate location at the time of sampling and the pH will be measured.

Water treatment system samples will be placed into the appropriate sample containers, preserved as described in Section 4, and labeled as described in Section 3. Water treatment system samples will be handled, packaged and shipped following the procedures in Section 4 and Exhibit A.

2.4 Biota Sampling and Analysis Program

A Biota Sampling and Analysis Program will be implemented to determine if PCB uptake is occurring in fish found in the unnamed tributary and in the Cobleskill Creek downstream of the confluence with this tributary. The Biota Sampling and Analysis Program will consist of fish sampling and analysis in general conformance with the NYSDEC-approved Biota Sampling and Analysis Plan (BBL, 1994). Fish sampling will be performed at the same two general locations that were sampled in 1994 and 2003. (i.e., one location in the Cobleskill Creek and one location in the unnamed tributary).

At both of these proposed locations, sampling efforts will target two fish species; a forage species and a sport species, if available. The two target fish species will be selected in the field based upon availability and abundance at the sampling locations. Specific sample locations will be selected in the field so that similar species can be collected from both locations, to the extent practical.

The fish will be collected at each of the sampling locations using electrofishing techniques. During the collection activities, fish will be identified and separated by species and by sample location and retained on ice. From both of the proposed sampling locations, three samples of the target forage species and up to three samples of edible size sport fish (if available) will be prepared for laboratory analysis in accordance with the procedures described in Section 4 and Exhibit F.

Fish sampling will be conducted every other year for a period of up to 30 years, with the exception that if the results of any two consecutive sampling periods show decreases in PCB concentrations, or a value of 0.1 ppm PCB in fish tissue is achieved, then sampling will occur in a geometric progression where each successive sampling is increased by one year (For example, if two consecutive decreases are recorded by year 5, successive sampling would be in years 8, 12, 17, 23, 30). If at anytime the results of two consecutive sampling periods show increases in PCB concentrations in fish tissue, sampling reverts to every other year and a new sampling progression will be developed by National Grid and NYSDEC.

3. Sample Designation System

3.1 Sample Identification Codes

A sample designation code will provide each sample with a unique "name". This system will apply to all groundwater and water treatment system samples collected that are to be transmitted for laboratory analysis as presented below.

Offsite Groundwater Samples

- The designation code for offsite groundwater sample collected from coreholes C-20, C-21, and C-22 will use their own identification (i.e., C-20, C-21, and C-22).

Water Treatment System Samples

When collecting samples from the permanent 100 gpm water treatment system, the following sample code prefixes will be used to identify collection points from the following locations:

- NTS-BCW (between the carbon vessels of the permanent 100 gpm water treatment system); and
- NTS-EW (effluent water from the permanent 100 gpm water treatment system).

When collecting samples from the permanent 100 gpm and the temporary 300 gpm water treatment systems, the following sample code prefixes will be used to identify collection points from the following locations:

- NTS-BCW (between the carbon vessels of the permanent 100 gpm water treatment system);
- TSU-BCW (between the carbon vessels of the temporary 300 gpm water treatment system); and
- Comb-EW (effluent water from the combined discharge of the permanent 100 gpm and temporary 300 gpm water treatment systems).

From sampling event to sampling event, an ascending numeric value will follow the sample code prefix (i.e., sample event one - NTS-BCW-1, NTS-EW-1; sample event two - NTS-BCW-2, NTS-EW-2).

The one-letter suffix, which designates the sample type, will be taken from the following list:

- Duplicate – “D”
- Filtered – “F”

Additional sample volumes collected for matrix spike (“MS”) and matrix spike duplicate (“MSD”) analysis will be noted on the chain-of-custody forms, and the associated additional sample containers will be labeled, as described above, with the appropriate suffix (“MS” or “MSD”).

Fish Sampling

When collecting fish samples from the Cobleskill Creek and unnamed tributary, the following identification for each sample will include, in this order, and separated by a hyphen, the Sample Location (CC = Cobleskill Creek, UT =

unnamed tributary), Fish Species collected (CS = common shiner, SR = Stoneroller, SB = smallmouth bass, WS = white sucker, HS = northern hoy sucker, FM = flathead minnow), and Sample Number (assigned in ascending historical chronological order of sample collection). For example, as five common shiner samples have been previously collected from Cobleskill Creek, the next common shiner sampled from Cobleskill Creek will have the Sample Identification: CC-CS-06. In the event species identified above are not available, alternate species will be utilized.

4. Sample Handling and Documentation

4.1 Sample Containers and Preservations

Appropriate sample containers, preservation methods, and laboratory holding times for groundwater and water treatment system samples are presented in Table 2.

The analytical laboratory will supply appropriate sample containers in a sealed cooler, as well as sample labels and preservatives. The field personnel will be responsible for properly labeling containers and preserving samples (as appropriate). Sample labeling procedures are described in Exhibit A.

4.2 Packing, Handling, and Shipping Requirements

Sample custody seals and packing materials for filled sample containers will also be provided by the analytical laboratory. The filled, labeled, and sealed containers will be placed in a cooler on ice and carefully packed to minimize the possibility of container breakage.

All samples will be packaged by the field personnel and transported as low-concentration environmental samples. The packaged samples will be either shipped via express overnight carrier (Federal Express or courier) or hand delivered by sampling personnel to the laboratory within 24 to 48 hours of sample collection. General procedures for packing, handling, and shipping environmental samples are included in Exhibit A.

4.3 Documentation

Field personnel will provide comprehensive documentation covering all aspects of field activities associated with implementation of the OM&M Plan. This documentation constitutes a record, which allows reconstruction of all field events to aid in the data review and interpretation process. All documents, records, and information relating to the performance of the field work will be retained in the project file.

The various forms of documentation to be maintained throughout the sampling activities include:

- Daily Production Documentation - A field log, which will contain a record of all activities performed at the site.

- Sampling Information - Detailed notes will be made as to the exact site of sampling, physical observations, sample depths, and weather conditions. Groundwater sampling field logs (included in Exhibit B) will be filled out during each sampling event and will contain sample location, data on water levels, well depths, physical observations of the water, and field measurements (temperature, pH, dissolved oxygen, turbidity, and conductivity). Quarry pond water treatment system sampling field logs (included in Exhibit C) will be filled out during each sampling event and will contain sample location and certain field and/or treatment system measurements (pH and turbidity).

- Sample Chain-of-Custody Forms - Chain-of-custody forms will provide the record of responsibility for sample collection, transport, and submittal to the laboratory. Chain-of-custody forms will be filled out at each sampling location, at a group of sampling locations, or at the end of each day of sampling by one of the field personnel designated to be responsible for sample custody. In the event that the samples are relinquished by the designated sampling person to other sampling or field personnel, the chain-of-custody form will be signed and dated by the appropriate personnel to document the sample transfer. The original chain-of-custody form will accompany the samples to the laboratory and copies will be forwarded to the project files.

Persons will have custody of samples when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so they cannot be tampered with. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel.

- Field Equipment, Calibration, and Maintenance Logs - To document the calibration and maintenance of field instrumentation, calibration and maintenance logs will be maintained for each piece of field equipment (which is not factory calibrated). Equipment calibration procedures and calibration and maintenance logs are provided in Exhibit D.

4.4 Management of OM&M-Derived Materials and Wastes

The handling of OM&M-derived materials and wastes is discussed below.

4.4.1 Disposable Equipment and Debris

Disposable equipment and debris, such as health and safety equipment, plastic sheeting, sampling equipment, and other equipment not reused in the field sampling activities will be collected in plastic bags during the sampling events and placed into steel drums, which will be temporarily stored in a suitable location onsite. The contents of the drums will be treated/disposed of by National Grid in accordance with applicable rules and regulations.

4.4.2 Decontamination Rinsate

Non-dedicated field sampling equipment (if any) will be decontaminated by following the procedures outlined in Exhibit E. Decontamination rinsate will be containerized at each sampling location or group of locations. Upon completion of the field activities, the rinsate will be placed in a steel drum to be temporarily stored in a suitable location. The drum contents will be treated/disposed by National Grid in accordance with applicable rules and regulations.

4.4.3 Recovered NAPL (if any)

Recovered NAPL and oil sorbing materials used to recover NAPL (if any) shall be appropriately containerized. The containers shall be labeled and temporarily stored in a suitable onsite location. The contents will be treated/disposed by National Grid in accordance with applicable rules and regulations.

5. Quality Assurance/Quality Control

This section summarizes the Quality Assurance/Quality Control (QA/QC) requirements for all field sampling activities associated with a remedial action at the Site.

5.1 Field Instrument Calibration and Preventative Maintenance

Field personnel are responsible for assuring that a master calibration/maintenance log will be maintained following procedures specified in Exhibit D for each measuring device. Each log will include, at a minimum, where applicable:

- Name of device and/or instrument calibrated (i.e., HNU, OVA, or Photovac);
- Device/instrument serial/I.D. number;
- Frequency of calibration;
- Date(s) of calibration(s);
- Results of calibration(s);
- Name of person(s) performing calibration(s); and
- Buffer solutions (pH meter only).

Equipment to be used each day shall be calibrated prior to the commencement of the day's activities or as suggested by the manufacturer.

Field parameter testing equipment (pH, conductivity, dissolved oxygen, turbidity, and temperature meters) will be calibrated and maintained in general conformance with manufacturer specifications.

5.2 QA/QC Sample Collection

The frequency of QA/QC field samples to be collected is provided in Table 1. This estimate is based on the QA/QC sample collection frequency as discussed in the QAPP. Guidance on the collection of the QA/QC samples is presented below.

Duplicate Samples

Duplicate groundwater samples will be sent for laboratory analysis to evaluate the reproducibility of the sampling technique used and duplicate water treatment system samples will be sent for laboratory analysis only to verify a positive detection (if any) of PCBs in a sample. Five percent (i.e., one for every 20 samples) of groundwater samples will be duplicated and all of the water treatment system samples will be duplicated. Duplicate samples will be collected using methods to maximize the compatibility of the samples. For example, groundwater contained in a bailer retrieved from a monitoring well will be divided between the sample and duplicate sample laboratory containers.

Matrix Spike/Matrix Spike Duplicate

Triple sample volumes from designated groundwater sample locations will be collected for each matrix in order to perform matrix spike/matrix spike duplicate (MS/MSD) analysis. QA/QC field samples for biota monitoring will consist of one MS/MSD sample per 20 samples collected. Table 1 sets forth the frequency of collection for matrix spike/matrix spike duplicates.

Tables

Table 1

M. Wallace and Son, Inc.
Cobleskill, New York
Field Sampling Plan

Environmental and Quality Control Analyses

Parameter	**Est. No. of Samples Per Event**	**Field QC Analyses**						**Laboratory QC Analyses**						**Est. Total No. of Samples Per Event**
		Trip Blank		**Field Dup**		**Rinse Blank**		**MS**		**MSD**		**Lab Dup**		
		Freq.	**No.**	**Freq.**	**No.**	**Freq.**	**No.**	**Freq.**	**No.**	**Freq.**	**No.**	**Freq.**	**No.**	
Offsite Groundwater Samples														
PCBs	6	--	--	1/20	1	--	--	1/20	1	1/20	1	--	--	9
Water Treatment System Samples														
PCBs (100 gpm system)	2	--	--	1/1	2	--	--	--	--	--	--	--	--	4
PCBs (100 and 300 gpm systems)	3	--	--	1/1	3	--	--	--	--	--	--	--	--	6

Notes:

1. Water treatment system samples will be collected and analyzed for PCBs using USEPA Method 608.
2. Duplicate water treatment system samples will be collected for each sample and will be held by the lab and analyzed for PCBs only if PCBs are detected in the original sample and/or as directed by the supervising contractor.
3. Groundwater samples will be analyzed for filtered and unfiltered PCBs using USEPA SW846 Method 8082, in accordance with NYSDEC Analytical Service Protocol (most current version). Category B deliverables shall be provided.
4. Filtered groundwater samples will be analyzed for PCBs only if PCBs are detected in the unfiltered sample.

Dup	Duplicate
Est.	Estimated
Freq.	Frequency
MS	Matrix Spike
MSD	Matrix Spike Duplicate
No.	Number
PCBs	Polychlorinated biphenyls

Table 2

M. Wallace and Son, Inc.
Cobleskill, New York
Field Sampling Plan

Sample Containers, Preservation, and Holding Times

Sample	Parameter	Analytical Method Reference	Sample Container	Minimum Volume of Sample	Preservation	Maximum Holding Time
Water treatment system (aqueous)	PCBs	USEPA Method 608	Two 1-liter amber glass with teflon-lined cap	1 liter	Cool, 4° C	Extract within 7 days, analyze within 40 days
Offsite groundwater (aqueous)	PCBs	USEPA SW846 Method 8082	Two 1-liter amber glass with teflon-lined cap	1 liter	Cool, 4° C	Extract within 7 days, analyze within 40 days
Fish	PCBs	USEPA SW846 Method 8082	Wrapped in aluminum foil then in freezer paper	20 grams	Frozen 0° C	NA
Fish	Percent Lipids		Wrapped in aluminum foil then in freezer paper	20 grams	Frozen 0° C	NA

Notes:

1. Unless otherwise specified, all holding times are measured from date of collection.
2. Laboratory pre-preserved bottles will be used for all water sampling.

Exhibits

Exhibit A

Sample Packing, Handling and Shipping Procedures

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Exhibit A – Sample Packing, Handling, and Shipping Procedures

Each sample will be given a unique identification. With this type of identification, no two samples will have the same label.

Samples will be promptly labeled upon collection with the following information:

- Project number and site;
- Unique sample identification;
- Analysis required;
- Date and time sampled;
- Sample type (composite or grab); and
- Preservative, if applicable.

Clear tape will be secured over the sample label and the chain-of-custody will be initiated.

Appropriate sample containers, preservation methods, and laboratory holding times for each sample type will be applied as identified in Table 2.

If samples are to be shipped by commercial carrier (e.g., Federal Express), sample bottles/jars will be packed in coolers containing the following:

- A drain plug (if present) that has been sealed on the interior and exterior with duct tape;
- One to 2 inches of vermiculite or bubble wrap on the bottom of the cooler;
- Water ice packaged in re-sealable plastic bags;
- Sufficient vermiculite or bubble wrap to fill in the remaining area; and
- The completed chain-of-custody in a re-sealable plastic bag, taped in place on the inside cover of the cooler.

The cooler will then be sealed with tape. Appropriate shipping labels, such as "this-end-up" and "fragile" stickers will be affixed to the cooler. Samples will be hand delivered or delivered by an express carrier within 48 hours of sample collection. The express carrier will not be required to sign the chain-of-custody form; however, the shipping receipt should be retained by the sampler, and forwarded to the project files.

Exhibit B

Groundwater Sampling Procedures

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Exhibit B – Groundwater Sampling Procedures

This protocol describes the procedures to be used to collect groundwater samples. No wells will be sampled until well development (Steps 1 through 12, as discussed below) has been performed. During precipitation events, groundwater sampling will be discontinued until precipitation ceases.

The following materials, as required, shall be available during groundwater sampling:

- Sample pump;
- Sample tubing;
- Power source (i.e., generator);
- Appropriate health and safety equipment as specified in the HASP;
- Plastic sheeting (for each sampling location);
- Dedicated or disposable bailers;
- New disposable polypropylene rope;
- Buckets to measure purge water;
- Water-level probe;
- Six-foot rule with gradation in hundredths of a foot;
- Conductivity/temperature meter;
- pH meter;
- Turbidity meter;
- Dissolved oxygen (DO) meter;
- Appropriate water sample containers;
- Appropriate blanks (trip blank supplied by the laboratory);
- Appropriate transport containers (coolers) with ice and appropriate labeling, packing, and shipping materials;
- Groundwater sampling logs;
- Chain-of-Custody forms;
- Indelible ink pens;
- Site map with well locations and groundwater contours maps; and
- Keys to wells.

The following steps detail the monitoring well sampling procedures:

1. Review materials checklist to ensure that the appropriate equipment has been acquired.

2. Identify site and well sampled on sampling log sheets, along with date, arrival time, and weather conditions. Identify the personnel and equipment used and other pertinent data requested on the sampling log.

3. Label all sample containers using an appropriate label.

4. Use safety equipment, as required in the HASP.

5. Place plastic sheeting adjacent to the well to use as a clean work area.

6. Remove lock from the well and if rusted or broken replace with a new brass keyed-alike lock.

7. Set out on plastic sheeting the dedicated or disposable sampling device and meters.

8. Prior to sampling, groundwater elevations will be measured at each monitoring well and the presence of NAPL (if any) within the well will be evaluated. Obtain a water-level depth and bottom of well depth using an electric well probe and record on the sampling log sheet. Clean the well probe after each use with a soapy (Alconox) water wash and a tap water rinse.

9. After groundwater elevations are measured and NAPLs are determined not to be present, groundwater will be purged from the wells. If NAPLs are determined present, then a groundwater sample will not be collected, rather the NAPL thickness will be measured and a representative NAPL sample may be collected (if required) using a peristaltic pump or bailer. If NAPL is present, remove with a bailer or alternative method (oil sorbing sock).

10. Pump, safety cable, electrical lines, and/or tubing (for peristaltic pumps) will be lowered slowly into the well to a depth corresponding to the center of the saturated screen section of the well.

11. Measure the water level again with the pump in the well before starting the pump. Start pumping the well at 200 to 500 milliliters per minute. Ideally, the pump rate should cause little water-level drawdown in the well (less than 0.3 feet and the water level should stabilize). The water level should be monitored every three to five minutes (or as appropriate) during pumping. Care should be taken not to cause the pump suction to be broken or entrainment of air in the sample. Record pumping rate adjustments and depths to water. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to avoid pumping the well dry and/or to ensure stabilization of indicator parameters. If the recharge rate of the well is very low, purging should be interrupted so as not to cause the drawdown within the well to advance below the pump. However, a steady flow rate should be maintained to the extent practicable. Sampling should commence as soon as the volume in the well has recovered sufficiently to permit sample collection.

12. During well development, monitor the field indicator parameters (turbidity, temperature, specific conductance, pH, and DO) every three to five minutes (or as appropriate). The well is considered stabilized and ready for sample collection when three well volumes have been purged or the indicator parameters have stabilized for three consecutive readings as follows (Puls and Barcelona, 1996):

    ±0.1 for pH
    ±3% for specific conductance (conductivity)
    ±10% for DO and turbidity

    Dissolved oxygen and turbidity usually require the longest time to achieve stabilization. The pump must not be removed from the well between purging and sampling. If the parameters have stabilized, but the turbidity is not in the range of the 50 NTU goal, the pump flow rate should be decreased to no more than 100 millimeters per minute. Measurement of the indicator parameters should continue every three to five minutes. Measurements for DO must be obtained using a flow-through cell. Other parameters may be taken in a clean container such as a glass beaker.

13. Fill in the sample label and cover the label with clear packing tape to secure the label onto the container.

14. After the groundwater field parameters have stabilized as discussed above, obtain the groundwater sample needed for analysis directly from the sampling device in the appropriate container and screw on the caps, tightly.

15. Secure with packing material and store at 4 degrees Celsius on wet ice in an insulated transport container (e.g., cooler) provided by the laboratory.

16. After all sampling containers have been filled; remove one additional volume of groundwater. Check the calibration of the meters and then measure and record on the field log the physical appearance, pH, DO, temperature, turbidity, and conductivity.

17. Record the time sampling procedures were completed on the field logs.

18. Place all disposable sampling materials (plastic sheeting, disposable bailers, and health and safety equipment) in appropriately labeled containers. Go to the next well and repeat Step 1 through Step 17 until all wells are sampled.

19. Complete the procedures for packaging, handling, and shipping with associated chain-of-custody forms (Exhibit A).

20. All waste materials (including recovered NAPL, if any) shall be properly containerized and managed as specified in the FSP.

Exhibit C

Water Treatment System Sampling Procedures

Exhibit C – Water Treatment System Sampling Procedures

This protocol describes the procedures to be used to collect samples from the quarry pond water treatment system(s).

The following materials, as required, shall be available during quarry pond water treatment system sampling:

- Appropriate health and safety equipment as specified in the HASP;
- Keys to 100 gpm water treatment system building;
- Alarm code, master code, and ID;
- Turbidity meter;
- Buckets to collect purge water;
- Appropriate water sample containers;
- Appropriate blanks (trip blank supplied by the laboratory, if applicable);
- Appropriate transport containers (coolers) with ice and appropriate labeling, packing, and shipping materials;
- Quarry pond water treatment system sampling logs;
- Chain-of-Custody forms; and
- Indelible ink pens.

The following steps detail the water treatment system sampling procedures:

1. Review materials checklist to ensure that the appropriate equipment has been acquired.

2. Use safety equipment, as required in the HASP.

3. Determine required number of samples to be collected in accordance with the OM&M Plan.

4. Identify location to collect sample (sampling port) on sampling log sheets, along with date, arrival time, and weather conditions. Identify the personnel and equipment used and other pertinent data requested on the water treatment system sampling log.

5. Place plastic sheeting adjacent to the sampling port to use as a clean work area.

6. Fill in the sample label and cover the label with clear packing tape to secure the label onto the container.

7. Prior to collecting samples, purge a minimum of five gallons of water from the collection port and return it to the quarry pond.

8. Obtain the sample needed for analysis directly from the sampling port in the appropriate container and screw on the caps, tightly. Duplicate samples shall be collected using methods to maximize the compatibility of the samples.

9. Secure caps by wrapping with clear packing tape and store at 4 degrees Celsius on wet ice in an insulated transport container (e.g., cooler) provided by the laboratory.

10. For each sample collected, record the following information on the water treatment system sampling log:

    1. Sample identification (see below);
    2. Date of sample;
    3. Time sample was collected;
    4. pH of sample; and
    5. Turbidity of sample.

11. Place all disposable sampling materials in appropriately labeled containers. Go to the next port and repeat Step 3 through Step 10 until all samples are collected.

12. Complete the procedures for packaging, handling, and shipping with associated chain-of-custody forms (Exhibit A).

Sample Identification (ID)

100-gpm Water Treatment System Sample ID

When collecting samples from the permanent 100-gpm water treatment system, the following sample code prefixes will be used to identify collection points from the following locations:

- NTS-BCW, (between the carbon vessels of the permanent 100-gpm water treatment system); and

- NTS-EW (effluent water from the permanent 100-gpm water treatment system).

Combined 100-gpm and 300-gpm Water Treatment System Sample ID

When collecting samples from the permanent 100-gpm and the temporary 300-gpm water treatment systems, the following sample code prefixes will be used to identify collection points from the following locations:

- NTS-BCW (between the carbon vessels of the permanent 100-gpm water treatment system);

- TSU-BCW (between the carbon vessels of the temporary 300-gpm water treatment system); and

- Comb-EW (effluent water from the combined discharge of the permanent 100-gpm and temporary 300-gpm water treatment systems).

As previously stated, duplicate quarry pond water treatment system samples will be marked "Hold" on the chain-of-custody and sent to the laboratory. The duplicate samples will be analyzed only to verify a positive detection of PCBs in a corresponding sample.

From sampling event to sampling event, an ascending numeric value will follow the sample code prefix (i.e., sample event one - NTS-BCW-1, NTS-EW-1; sample event two - NTS-BCW-2, NTS-EW-2). Quarry pond water treatment system sampling field logs (included in Exhibit C) will be filled out during each sampling event and will contain sample location and field measurements (pH and turbidity).

Exhibit D

Equipment Calibration, Operation, and Maintenance Procedures

Exhibit D – Equipment Calibration, Operation, and Maintenance Procedures

All field screening equipment will be calibrated immediately prior to each day's use and more frequently if required. The calibration procedures will conform to the manufacturer specifications. Records of all instrument calibration will be maintained by the field personnel. Copies of all of the instrument manuals shall be maintained with the instruments by the field personnel.

Oil/Water Interface Probe

The oil/water interface probe will be checked once to a standard (i.e., 100 ft engineer’s tape) to assess if the meter has been correctly calibrated by the manufacturer or vendor. If the markers are incorrect, the meter will be sent back to the manufacturer or vendor.

pH Meter

The pH meter will be calibrated at the start of each day of use, and after very high or low readings as required by this plan. National Institute of Standards and Technology traceable standard buffer solutions that bracket the expected pH range will be used. The standards will most likely be a pH of 7.0 and 10.0 standard units. The pH calibration and slope knobs will be used to set the meter to display the value of the standard being checked. The calibration data will be recorded in field notebooks.

Specific Conductivity Meter

Calibration checks using the appropriate conductivity standard for the meter will be performed at the start of each day of use, and after very high or low readings, as required by this plan. Readings must be within five percent to be acceptable. The thermometer of the meter will be calibrated against the field laboratory thermometer prior to each day of use.

Dissolved Oxygen (DO) Meter

The DO meter will be calibrated and the condition of the DO sensor will checked at the start of each day of use. Calibration and maintenance of the DO meter will be conducted in accordance with the manufacturer specifications. The calibration data will be recorded in field log.

Turbidity Meter

The turbidity meter will be calibrated daily prior to use. Calibration and maintenance will be conducted in accordance with the manufacturer specifications. Calibration and maintenance information will be recorded in the field log.

Exhibit E

Field Equipment Decontamination and Cleaning Procedures

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Exhibit E – Field Equipment Decontamination and Cleaning Procedures

I. Sampling Equipment Decontamination

Generally, dedicated (or disposable) sampling equipment will be used during the OM&M activities (e.g., plastic tubing, ground-water sample bailers). However, equipment that is not dedicated (i.e., pH meter, submersible pump, etc.) will be decontaminated prior to each use to mitigate the potential for cross-contamination of the samples collected for laboratory analysis. The decontamination procedures to be utilized during the investigation are presented below:

For PCB Sampling

1. Alconox (or equivalent) detergent solution wash.
2. Tap water rinse.
3. 10% nitric acid (HNO_3) ultrapure rinse (if carbon steel split spoon is used, then 1% nitric acid should be used instead).
4. Distilled water rinse.
5. Methanol rinse (pesticide grade or better).
6. Distilled water rinse.
7. Hexane rinse (pesticide grade or better).
8. Distilled (demonstrated analyte free) water rinse (should be five times the volume of solvent used in Step 7).
9. Allow to air-dry.
10. Wrap in aluminum foil for storage or transport if it is not going to be used immediately.

All waste materials generated during cleaning procedures will be collected and contained onsite in an appropriate container and temporarily stored onsite pending treatment/disposal in accordance with applicable rules and regulations.

Exhibit F

Resident Fish Sampling Procedures

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Exhibit F – Resident Fish Sampling Procedures

This protocol sets forth the field procedures for fish collection, species identification, length and weight measurements, and sample processing. All field operations will be conducted by trained field biologists. The following procedures apply to all target fish species retained for chemical analysis.

Materials

The following materials will be available for use, as required, during fish collection activities:

- Health and Safety equipment (as required by the health and safety plan);
- Fish collection equipment (see Attachment C1 and C2);
- Live well;
- Holding container with ice;
- Fish measuring board;
- Suspended-weight or top-loading spring balance;
- Top-loading electronic balance;
- Mesh bags, trays, or other containers suitable for holding fish to be weighed;
- Appropriate packaging materials and forms;
- Transport container (cooler) with ice; and
- Field notebook.

Procedures

The general procedures that will be followed during fish collection are provided below.

1. Identify sampling location and target fish species for collection.

2. Fish will be collected at each of the sampling locations using electrofishing techniques.

3. Don health and safety equipment according to the collection procedure selected (as required by the health and safety plan).

4. Field crew will set up, test, and use electrofishing equipment in accordance with the procedures in the operating manual for the unit employed at the site.

5. Collect the selected number of each target species specified for the sampling location, to the extent feasible.

6. When fish are collected, record the following in the field notebook:
   - Sampling location (general and specific);
   - Date and time of sampling;
   - Crew;
   - Sampling method; and
   - General notes on habitat type and fish species observed.

7. Retain target fish species for chemical analysis. Release non-target fish species. For adult smallmouth bass and brown bullhead sampling, fish should be $\geq$25 cm in size. For YOY sampling, the estimated maximum total length of YOY spottail shiners at the time of sampling is 6.5 cm (Scott and Crossman, 1973 and Becker, 1983).

8. Place retained fish in a holding container with ice.

9. Continue coverage of the area. If no additional fish are collected, move to a different area within the same sampling location.

10. Repeat steps 4 through 8 until selected quantities for each target fish species for the sampling location are obtained or the entire area of the sampling location has been covered. At the crew leader's discretion, use an alternate technique per those described above in step 2 to obtain the selected quantities of target species (if possible).

11. Identification of retained specimens will be conducted by examining each fish externally or with the aid of optical equipment (when necessary) for diagnostic characteristics as described in any of the following references:

    - Hubbs, C.L. & K.F. Lagler, 1958. Fishes of the Great Lakes Region. University of Michigan Press, Ann Arbor, MI. 213p.
    - Smith, C.L. 1985. The Inland Fishes of New York State. NYSDEC, Albany, NY. 522p.
    - Werner, R.G. 1980. Freshwater Fishes of New York State, Syracuse University Press, Syracuse, NY. 186p.

12. Record common names (of standard and unambiguous usage) in the field notebook.

13. For sample preparation, place the fish on the measuring board and measure total fish length. Total length is defined as the distance from the anterior extent of the head to the tip of the longest caudal fin lobe when compressed.

14. Record length to the nearest 0.1 cm in the field notebook. For composite samples, the maximum and minimum length for individuals comprising the sample will be recorded.

15. Calibrate the balances prior to weighing fish from each sample location (balances will be calibrated following manufacturer specifications and procedures.)

16. Zero the balance prior to weighing each fish.

17. Weigh individual fish singularly using one of the following methods:
    a. If using a top-loading balance weigh either directly or in a tared container; or
    b. If using a suspended-weight balance weigh either directly or in a mesh bag or other suitable container.

    The minimum mass requirements for the YOY spottail shiner analytical program are 10 grams per sample.

18. Record the total fish weight to the nearest gram in the field notebook. For composite samples, the number of individuals in each composite will also be recorded in the field notebook.

19. Examine each fish for the occurrence and nature of any external anomalies (e.g., general physical condition), including absence or erosion of fins; deformation of any structure; cuts, scars or areas of regenerated scales; presence of apparent lesions or diseases; and the occurrence of other abnormalities. Record observations in the field notebook.

20. Prepare the samples for shipment to the laboratory. Wrap whole fish and whole fish composite samples in aluminum foil and then freezer paper. Samples will be wrapped with a label containing the appropriate sample information.

21. Select the fish tissue sample preparation procedure (i.e., skin-on fillets, whole-body composite) and chemical analysis that the laboratory will follow. Record this information for each fish tissue sample in the field notebook and on the chain-of-custody form. Laboratory preparation of fillet and remaining carcass fish tissue samples will be completed per the guidance below:

    a. NYSDEC Standard Fillet (skin-on, scales-off fillet)
    This consists of the entire fillet and overlying skin. Standard skin-on, scales-off fillets will be prepared for all individual game fish samples (except bullhead and catfish) exceeding 6 inches in length.

22. Prepare samples for shipment to the laboratory following the appropriate packing and shipping with chain-of-custody procedures presented in Exhibit A.

References:

Becker, George C. Fishes of Wisconsin. The University of Wisconsin Press, Madison, WI. 1983 (p 540 – 544).

Blasland, Bouck & Lee, Inc. (BBL). Health and Safety Plan. 2007.

Scott, W.B. and Crossman, E.J. Freshwater Fishes of Canada Fisheries. Research Board of Canada, Ottawa. 1973.

Appendix B

Quality Assurance Project Plan

nationalgrid

Operation, Maintenance and Monitoring Plan
M. Wallace and Son, Inc. Scrapyard Site
Cobleskill, New York

Revised
January 2007

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Quality Assurance Project Plan

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Operation, Maintenance and Monitoring Plan
M. Wallace and Son, Inc. Scrapyard Site
Cobleskill, New York

Revised
January 2007

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Acronyms and Abbreviations

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Attachments

1. Introduction

1.1 General

This *Quality Assurance Project Plan (*QAPP*)* supports the *Operation, Maintenance and Monitoring Plan* (OM&M Plan) for the M. Wallace and Son, Inc. Scrapyard Site (Site) located in Cobleskill, New York. The OM&M Plan provides the details and information necessary to conduct OM&M activities associated with the New York State Department of Environmental Conservation- (NYSDEC-) selected remedy for those portions of the Site that are not part of the active scrapyard for M. Wallace and Son, Inc. operations.

This QAPP presents the analytical methods and procedures to be followed during implementation of the post-remediation field monitoring and sampling activities, including procedures to be followed by analytical laboratories in generating analytical data. In addition, this QAPP outlines minimum requirements to be met by analytical laboratories. The field sampling procedures are presented in the *Field Sampling Plan* (FSP) included as Appendix A of the OM&M Plan. The OM&M Plan, FSP and this QAPP are integrated and cross-referenced where applicable to minimize redundancy.

Information contained in this QAPP has been organized into the following sections:

Section	Content
1	Introduction
2	Project Organization and Responsibilities
3	Quality Assurance Objectives for Measurement of Data
4	Sampling Procedures
5	Sample and Document Custody
6	Calibration Procedures and Frequency
7	Analytical Procedures
8	Data Reduction, Validation, and Reporting
9	Field and Laboratory Quality Control Checks
10	Performance and System Audits
11	Preventive Maintenance
12	Data Assessment Procedures
13	Corrective Action
14	Quality Assurance Reports to Management

Details are provided in the subsequent sections. This document also contains pertinent information from the OM&M Plan and FSP related to the measurement and evaluation of the analytical data.

1.2 Monitoring and Sampling Activities

The purpose of this QAPP is to present the quality assurance/quality control (QA/QC) procedures to be implemented during the monitoring/sampling activities to provide data which is sufficient to meet the OM&M program objectives. As detailed in the OM&M Plan, the following monitoring and sampling activities will be conducted as part of the OM&M program:

- Light nonaqueous phase liquid (LNAPL) monitoring;

- Quarry pond water treatment system monitoring and sampling;
- Groundwater sampling activities associated with offsite coreholes C-20, C-21, and C-22; and
- Biota sampling.

Data Quality Objectives (DQOs) for these activities are discussed in the following subsection.

1.3 Data Quality Objectives

DQOs are qualitative and quantitative statements that specify the quality of the data required to support decisions made during site-related activities and are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality. The three analytical categories listed below address various data uses and the QA/QC effort and methods required to achieve the desired level of quality.

Screening Data: Screening data affords a quick assessment of site characteristics or conditions. Screening data is applicable for data collection activities that involve rapid, non-rigorous methods of analysis and quality assurance. Screening data is generally applied to physical and/or chemical properties of samples; relative concentration differences; and preliminary health and safety assessment.

Screening Data with Definitive Confirmation: Screening data provides rapid identification and quantitation; however, the quantitation may be relatively imprecise. Screening data with definitive confirmation is available for data collection activities that require qualitative and/or quantitative verification of a select portion of sample findings (10 percent or more). The data can also be used to verify less rigorous laboratory-based methods.

Definitive Data: Definitive data are generated using rigorous analytical methods, such as approved United States Environmental Protection Agency (USEPA) reference methods. Data are analyte-specific, with confirmation of analyte identity and concentration. Methods produce tangible raw data (e.g., chromatograms, spectra, digital values) in the form of paper printouts or computer-generated electronic files.

It is anticipated that both the screening and definitive data categories will be used during the investigation. Field parameters which will be obtained during groundwater investigation (i.e., pH, conductivity, dissolved oxygen, temperature, and turbidity) and quarry pond water treatment system monitoring, will be measured using screening techniques. All remaining parameters will be determined using definitive techniques.

For the remedial field sampling activities, the following three levels of data reporting will be used.

- Level 1 - Minimal Reporting: Minimal or "results only" reporting is used for analyses which, either due to their nature (i.e., field monitoring) or the intended data use (i.e., preliminary screening), do not generate or require extensive supporting documentation.
- Level 2 - Modified Reporting: Modified reporting is used for analyses which are performed following standard USEPA-approved methods and QA/QC protocols and which, based on the intended data use, require some supporting documentation but not, however, full "Contract Laboratory Procedures (CLP)-type" reporting.
- Level 3 - Full Reporting: Full "CLP-type" reporting is used for those analyses which, based on the intended data use, require full documentation.

DQOs have been specified for each monitoring and sampling activity. The DQOs presented herein address investigation efforts only and do not cover health and safety issues, which are addressed in detail in the *Health and Safety Plan* (HASP) for this project, included as Appendix C of the OM&M Plan.

A DQO summary for the identified monitoring and sampling efforts is presented below. The summary consists of stated DQOs relative to the following items:

A. Data Uses;

B. Data Types;

C. Data Quality and Reporting;

D. Data Quantity;

E. Sampling and Analytical Methods; and

F. Data Precision, Accuracy, Representativeness, Completeness, and Comparability (PARCC) parameters.

The reporting levels for the monitoring and sampling efforts identified herein are presented in the following sections.

1.3.1 Groundwater Sampling/Monitoring Activities

Data Uses

The groundwater sampling/monitoring activities are designed to generate hydrogeologic and water quality data to facilitate confirming the effectiveness of the selected remedy in providing protection of human health and the environment.

Data Types

Chemical data for groundwater will include unfiltered and filtered (as appropriate) samples for polychlorinated biphenyl (PCB) analysis from offsite monitoring wells C-20, C-21, and C-22. Physical data for groundwater will consist of groundwater level information from offsite monitoring wells. In addition, field parameters consisting of pH, conductivity, dissolved oxygen, temperature, and turbidity will be measured for each offsite groundwater sample collected for the post-remediation monitoring program. Finally, groundwater within these monitoring wells will be evaluated for the absence/presence of LNAPL.

Data Quality and Reporting

Laboratory analysis of groundwater samples for PCBs will be conducted using the USEPA SW-846 Method 8082 as referenced in the NYSDEC 2000 Analytical Service Protocol (ASP) or most current version. The analytical results will be reported using Category B deliverables (i.e., Reporting Level 3). Field parameters will be measured and documented as presented in the FSP.

Data Quantity

The groundwater sampling activities will involve the collection of groundwater samples from offsite monitoring wells C-20, C-21, and C-22 for laboratory analysis for unfiltered and filtered (as appropriate) PCBs. As previously stated, field parameters will be obtained for each groundwater sample collected for PCB analysis. The type and quantity of QA/QC samples to be submitted for laboratory analysis during the field sampling activities are presented in Table 1.

Sampling and Analytical Methods

The groundwater sampling procedures are provided in attachments to the FSP. The laboratory analytical methods for groundwater samples are presented in Table 2 of this QAPP.

PARCCs Parameters

Precision and accuracy QC limits for chemical constituents which are used during data validation to assess analytical performance, are included in Table 3. Data representativeness will be addressed by the sample quantities and locations identified in the OM&M Plan. Data comparability is intended to be achieved using standard USEPA-/NYSDEC-approved methods, which are presented in Table 2.

1.3.2 Quarry Pond Water Treatment System Sampling/Monitoring Activities

Data Uses

The quarry pond water treatment system sampling/monitoring activities are designed to generate water quality data to facilitate confirming the effectiveness of the water treatment system in preventing the discharge of quarry pond water containing PCBs in excess of 0.065 parts per billion (ppb) into the offsite storm water drainage system.

Data Type

Chemical data for water from the treatment system will include samples for PCB analysis from either the 100 gallons per minute (gpm) treatment system or both the 100-gpm and 300-gpm treatment systems. In addition, pH will be measured for each water treatment system sample collected.

Data Quality and Reporting

Laboratory analysis of water treatment system samples for PCBs will be conducted using the USEPA Method 608. The analytical results will be presented using Reporting Level 2 criteria. Field measurements of pH will be performed in accordance with the equipment manufacturer's procedures, and as presented in the FSP.

Data Quantity

The water treatment system sampling activities will involve the collection of water samples from the effluent stream and from between the carbon vessels of the discharging water treatment systems for laboratory analysis for PCBs. Measurements of pH will be obtained for each water treatment system sample collected for PCB analysis.

Sampling and Analytical Methods

The quarry pond water treatment system sampling procedures are provided in the FSP. The laboratory analytical methods for water treatment system samples are presented in Table 2 of this QAPP.

1.3.3 Biota Sampling and Analysis Program

Data Uses

The Biota Sampling and Analysis Program (fish sampling) are designed to determine if polychlorinated biphenyl (PCB) uptake is occurring in fish found in the unnamed tributary and in Cobleskill Creek (downstream of unnamed tributary).

Data Type

Chemical data for fish collected will include sample for PCB analysis and percent lipids. In addition, sample location, species, total weight, and general physiological condition will be recorded in the field data sheet.

Data Quality and Reporting

Laboratory analysis of fish samples for PCBs will be conducted using USEPA Method 8082. The analytical results will be reported using Category B deliverables (i.e., Reporting Level 3). Field measurements will be documented as presented in the FSP.

Data Quantity

From both of the proposed sampling locations, three samples of the target forage species and up to three samples of the edible size sport fish (if available) will be prepared for laboratory analysis in accordance with the procedures described in the FSP. As previously stated field measurements will be documented as presented in the FSP. Type and quantity of QA/QC Samples to be submitted for laboratory analysis are presented in Table 1.

Sampling and Analytical Methods

The fish sampling procedures are presented in the FSP. The laboratory analytical methods for fish samples are presented in Table 2 of this QAPP.

2. Project Organization and Responsibilities

2.1 Project Organization

The field sampling activities will require integration of personnel from the various organizations, collectively referred to as the project team. A detailed description of the responsibilities of each member of the project team is presented below.

2.1.1 Overall Project Management

The OM&M activities for the Site, including the LNAPL recovery systems and post-remediation monitoring activities, require integration of key project management personnel from the organizations identified below:

Project Title	Company/Organization	Name	Phone Number
NYSDEC Project Manager	New York State Department of Environmental Conservation	Daniel Lightsey, P.E.	(518) 357-2045
NYSDOH	New York State Department of Health	To Be Determined	(518) 402-7860
Public Health Director	Schoharie County Department of Health	Carl J. Stefanik, P.E.	(518) 295-8365
Project Manager	National Grid	James F. Morgan	(315) 428-3101
OM&M Project Manager	National Grid	Steven P. Stucker, CPG	(315) 428-5652

2.2 Team Member Responsibilities

This subsection of the QAPP discusses the responsibilities and duties of the project team members.

2.2.1 Project Manager/OM&M Project Manager

Responsibilities and duties of the project coordinator and/or OM&M project manager include:

1. Overall direction of the operation, maintenance and monitoring activities;
2. Direction of the Contractor and its subcontractors; and
3. Review of Contractor work products, including data, memoranda, letters, and reports and documents transmitted to the NYSDEC.

2.2.2 Contractor(s)

National Grid will procure contractor(s) which general responsibilities may include:

1. Coordinate and execute the OM&M field sampling activities defined in the OM&M Plan;
2. Transmit the results of OM&M field monitoring and sampling activities to the project coordinator; and

3. Perform data validation of the OM&M groundwater sampling analytical results and transmit the validated results to the project coordinator.

Project Officer

Responsibilities and duties include:

1. Oversight of Contractor work products; and
2. Provide approval for major project deliverables.

Project Manager

Responsibilities and duties include:

1. Management and coordination of the project as defined in the OM&M Plan;
2. Review deliverables prepared by the Contractor; and
3. Assure corrective actions are taken for deficiencies cited during audits of site activities.

Field Personnel

Responsibilities and duties include:

1. Perform field procedures associated with the OM&M field sampling/monitoring activities, as set forth in the OM&M Plan;
2. Collect QA/QC samples;
3. Calibrate, operate, and maintain field equipment;
4. Reduce field data;
5. Maintain sample custody; and
6. Prepare field records and logs.

Quality Assurance Manager (QAM)

Responsibilities and duties include:

1. Review/validate laboratory data packages;
2. Oversee and interface with the analytical laboratory;
3. Coordinate field QA/QC activities, including audits of sampling/monitoring activities;
4. Review field reports and data;
5. Review audit reports; and
6. Prepare interim QA/QC compliance reports.

2.2.3 Analytical Laboratories

General responsibilities and duties of the analytical laboratories include:

1. Perform sample analyses and associated laboratory QA/QC procedures;
2. Supply sampling containers and shipping cartons;
3. Maintain laboratory custody of sample;
4. Strictly adhere to protocols in this QAPP; and
5. Maintain the necessary ELAP approval.

Laboratory Project Manager

Responsibilities and duties include:

1. Serve as primary communication link between the Supervising Contractor and laboratory technical staff;
2. Monitor work loads and ensure availability of resources;
3. Oversee preparation of analytical reports; and
4. Supervise in-house chain-of-custody.

Laboratory Quality Assurance Manager

Responsibilities and duties include:

1. Supervise the group that reviews and inspects project-related laboratory activities; and
2. Conduct audits of laboratory activities.

2.2.4 NYSDEC

Project Manager

Responsibilities and duties include:

1. Provide NYSDEC review and approval of the OM&M Plan, supporting documents, and future deliverables; and
2. Monitoring progress of OM&M activities.

3. Quality Assurance Objectives for Measurement of Data

3.1 Selection of Measurement Parameters, Laboratory Methods, and Field Testing Methods

This section identifies the parameters that will be measured in the field and parameters that will be analyzed in the laboratory as part of the groundwater and water treatment system field sampling activities. This section also identifies the quality assurance objectives for the groundwater field measurement/laboratory analysis of the parameters.

3.1.1 Field Parameters and Methods

The subsections below identify the parameters that will be measured in the field and the quality assurance objectives for measurement of the parameters.

The following field measurements/testing will be performed, as described in the FSP:

- Measurement of groundwater elevations;
- Measurement of LNAPL thickness, if present;
- Measurement of water quality field parameters, including pH, conductivity, dissolved oxygen, temperature, and turbidity; and
- Measurement of fish length, weight, and observations of general physical condition.

3.1.2 Laboratory Parameters and Methods

Laboratory analyses of groundwater, water treatment system and fish samples will be performed as set forth in Table 1. Groundwater samples will be collected for both filtered and unfiltered PCBs. Initially, the laboratory will only analyze the unfiltered groundwater samples. In the event that PCBs are detected in any unfiltered sample, the laboratory will filter and analyze the filtered groundwater sample collected from that same monitoring well. Water treatment system samples will be analyzed for total PCBs (i.e., not filtered). Fish samples will be analyzed for total PCBs and percent lipids. Table 2 presents the selected analytical methods, reporting limits and laboratory method detection limits to be used for each analytical parameter.

3.2 Quality Assurance Objectives

The overall quality assurance objective for groundwater field sampling/monitoring activities is to develop and implement procedures for sampling, chain-of-custody, laboratory analysis, instrument calibration, data reduction and reporting, internal quality control, audits, preventive maintenance, and corrective action, such that valid data will be generated. These procedures are presented or referenced in the following sections of this QAPP. Specific QC checks are discussed in Section 9.0 of this QAPP.

Quality assurance objectives are generally defined in terms of five parameters:

1. Representativeness;
2. Comparability;
3. Completeness;
4. Precision; and
5. Accuracy.

Each parameter is defined below.

3.2.1 Representativeness

Representativeness is the degree to which sampling data accurately and precisely represent site conditions, and is dependent on sampling and analytical variability and the variability of the site. The OM&M Plan presents the rationale for sample quantities and locations. The FSP and this QAPP present field sampling methodologies and laboratory analytical methodologies, respectively. The use of the prescribed field and laboratory analytical methods with associated holding times and preservation requirements are intended to provide representative data. Further discussion of QC checks is presented in Section 9.0 of this QAPP.

3.2.2 Comparability

Comparability is the degree of confidence with which one data set can be compared to another. Comparability between phases of the field sampling will be maintained through consistent use of the sampling and analytical methodologies set forth in this QAPP and the FSP, using established QA/QC procedures, and through utilization of appropriately trained personnel.

3.2.3 Completeness

Completeness is defined as a measure of the amount of valid data obtained from an event and/or investigation compared to the total amount that was obtained. This will be determined upon final assessment of the analytical results, as discussed in Section 12.0 of this QAPP.

3.2.4 Precision

Precision is a measure of the reproducibility of sample results. The goal is to maintain a level of analytical precision consistent with the objectives of the field sampling activities. To maximize precision, sampling and analytical procedures will be followed. All field sampling activities will adhere to established protocols presented in this QAPP and FSP. Checks for analytical precision will include the analysis of matrix spike, matrix spike duplicates, laboratory duplicates and field duplicates. Checks for field measurement precision will include obtaining duplicate field measurements. Further discussion of precision QC checks is provided in Sections 9.0 and 12.0 of this QAPP.

3.2.5 Accuracy

Accuracy is a measure of how close a measured result is to the true value. Both field and analytical accuracy will be monitored through initial and continuing calibration of instruments. In addition, reference standards, matrix spikes, blank spikes, and surrogate standards will be used to assess the accuracy of the analytical data. Further discussion of these QC samples is provided in Sections 9.0 and 12.0 of this QAPP.

4. Sampling Procedures

Groundwater, water treatment system, and fish samples will be collected as described in the FSP. The FSP contains detailed procedures for measuring groundwater elevations; performing LNAPL measurements/assessments; performing water quality measurements; collecting groundwater and water treatment system samples; collecting fish samples; decontaminating equipment; and handling, packing, and shipping samples for laboratory analysis.

Additional QA/QC samples will be collected. The frequency of QA/QC field samples to be collected is provided in Table 1. Guidance on the collection of QA/QC samples is presented below.

Rinse Blanks (Nondedicated Sampling Equipment)

Rinse blanks will be prepared by pouring analyte-free water over decontaminated sampling equipment as a check that the decontamination procedure has been adequately performed and that cross contamination of samples will not occur due to the equipment. One rinse blank will be collected for each type of equipment used each day a decontamination event occurs. The same aliquot of rinse water may be used on all equipment coming in contact with a particular matrix for analysis for inorganic constituents. Rinse blanks will be collected at the beginning of the day before the sampling event and must accompany the samples collected that day. Rinse blanks will be prepared in the field. Laboratory-supplied analyte-free water will be poured into or over the sampling equipment and then directly into the laboratory-supplied sample bottles. The intent is for the water making up the blank to follow the same path, and therefore, come in contact with the same equipment as the samples. When dedicated sampling devices are used, or sample containers are used to collect the samples, rinse blanks will not be necessary.

Duplicate Samples

Duplicate groundwater samples will be sent for laboratory analysis to evaluate the reproducibility of the sampling technique used and duplicate quarry pond water treatment system samples will be sent for laboratory analysis to verify a positive detection of PCBs in a sample. At a minimum, 5% (i.e., one for every 20 samples) of groundwater samples will be duplicated and all quarry pond water treatment system samples will be duplicated, although only those water treatment system samples with PCBs detected in them will have their duplicates analyzed. Duplicate samples will be collected using methods to maximize the compatibility of the samples. For example, groundwater contained in a bailer retrieved from a monitoring well will be divided between the sample and duplicate sample laboratory containers.

Matrix Spike/Matrix Spike Duplicate

Triple sample volumes from designated groundwater and fish sample locations will be collected for each matrix in order to perform matrix spike/matrix spike duplicate analysis. Table 1 sets forth the frequency of collection for matrix spike/matrix spike duplicate samples.

5. Sample and Document Custody

5.1 Field Procedures

The objective of field sample chain-of-custody is to assure that samples are not tampered with from the time of sample collection through time of transport to the analytical laboratory. Persons will have "custody of samples" when the samples are in their physical possession, in their view after being in their possession, or in their physical possession and secured so they cannot be tampered with. In addition, when samples are secured in a restricted area accessible only to authorized personnel, they will be deemed to be in the custody of such authorized personnel. A discussion of sample custody and directions for the field use of chain-of-custody forms are provided below.

5.2 Laboratory Procedures

The following section presents a description of the laboratory procedures, which will be followed during the implementation of the field sampling activities.

5.2.1 General

Upon sample receipt, laboratory personnel will be responsible for sample custody. The original field chain-of-custody form will accompany all samples requiring laboratory analysis. The laboratory will use chain-of-custody guidelines described in USEPA SW-846. Samples will be kept secured in the laboratory until all stages of analysis are complete. All laboratory personnel having samples in their custody will be responsible for documenting and maintaining sample integrity.

5.2.2 Sample Receipt and Storage

Immediately upon sample receipt, the laboratory sample custodian will verify the package seal, open the package, and compare the contents against the field chain-of-custody. At this time, the laboratory sample custodian will also be responsible for logging the samples in, assigning a unique laboratory identification number to each, and labeling the sample bottle with the laboratory identification number. The sample will then be moved into an appropriate storage location to await analysis. If a sample container is broken, the sample is in an inappropriate container, or has not been preserved by appropriate means, ARCADIS BBL will be notified. A project file shall be created with all relevant custody documentation.

5.2.3 Sample Analysis

Analysis of an acceptable sample will be initiated by a work sheet, which will contain all pertinent information for analysis. The analyst will sign and date the laboratory chain-of-custody form when removing the samples from storage.

Samples will be organized into sample delivery groups (SDGs) by the laboratory according to analytical parameter. An SDG may contain up to 20 field groundwater samples (field duplicates, trip blanks, and rinse blanks are considered field samples for the purposes of SDG assignment). All samples assigned to a single SDG must be received by the laboratory over a maximum of seven calendar days and must be processed through the laboratory (preparation, analysis, and reporting) as a group. Every SDG must include a minimum of one matrix spike/matrix spike duplicate (MS/MSD) or one MS/laboratory duplicate pair provided by the field sampling personnel.

Each SDG will therefore be self-contained for all of the required quality control samples. All parameters within an SDG will be extracted and analyzed together in the laboratory. At no time will the laboratory be allowed to run any sample (including QC samples) at an earlier or later time than the rest of the SDG. An entire SDG for any single parameter will be analyzed on a single instrument within the laboratory. These rules for analysis will ensure that the quality control samples for an SDG are applicable to the samples of the same SDG, and that the best possible comparisons may be made.

Information regarding the sample, analytical procedures performed, and the results of the testing will be recorded on laboratory forms or personal notebook pages by the analyst. These notes will be dated, and also identify the analyst, the instrument used, and the instrument conditions.

5.2.4 Laboratory Project Files

For all analytical laboratory samples analyzed, the laboratory will establish a file for all pertinent data. The file will include the chain-of-custody forms, raw data, chromatograms (required for all constituents analyzed by chromatography), and sample preparation information. The laboratory will retain project records for a period of five years.

5.2.5 Laboratory Documentation

Documentation

Workbooks, bench sheets, instrument logbooks, and instrument printouts are used to trace the history of samples through the analytical process, and document and relate important aspects of the work, including the associated quality controls. All logbooks, bench sheets, instrument logs, and instrument printouts are part of the permanent record of the laboratory.

Each page or entry is to be dated and initialized by the analyst at the time of entry. Errors in entry will be crossed out in indelible ink with a single stroke and corrected without the use of white-out or by obliterating or writing directly over the erroneous entry. All corrections are to be initialed and dated by the individual making the correction. Pages of logbooks that are not completed as part of normal record keeping should be completed by lining out unused portions.

Laboratory notebooks will be periodically reviewed by the laboratory section leaders for accuracy, completeness, and compliance to this QAPP. The laboratory section leader verifies all entries and calculations. If all entries on the pages are correct, then the laboratory section leader initials and dates the pages. Corrective action is taken for incorrect entries before the laboratory section leader signs.

Computer Tape and Hard Copy Storage

Whenever possible, raw data are maintained in electronic format. The electronic media is stored for a minimum of five years. All non-digital data is maintained as hard copy for a minimum of five years.

Sample Storage Following Analysis

Samples are maintained by the laboratory for one month after the final report is delivered to ARCADIS BBL. After this waiting period, the samples will be disposed of in accordance with applicable rules and regulations.

5.3 Project File

Field sampling activities documentation will be maintained by National Grid.

6. Calibration Procedures and Frequency

6.1 Field Equipment Calibration Procedures and Frequency

Specific procedures for performing and documenting calibration and maintenance for the field equipment used to measure field parameters (including conductivity, temperature, dissolved oxygen, pH, and turbidity) and groundwater elevation are provided in the FSP. Calibration checks will be performed daily when measuring field parameters. For groundwater sampling, the pH meter will be calibrated at each sampling location. Field equipment, frequency of calibration, and calibration standards are provided in Table 4.

Field personnel are responsible for assuring that a master calibration/maintenance log will be maintained following procedures specified in the FSP for each measuring device. Each log will include at a minimum where applicable:

- Name of device and/or instrument calibrated;
- Device/instrument serial/I.D. number;
- Frequency of calibration;
- Date(s) of calibration(s);
- Results of calibration(s);
- Name of person(s) performing calibration(s);
- Identification of calibration gas (i.e., isobutylene or methane); and
- Buffer solutions (pH meter only).

6.2 Laboratory Equipment Calibration Procedures and Frequency

Instrument calibration procedures will follow the specifications provided by the instrument manufacturer or specific analytical method used. Laboratories will be required to maintain the necessary ELAP-accreditation.

7. Analytical Procedures

7.1 Field Analytical Procedures

Data to be collected during field sampling activities will include the measurement of field parameters, including pH, conductivity, dissolved oxygen, temperature, and turbidity for groundwater samples, the collection of groundwater elevations, and length, weight and general physical condition of fish samples. In addition, pH will be measured for quarry pond water treatment system samples. Specific field measurement protocols are provided in the FSP. Field measurement quality control limits in terms of precision and accuracy are presented in Table 5.

7.2 Laboratory Analytical Procedures

The subsections below include a general summary of laboratory analytical requirements, specifics related to each sample medium to be analyzed, and details of the methods to be used for this project. Current NYSDEC ASP-approved methods and updates will be used where applicable.

7.2.1 General

The following tables summarize general analytical requirements:

Table	Title
Table 1	Environmental and Quality Control Analyses
Table 2	Parameters, Methods, and Reporting Limits
Table 6	Sample Containers, Preservation, and Holding Times

7.2.2 Sample Matrices

Analytical results for all analyses will be reported in the units identified in Table 2. The QC limits for groundwater and water treatment system samples collected during the field sampling activities are presented in Table 3.

7.2.3 Analytical Requirements

The primary sources for methods that will be used during the field sampling activities are provided in the NYSDEC 2000 ASP documents (or most current version). Analyses for PCBs contained in the groundwater and fish samples will be performed using USEPA SW-846 Method 8082 as referenced in the NYSDEC 2000 ASP, including Category B deliverables for data validation. Analyses for PCBs contained in the water treatment system samples will be performed using USEPA Method 608.

8. Data Reduction, Validation, and Reporting

8.1 General

After field and laboratory data are obtained, the data will be subject to the following:

1. Reduction or manipulation mathematically or otherwise into meaningful and useful forms;
2. Review;
3. Organization, interpretation, and reporting; and
4. Validation/data usability summary.

The subsections below present descriptions of the data reduction, review, and reporting activities that will be conducted in the field and laboratory as part of the field sampling activities. In addition, a description of the data validation activities to be performed is presented below.

8.2 Field Data Reduction, Review, and Reporting

A discussion of the reduction, review, and reporting of data collected in the field is presented below.

8.2.1 Field Data Reduction

Information collected in the field through visual observation, manual measurement and/or field instrumentation will be recorded in field notebooks, data sheets, and/or on forms. Such data will be reviewed for adherence to this QAPP and for consistency. Concerns identified as a result of this review will be discussed with field personnel, corrected if possible, and as necessary, incorporated into the data evaluation process.

8.2.2 Field Data Review

Field data calculations, transfers, and interpretations will be conducted by field personnel and reviewed for accuracy by the Field Manager and the QAM. All logs and documents will be checked for:

1. General completeness;
2. Readability;
3. Use of appropriate procedures;
4. Appropriate instrument calibration and maintenance;
5. Reasonableness in comparison to present and past data collected;
6. Correct sample locations; and
7. Correct calculations and interpretations.

8.2.3 Field Data Reporting

Where appropriate, field data forms and calculations will be processed and included in appropriate reports (as described in the OM&M Plan. The original field logs, documents, and data reductions will be kept in the project file by National Grid.

8.3 Laboratory Data Reduction, Review, and Reporting

A discussion of the laboratory reduction, review, and reporting of analytical data is presented below.

8.3.1 Laboratory Data Reduction

The calculations used for data reduction are specified in each of the analytical methods previously referenced. Whenever possible, analytical data is transferred directly from the instrument to a computerized data system. Raw data is entered into permanently-bound laboratory notebooks. The data entered are sufficient to document all factors used to arrive at the reported value.

Concentration calculations for chromatographic analyses are based on response factors. Quantitation is performed using either internal or external standards.

Non-aqueous values are reported on a dry-weight basis. Unless otherwise specified, all values are reported uncorrected for blank contamination.

8.3.2 Laboratory Data Review

Each laboratory section will provide extensive data review according to the methods used, prior to submission of results. The analyst will be responsible for primary review of data generated from sample analysis. If recoveries of all QC samples are within specified QC limits, then the data will be presented for secondary review. If recoveries of any QC samples exceed specified QC limits, then affected samples will be reanalyzed.

The laboratory Project Manager will determine if the analytical results of the sample(s) are consistent. If so, then the data will be presented in a final report. If discrepancies or deficiencies exist in the analytical results, then corrective action will be taken as discussed in Section 13.0. Deficiencies discovered, as a result of internal data validation, as well as the corrective actions to be used to rectify the situation, will be documented on a Corrective Action Form provided as Attachment A to this QAPP.

8.3.3 Laboratory Data Reporting

The laboratory is responsible for reporting the data in tabular format. Data will be tabulated by method and sample with reference to the sample by both field and laboratory identifications. The data tables will provide a cross-reference between each sample and the appropriate QC data package.

The laboratory will prepare full ASP Category B (i.e., Reporting Level 3) data packages and case narratives for each sample delivery group for the laboratory analyses of groundwater and fish samples for PCBs. Reports will include all raw data required to recalculate any result, including sample and standard printouts, chromatograms, and quantitation reports. In addition, sample preparation records including extraction sheets, digestion sheets, percent solids, and logbook pages will also be provided in the data package. The analytical results for water treatment system sampling will be presented using Reporting Level 2 criteria.

8.4 Data Validation/Data Usability Study

Analytical data may be evaluated using either the Data Usability Summary Report (DUSR) format or full analytical data validation. The DUSR would be utilized for routine characterization samples. The decision whether to utilize the DUSR for each sample delivery group would be made by the project manager based on the anticipated use of the analytical results. Data validation would be completed for specific groups of samples that are used to support conclusions or recommendations. Groundwater PCB analytical results collected as a part of the post-remediation monitoring activities will undergo full data validation.

Data validation entails a review of the QC data and the raw data to verify that the laboratory was operating within required limits, the analytical results are correctly transcribed from the instrument read outs, and which, if any, environmental samples are related to any out-of-control QC samples. The objective of data validation is to identify any questionable or invalid laboratory measurements.

Review of laboratory data packages would include an assessment of compliance with method guidelines and project-specific requirements. Specifically included is an evaluation of holding times, calibration requirements (initial and continuing), blank contamination, surrogate spikes (where applicable), matrix spikes and duplicates (where applicable), and compound identification. The data validator would use USEPA Region II's Functional Guidelines and the most recent versions of the USEPA SW-846 documents available at the time of project initiation as guidance, where appropriate. Data validation would consist of data editing, screening, checking, auditing, reviewing, and data interpretation to determine if the data quality is sufficient to meet the DQOs. Data validation would include a review of completeness and compliance, including but not limited to, the elements provided in Table 7.

The data validator would verify that reduction of laboratory measurements and laboratory reporting of analytical parameters is in accordance with the procedures specified for each analytical method (i.e., perform laboratory calculations in accordance with the method-specific procedure) and/or as specified in this QAPP. The data quality would be evaluated by application of the Functional Guidelines procedures and criteria modified as necessary to address project-specific and method-specific criteria, control limits, and procedures.

Upon receipt of the laboratory data, the data validator would execute the following reduction, validation, and reporting scheme:

- Evaluate completeness of data package;
- Verify that field chain-of-custody forms were completed and that samples were handled properly;
- Verify that holding times were met for each parameter. Holding times' exceedences, should they occur, will be documented. Data for all samples exceeding holding time requirements would be flagged as either estimated or rejected. The decision as to which qualifier is more appropriate would be made on a case-by-case basis;
- Verify that parameters were analyzed according to the methods specified;
- Review QA/QC data (i.e., make sure duplicates, blanks, and spikes were analyzed on the required number of samples, as specified in the method, verify that duplicate and matrix spike recoveries are acceptable);
- Investigate anomalies identified during review. When anomalies are identified, they would be discussed with the project manager and/or laboratory manager, as appropriate; and

- If data appears suspect, the specific data of concern would be investigated. Calculations would be traced back to raw data; if calculations do not agree, the cause would be determined and corrected.

Deficiencies discovered as a result of data validation, as well as the corrective actions implemented in response, would be documented and submitted in the form of a written report.

It should be noted that the existence of qualified results does not automatically invalidate data. The goal to produce the best possible data does not necessarily mean producing data without QC qualifiers. Qualified data can provide useful information.

Resolution of any issues regarding laboratory performance or deliverables would be handled between the laboratory and the data validator.

Upon completion of the validation of the sample delivery group/parameter, a data validation report addressing the following topics (as applicable to each method) would be prepared:

1. Assessment of the data package;
2. Description of any protocol deviations;
3. Failures to reconcile reported and/or raw data;
4. Assessment of any compromised data;
5. Laboratory case narrative;
6. Overall appraisal of the analytical data; and
7. Table of site name, sample quantities, data submitted to the laboratory, year of protocol used, date of extraction and analysis, matrix, and fractions analyzed.

The data validation reports will be transmitted (if necessary) to the NYSDEC, and kept in the project file by National Grid.

9. Field and Laboratory Quality Control Checks

Both field and laboratory quality control checks are proposed for the field sampling/monitoring activities. In the event that there are any deviations from these checks, the ARCADIS BBL QAM will be notified. The proposed field and laboratory control checks are discussed below. Quality control samples will be prepared as discussed in Section 4 of this QAPP.

9.1 Field Quality Control Checks

A discussion of the field quality control checks including quality control checks for field measurements, sample containers, field duplicates, rinse blanks, and trip blanks is presented below.

9.1.1 Field Measurement

To verify the quality of data using field instrumentation, duplicate measurements will be obtained and reported for all field measurements. A duplicate measurement will involve obtaining measurements a second time at the same sampling locations.

9.1.2 Sample Containers

Certified-clean sample containers for groundwater and water treatment system samples to be analyzed during the field sampling activities will be I-Chem 300 Series, or equivalent. The certified-clean sample containers will be supplied by the analytical laboratory.

9.1.3 Field Duplicates

Field duplicates will be collected for the groundwater and water treatment system samples. The groundwater sample duplicates will be used to check reproducibility of the sampling methods and the water treatment system samples will be used to verify positive detections of PCBs in samples. Field duplicates will be prepared as discussed in Section 4 of this QAPP. At a minimum, field duplicate groundwater samples will be analyzed at a 5 percent frequency (one every 20 samples) for each analytical parameter and each sample matrix. Table 1 provides an estimated number of field duplicates to be prepared for each applicable parameter and matrix.

9.1.4 Rinse Blanks

Rinse blanks are used to monitor the cleanliness of the sampling equipment and the effectiveness of the cleaning procedures. Rinse blanks will be prepared and submitted for analysis at a frequency of one per day (when sample equipment cleaning occurs) or once for every 20 samples collected, whichever is more. Rinse blanks will be prepared by filling sample containers with deionized water (supplied by the laboratory) which has been routed through a cleaned sampling device. When dedicated sampling devices are used, or sample containers are used to collect the samples, rinse blanks will not be necessary. As identified in Table 1, rinse blanks are not anticipated to be necessary for the groundwater and treatment system water samples to be collected during the field sampling activities.

9.2 Laboratory Quality Control Checks

Internal laboratory quality control checks will be used to monitor data integrity. These checks will include method blanks, matrix spikes (and matrix spike duplicates), spike blanks, internal standards, surrogate samples, calibration standards, and reference standards. Project QC limits for duplicates and matrix spikes are identified in Table 3. Laboratory control charts will be used to determine long-term instrument trends.

9.2.1 Method Blanks

Sources of contamination in the analytical process, whether specific analytes or interferences, need to be identified, isolated, and corrected. The method blank is useful in identifying possible sources of contamination within the analytical process. For this reason, it is necessary that the method blank is initiated at the beginning of the analytical process and encompasses all aspects of the analytical work. As such, the method blank would assist in accounting for any potential contamination attributable to glassware, reagents, instrumentation, or other sources, which could affect sample analysis. One method blank will be analyzed with each analytical series associated with no more than 20 samples. ASP guidelines for acceptance will be used. Guidelines for non-standard methods are provided in the appropriate protocols.

9.2.2 Matrix Spikes/Matrix Spike Duplicates

Matrix spikes and matrix spike duplicates will be used to measure the accuracy of analyte recovery from the sample matrices. All matrix spikes and matrix spike duplicates will be site-specific. Matrix spike/matrix spike duplicate pairs will be analyzed at a 5 percent frequency (every 20 groundwater samples).

Results for the organic matrix spike data will be examined in conjunction with matrix spike blanks (Section 9.2.3 of this QAPP) data and surrogate spike (Section 9.2.4) data to assess the accuracy of the analytical method. When matrix spike recoveries are outside QC limits, associated spike blank and surrogate recoveries will be evaluated to attempt to verify the reason for the variance(s), and determine the effect on the reported sample results. Table 1 presents an estimated number of matrix spike and matrix spike duplicate analyses for each applicable matrix and parameter.

9.2.3 Matrix Spike Blanks

Spike blanks will be included to provide an additional assessment of data accuracy. The spike blanks provide an assessment of method performance without interferences, which may be present in environmental samples. Spike blanks will be analyzed at a frequency of one blank associated with no more than 20 samples. For spike blank analyses, clean matrix is spiked and recoveries are calculated similar to matrix spike recoveries. Matrix spike blank data will be assessed in conjunction with matrix spike data, as discussed in Section 10.2.2 of this QAPP. Table 1 presents an estimated number of matrix spike blanks for each matrix and parameter.

9.2.4 Surrogate Spikes

Surrogates are compounds unlikely to be found in nature that have properties similar to the analytes of interest. This type of control is primarily used for organic samples analyzed by Gas Chromatograph/Mass Spectrometry (GC/MS) and GC methods and is added to the samples prior to purging or extraction. The surrogate spike is utilized to provide broader insight into the proficiency and efficiency of an analytical method on a sample specific basis. This control reflects analytical conditions, which may not be attributable to sample matrix.

Surrogate spike compounds will be selected utilizing the guidance provided in the analytical methods summarized in Table 2.

If surrogate spike recoveries exceed specified QC limits, then the analytical results need to be evaluated thoroughly in conjunction with other control measures. In the absence of other control measures (i.e., internal standard and matrix spikes), the integrity of the data may not be verifiable and reanalysis of the sample with additional controls may be necessary.

9.2.5 Calibration Standards

Calibration check standards analyzed within a particular analytical series provide insight regarding the instrument's stability. A calibration check standard will be analyzed at the beginning and end of an analytical series, or periodically throughout a series containing a large number of samples.

In general, calibration check standards will be analyzed after every 12 hours, or more frequently as specified in the applicable analytical method. In analyses where internal standards are used, a calibration check standard will only be analyzed in the beginning of an analytical series. If results of the calibration check standard exceed specified tolerances, then all samples analyzed since the last acceptable calibration check standard will be reanalyzed.

Laboratory instrument calibration standards will be selected utilizing the guidance provided in the analytical methods summarized in Table 2.

9.2.6 Internal Standards

Internal standard areas and retention times are monitored for organic analyses performed by GC/MS methods. Method-specified internal standard compounds are spiked into all field samples, calibration standards, and QC samples after preparation and prior to analysis. If internal standard areas in one or more samples exceed the specified tolerances, the cause will be investigated, the instrument recalibrated (if necessary), and all affected samples reanalyzed.

The use of internal standards will be as provided within the analytical methods summarized in Table 2.

10. Performance and System Audits

10.1 General

This section describes the performance and system audits that may be completed in the field and the laboratory during the groundwater field sampling activities.

10.2 Field Audits

Field performance and system audits that will be completed (as necessary) during this project are described in the subsections below.

10.2.1 Performance Audits

The Field Manager will monitor field performance. Field performance audit summaries will contain an evaluation of field measurements and field meter calibrations to verify that measurements are taken according to established protocols. The ARCADIS BBL QAM will review all field reports and communicate concerns to the ARCADIS BBL Project Manager and/or Field Manager, as appropriate. In addition, the ARCADIS BBL QAM will review the rinse blank data (if any) to identify potential deficiencies in field sampling and cleaning procedures.

10.2.2 Internal System Audits

A field internal system audit is a qualitative evaluation of all components of field QA/QC. The system audit compares scheduled QA/QC activities from this document with actual QA/QC activities completed. The Field Manager and QAM will periodically confirm that work is being performed consistent with this QAPP, the OM&M Plan, FSP and the HASP.

10.3 Laboratory Audits

The analytical laboratory will perform internal audits consistent with NYSDEC ASP (or most current version). National Grid reserves the right to conduct an onsite audit of the laboratory prior to the start of analyses for the project. Additional audits may be performed during the course of the project, as deemed necessary.

11. Preventative Maintenance

Preventive maintenance schedules have been developed for both field and laboratory instruments. A summary of the maintenance activities to be performed is presented below.

11.1 Field Instruments and Equipment

Prior to any field sampling, each piece of field equipment will be inspected to assure it is operational. If the equipment is not operational, it must be serviced prior to use. All meters which require charging or batteries will be fully charged or have fresh batteries. If instrument servicing is required, it is the responsibility of the appropriate Field Manager or field personnel to follow the maintenance schedule and arrange for prompt service.

Field instrumentation to be used during OM&M activities includes meters to measure pH, conductivity, dissolved oxygen, temperature, turbidity, and water levels. Field equipment also includes sampling devices for collecting groundwater and quarry pond water treatment system samples, as well as an oil/water interface probe to determine absence/presence of NAPL within a monitoring well. A logbook will be kept for each field instrument. Each logbook contains records of operation, maintenance, calibration, and any problems and repairs. The Field Managers will review calibration and maintenance logs.

Field equipment returned from a site will be inspected to confirm it is in working order. The last individual to use the equipment will record this inspection in the logbook or field notebooks, as appropriate.

Non-operational field equipment will be either repaired or replaced. Appropriate spare parts will be made available for field meters. A summary of preventive maintenance requirements for field instruments is provided in Table 8. Details regarding field equipment maintenance, operation, and calibration are provided in the FSP.

12. Data Assessment Procedures

The analytical data generated during the groundwater field sampling activities will be evaluated with respect to precision, accuracy, and completeness and compared to the data quality objectives set forth in Sections 1.0 and 3.0 of this QAPP. Table 3 summarizes QC limits required to evaluate analytical performance.

The procedures utilized when assessing data precision, accuracy, and completeness are presented below.

12.1 Data Precision Assessment Procedures

Field precision is difficult to measure because of temporal variations in field parameters. However, precision will be controlled with experienced field personnel, properly calibrated meters, and duplicate field measurements. Field duplicates will be used to assess precision for the entire measurement system including sampling, handling, shipping, storage, preparation, and analysis.

Laboratory data precision for organic analyses will be monitored using matrix spike/matrix spike duplicate sample analyses. For other parameters, laboratory data precision will be monitored with field duplicates and/or laboratory duplicates as identified in Table 1.

The precision of data will be measured by calculation of the relative percent difference (RPD) by the following equation:

$$RPD = \frac{(A-B)}{(A+B)/2} \times 100$$

Where:

A = Analytical result from one of two duplicate measurements
B = Analytical result from the second measurement

Precision objectives for duplicate analyses are identified in Table 3.

12.2 Data Accuracy Assessment Procedures

Experienced field personnel, properly calibrated field meters, and adherence to established protocols will control the accuracy of field measurements. The accuracy of field meters will be assessed by review of calibration and maintenance logs.

Laboratory accuracy will be assessed via the use of matrix spikes, surrogate spikes, and reference standards. Where available and appropriate, QA performance standards will be analyzed periodically to assess laboratory accuracy. Accuracy will be calculated in terms of percent recovery as follows:

$$\% \text{ Recovery} = \frac{A-X}{B} \times 100$$

Where:
A = Value measured in spiked sample or standard
X = Value measured in original sample
B = True value of amount added to sample or true value of standard

This formula is derived under the assumption of constant accuracy between the original and spiked measurements. Accuracy objectives for matrix spike recoveries are identified in Table 3.

12.3 Data Completeness Assessment Procedures

Completeness of a field or laboratory data set will be calculated by comparing the number of valid sample results generated to the total number of results generated.

$$\text{Completeness} = \frac{\text{Number Valid Results}}{\text{Total number of results generated}} \times 100$$

The data completeness goal is 100%. Any data deficiencies will be evaluated to assess impacts on project goals and requirements for resampling and/or reanalysis. The assessment of completeness will require professional judgment to determine data useability for intended purposes.

13. Corrective Action

Corrective actions are required when field or analytical data are not within the objectives specified in this QAPP or the FSP. Corrective actions include procedures to promptly investigate, document, evaluate, and correct data collection and/or analytical procedures. Field and laboratory corrective action procedures for the sampling/monitoring activities are described below.

13.1 Field Procedures

When conducting the field work, if a condition is noted that would have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause, and corrective action implemented will be documented on a Corrective Action Form (Attachment A) and reported to the appropriate Field Manager, QAM, and Project Manager.

Examples of situations, which would require corrective actions, are provided below:

1. Protocols as defined by this QAPP have not been followed;
2. Equipment is not in proper working order or properly calibrated;
3. QC requirements have not been met; and
4. Issues resulting from performance or systems audits.

Project personnel will continuously monitor ongoing work performance in the normal course of daily responsibilities.

13.2 Laboratory Procedures

In the laboratory, when a condition is noted to have an adverse effect on data quality, corrective action will be taken so as not to repeat this condition. Condition identification, cause, and corrective action to be taken will be documented, and reported to the appropriate project manager and QAM. The laboratory will verify that the corrective action has eliminated the adverse condition.

Corrective action may be initiated, at a minimum, under the following conditions:

1. Protocols as defined by this QAPP have not been followed;
2. Predetermined data acceptance standards are not obtained;
3. Equipment is not in proper working order or calibrated;
4. Sample and test results are not completely traceable;
5. QC requirements have not been met; and
6. Issues resulting from performance or systems audits.

Laboratory personnel will continuously monitor ongoing work performance in the normal course of daily responsibilities.

14. Quality Assurance Reports to Management

14.1 Internal Reporting

For data qualified by the data validator, data users relative to project decision-making requirements will assess data usability. Supporting data (i.e., historic data, related field or laboratory data) will be reviewed to assist in determining data quality, as appropriate.

14.2 Reporting

Validated data reports prepared will contain a separate QA/QC section(s) summarizing the quality of data collected and/or used as appropriate to achieve the project data quality objectives, which are discussed in Section 1.3 of this QAPP. The QAM will prepare the QA/QC summaries using reports and memoranda documenting the data assessment and validation.

In addition, records will be maintained to provide evidence of the QA activities. A QA records index will be initiated at the beginning of the project, and all information received from outside sources or developed during the project will be retained by National Grid. Upon termination of an individual task or work assignment, working files will be forwarded to the project files.

Tables

Table 1

M. Wallace and Son, Inc.
Cobleskill, New York
Field Sampling Plan

Environmental and Quality Control Analyses

Parameter	**Est. Sample Quantity per Event**	**Field QC Analyses**						**Laboratory QC Analyses**						**Est. Overall Annual Total**
		Trip Blank		**Field Dup**		**Rinse Blank**[1]		**MS**		**MSD**		**Lab Dup**		
		Freq.	**No.**	**Freq.**	**No.**	**Freq.**	**No.**	**Freq.**	**No.**	**Freq.**	**No.**	**Freq.**	**No.**	
Semi-Annual Offsite Groundwater Samples														
PCBs	6	--	--	1/20	1	--	--	1/20	1	1/20	1	--	--	18
Monthly Water Treatment System Samples														
PCBs (100 gpm system)	2	--	--	1/1	2	--	--	--	--	--	--	--	--	48
PCBs (100 and 300 gpm system)	3	--	--	1/1	3	--	--	--	--	--	--	--	--	12
								MS		**MSD**				**Total**
Biota Samples														
PCBs	12	--	--	--	--	--	--	1/20	1	1/20	1	--	--	14

Notes:

1. Monthly water treatment system samples will be collected and analyzed for PCBs using USEPA Method 608.
2. Duplicate water treatment system samples will be collected for each sample and will be held by the lab and analyzed for PCBs only if PCBs are detected in the original sample and/or as directed by the engineer.
3. Semi-annual groundwater samples will be analyzed for filtered and unfiltered PCBs using USEPA Method 8082 in accordance with NYSDEC Analytical Service Protocol (or most current version). Category B deliverables shall be provided.
4. Filtered samples will be analyzed for PCBs only if PCBs are detected in the unfiltered sample.
5. This table assumes 12 rounds of samples will be collected from the 100 gpm water treatment system and four rounds of samples will be collected from the combined operation of the 100 and 300 gpm water treatment system.

DUP	Duplicate
Est.	Estimated
Freq.	Frequency
MS	Matrix Spike
MSD	Matrix Spike Duplicate
No.	Number
PCBs	Polychlorinated biphenyls
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristics Leaching Procedure

Table 2

M. Wallace and Son, Inc.
Cobleskill, New York
Quality Assurance Project Plan

Parameters, Methods, and Reporting Limits

Constituent	Reporting Limits Water (ppb)
PCBs (USEPA SW-846 Method 8082)	
Aroclor 1221	0.05
Aroclor 1232	0.05
Aroclor 1242	0.05
Aroclor 1248	0.05
Aroclor 1254	0.05
Aroclor 1260	0.05
Total PCBs	0.05
PCBs (USEPA Method 608)	
Total PCBs	0.065

Notes:

1. USEPA SW-846 Method 8082 will be used for analysis of groundwater samples for PCBs.
2. PCBs = Polychlorinated Biphenyls.
3. ppb = parts per billion.
4. USEPA Method 608 will be used for analysis of quarry pond water treatment system samples for PCBs.

Table 3

M. Wallace and Son, Inc.
Cobleskill, New York
Quality Assurance Project Plan

Quality Control Limits

Constituent	Accuracy, % Recovery	Precision, RPD
GROUNDWATER		
Aroclor 1242	39 – 150	--
Aroclor 1254	39 – 150	--

Notes:

1. The listed QC limits are from USEPA SW-846 Method 8082, as presented in the NYSDEC 2000 ASP.
2. RPD = Relative percent difference.

Table 4

M. Wallace and Son, Inc.
Cobleskill, New York
Quality Assurance Project Plan

Field Calibration Frequency

Equipment	Calibration Check	Calibration Standard	Calibration Standard Holding Time
pH Meter	Prior to use - daily[1]	pH 4.0 pH 7.0 pH 10.0	One Month
Conductivity Meter	Prior to use - daily	1,000 mg/l Sodium Chloride	One Month
Water Level Meter	Prior to implementing field work	100-foot engineer's tape	N/A
Dissolved Oxygen Meter	Per sampling event	Air	N/A
Turbidity	Prior to use - daily	Formazin 0.5 NTU, 5.0 NTU, 40.0 NTU	N/A
PID	Prior to use - daily	Isobutylene	N/A

Notes:

1. The pH meter will also be calibrated at each well prior to groundwater sampling.
2. N/A = not applicable.
3. NTU = nephelometric turbidity units.
4. mg/l = milligrams per liter.
5. PID = photoionization detector.

Table 5

M. Wallace and Son, Inc.
Cobleskill, New York
Quality Assurance Project Plan

Field Measurements Quality Control

Field Parameter	**Precision** [1]	**Accuracy**
Water Temperature	± 1ºC	± 1ºC instrument capability
pH	± 0.1 S.U. [2]	± 0.1 S.U. (instrument capability)
Conductivity	± 0.01 mS/cm [3]	± 5% standard
Dissolved Oxygen	± 0.02 mg/l [4]	± 5%
Turbidity	± 1.0 NTU	± 2% standard
Water Level	± 0.01 foot	± 0.01 foot

Notes:

1. Precision units presented in applicable significant figures.
2. ^{O}C = degrees Celsius.
3. S.U. = standard units.
4. mS/cm = millisiemens per centimeter.
5. mg/l = milligrams per liter.
6. NTU = nephelometric turbidity unit.

Table 6

M. Wallace and Son, Inc.
Cobleskill, New York
Quality Assurance Project Plan

Sample Containers, Preservation, and Holding Times

Parameter	Analytical Method Reference	Sample Container	Minimum Volume of Sample	Preservation	Maximum Holding Time
PCBs	USEPA Method 608	Two 1-liter amber glass with teflon-lined cap	1 liter	Cool, 4° C	Extract within 7 days, analyze within 40 days
PCBs	USEPA SW846 Method 8082	Two 1-liter amber glass with teflon-lined cap	1 liter	Cool, 4° C	Extract within 7 days, analyze within 40 days

Notes:

1. Unless otherwise specified, all holding times are measured from date of collection.
2. Laboratory pre-preserved bottles will be used for all water sampling.
3. °C = degrees Celsius.

Table 7

M. Wallace and Son, Inc.
Cobleskill, New York
Quality Assurance Project Plan

Data Validation Checklist - Laboratory Analytical Data

Review for Completeness	
1.	All chain-of-custody forms included.
2.	Case narratives.
3.	QA/QC summaries of analytical data, including supporting documentation.
4.	All relevant calibration data, including supporting documentation.
5.	Instrument and method performance data.
6.	Documentation showing laboratory's ability to attain specified method detection limits.
7.	Data report forms of examples for calculations of concentrations.
8.	Raw data used in identification and quantification of the analysis required.
Review of Compliance	
1.	Data package completed as described above.
2.	QAPP requirements for data production and reporting have been met.
3.	QA/QC criteria have been met.
4.	Instrument type and calibration procedures have been met.
5.	Initial and continuing calibration have been met.
6.	Data reporting forms are completed.
7.	Problems and corrective actions documents.

Table 8

M. Wallace and Son, Inc.
Cobleskill, New York
Quality Assurance Project Plan

Preventative Maintenance Summary

Maintenance	Frequency
Turbidity Meter	
Store in protective casing	D
Inspect equipment after use	D
Clean sample cells	D
Clean lens	M or X
Check and recharge batteries	D
Keep log book on instrument	D
Have replacement meter available	D
Return to manufacturer for service	X
Calibration	D
Conductivity, pH, Dissolved Oxygen Meters	
Store in protective casing	D
Inspect equipment after use	D
Clean probe	D
Keep log book in instrument	D
Have replacement meter available	D
Replace probes	X
Return to manufacturer for service	X
Calibration	D
Thermometer	
Store in protective casing	D
Inspect equipment after use	D
Have a replacement thermometer available	D
Water Level Meter	
Store in protective covering	D
Inspect equipment after use	D
Check indicators/batteries	D
Keep log book on instrument	D
Have a replacement meter available	X
Photoionization Detector	
Store in protective casing	D
Inspect equipment after use	D
Check and recharge batteries	D
Clean UV lamp and ion chamber	M or X
Keep log book on instrument	D
Have replacement meter available	D
Return to manufacturer for service	X
Calibration	D

Notes:
D = Daily
M = Monthly
X = Operator's discretion

Attachments

Attachment A

Corrective Action Form

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M. Wallace and Son, Inc.
Cobleskill, New York
Quality Assurance Project Plan

Corrective Action Form

Condition:

____

____

Resolution (Corrective Action): ________________________________

____

____

____

Affected Documents: ________________________________

____

____

Signature: ____________________ Date: ____________________

Follow-up: ________________________________

Corrective Action Verified: ________________________________

By: ____________________ Date: ____________________

Appendix C

Health and Safety Plan

nationalgrid

Operation, Maintenance and Monitoring Plan
M. Wallace and Son, Inc. Scrapyard Site
Cobleskill, New York

Revised
January 2007

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Health and Safety Plan

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Operation, Maintenance and Monitoring Plan
M. Wallace and Son, Inc. Scrapyard Site
Cobleskill, New York

Revised
January 2007

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1. Introduction

1.1 Objective

This *Health and Safety Plan* (HASP) supports the *Operation, Maintenance and Monitoring Plan* (OM&M Plan) for the M. Wallace and Son, Inc. Scrapyard Site (Site) in Cobleskill, New York. The OM&M Plan has been prepared as part of the New York State Department of Environmental Conservation - (NYSDEC-) selected remedy presented in the Record of Decision (ROD) for the Site, dated March 1999, which was subsequently amended by an Explanation of Significant Difference (ESD) issued by the NYSDEC in May 2000. The NYSDEC-required remedial action activities were completed in 2001/2002, as detailed in the *Remedial Action Report* (BBL, 2003) approved by the NYSDEC in a November 4, 2003 letter to National Grid. This HASP has been prepared by ARCADIS BBL for OM&M field activities to be conducted at the Site for those portions of the Site that are not part of the active scrapyard for the M. Wallace and Son, Inc. operations.

In general, OM&M field activities anticipated to be conducted include:

- Mobilization;
- Onsite Observation;
- Groundwater Sampling and Monitoring, including light nonaqueous phase liquid (LNAPL) recovery;
- Quarry Pond Water Treatment System Sampling and Monitoring;
- Fish sampling;
- Groundwater Monitoring Wells/Coreholes Decommissioning/Abandonment;
- Decontamination Activities; and
- Demobilization.

The objective of this HASP is to provide a mechanism for establishing safe working conditions at the Site. The safety organization, procedures, and protective equipment have been established based on an analysis of potential hazards. Specific hazard control methodologies have been evaluated and selected to minimize the potential of injury, illness, or other hazardous incident.

1.2 Site Description

The Site is located at the intersection of New York State Route 10 (Route 10, also known as Elm Street) and Settles Mountain Road (formerly known as West Street) in the Village of Cobleskill, Schoharie County, New York. The portion of the M. Wallace and Son, Inc. property located north of Route 10 is the “Site” and encompasses an area of approximately 6 acres. The Site is bordered by West Street to the west; Route 10 to the south; several apartments and residential housing to the east; and a high school athletic field to the north.

1.3 Policy Statement

ARCADIS BBL’s policy is to provide a safe and healthful work environment. No aspect of operations is of greater importance than injury and illness prevention. A fundamental principle of safety management is that all injuries, illnesses, and incidents are preventable. ARCADIS BBL will take every reasonable step to eliminate or control hazards to minimize the possibility of injury, illness, or incident.

This HASP prescribes the procedures that must be followed while performing Site activities. Operational changes that could affect the health and safety of personnel, the community, or the environment will not be made without prior approval of the project manager (PM) and the health and safety officer (HSO). This document will be reviewed periodically to confirm that it is current and technically correct. Any changes in Site conditions and/or the scope of work will require a review of and modification to this HASP. Such changes will be completed in the form of an addendum or a revision to this HASP.

The provisions of this HASP are mandatory for all ARCADIS BBL personnel and ARCADIS BBL subcontractors assigned to the project. Subcontractors may prepare and follow their own Site-specific HASPs provided that they meet the basic requirements of this HASP. All visitors to ARCADIS BBL work areas at the Site must abide by the requirements of this HASP.

This HASP complies with applicable Occupational Safety and Health Administration (OSHA) regulations, United States Environmental Protection Agency (USEPA) *Standard Operating Safety Guidelines* (USEPA, 1992), and BBL's *Health and Safety Policies and Procedures Manual* (BBL, 2003). This HASP follows the guidelines established in the references listed in Section 10 - References.

1.4 Definitions

The following definitions (listed alphabetically) are applicable to this HASP.

- *Contamination Reduction Zone (CRZ)* - area between the Exclusion Zone and Support Zone that provides a transition between contaminated and clean areas. Decontamination stations are located in this zone.

- *Emergency* - Any occurrence (including any failure of hazard control or monitoring equipment) or event (internal or external) to the permit space that could endanger confined space entrants.

- *Exclusion Zone (EZ)* - any portion of the Site where hazardous substances are, or are reasonably suspected to be, present in the air, water, or soil.

- *Incident* - All losses, including first-aid cases, injuries, illnesses, near misses, spills/leaks, equipment and property damage, motor vehicle accidents, regulatory violations, fires, and business interruptions.

- *Near Miss* - An incident in which no injury, illness, motor vehicle accident, equipment or property damage, etc. occurred, but under slightly different circumstances could have occurred.

- *Project* - All onsite work performed under the scope of work.

- *Site* - The area described in Section 1.2 - Site Description, where the work is to be performed by ARCADIS BBL personnel and subcontractors.

- *Subcontractor* - Includes contractor personnel hired by ARCADIS BBL.

- *Support Zone (SZ)* - all areas of the Site excluding the EZ and CRZ. The SZ surrounds the immediate area where project activities are underway. Support equipment is located in this zone.

- *Visitor* - All other personnel, except the onsite personnel.

- *Work Area* - The portion of the Site where work activities are actively being performed. This area may change daily as work progresses.

2. Roles and Responsibilities

2.1 All Personnel

All ARCADIS BBL and subcontractor personnel must adhere to the procedures outlined in this HASP during the performance of their work. Each person is responsible for completing tasks safely and reporting any unsafe acts or conditions to their supervisor. No person may work in a manner conflicting with these procedures. After due warnings, the PM will dismiss from the Site any person or subcontractor who violates safety procedures.

All ARCADIS BBL and subcontractor personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained in this HASP prior to initiating Site activities. In addition, all personnel will attend an initial hazard briefing prior to beginning work at the Site.

The roles of ARCADIS BBL personnel and subcontractors are outlined in the following subsections. A summary table for key project personnel and contacts is provided below.

TABLE 2-1
KEY PERSONNEL

Agency Personnel		
Role	**Name**	**Address/Telephone No.**
NYSDEC Project Manager	Daniel Lightsey, P.E.	1150 N. Westcott Road Schenectady, NY 12306 (518) 357-2045
Role	**Name**	**Address/Telephone No.**
NYSDOH Representative	To Be Determined	Flanigan Square 547 River Street Troy, NY 12180 (518) 402-7860
National Grid Personnel		
Role	**Name**	**Address/Telephone No.**
Program Manager	James F. Morgan	300 Erie Blvd. West Syracuse, NY 13202-4250 (315) 428-3101
OM&M Project Manager	Steven P. Stucker, CPG	300 Erie Blvd. West Syracuse, NY 13202-4250 (315) 428-5652
ARCADIS BBL Personnel		
Role	**Name**	**Address/Telephone No.**
Project Officer	James M. Nuss, P.E.	6723 Towpath Road Syracuse, NY 13214-0066 Office: (315) 446-9120
Project Manager	Gunther J. Schnorr	6723 Towpath Road Syracuse, NY 13214-0066 Office: (315) 446-9120

	ARCADIS BBL Personnel	
Role	**Name**	**Address/Telephone No.**
Health and Safety Officer	Jay D. Keough, CIH	8 South River Road Cranbury, NJ 08512 Office: (609) 860-8072
Health and Safety Manager	Charles P. Webster, CSP	6723 Towpath Road Syracuse, NY 13214-0066 Office: (315) 446-9120 Cell: (315) 247-5971
Site Supervisor	To be determined	
Health and Safety Supervisor	To be determined	

2.2 ARCADIS BBL Personnel

2.2.1 Project Officer (PO)

The PO is responsible for providing resources to assure project activities are completed in accordance with this HASP, and for meeting regulatory and contractual requirements.

2.2.2 Health and Safety Officer

The HSO or his/her designee (the health and safety manager) has overall responsibility for the technical health and safety aspects of the project, including review and approval of this HASP. Inquiries regarding ARCADIS BBL health and safety procedures, project procedures, and other technical or regulatory issues should be addressed to this individual. The HSO or his/her designee must approve changes or addenda to this HASP.

2.2.3 Project Manager

The PM is responsible for verifying that project activities are completed in accordance with the requirements of this HASP. The PM is responsible for confirming that the Site supervisor (SS) has the equipment, materials, and qualified personnel to fully implement the safety requirements of this HASP, and/or those subcontractors assigned to this project meet the requirements established by ARCADIS BBL. It is also the responsibility of the PM to perform the following duties:

- Consult with the HSO on Site health and safety issues;
- Verify that subcontractors meet health and safety requirements prior to commencing work;
- Review Safe Work Observation (SWO) reports;
- Verify that all incidents are thoroughly investigated;

- Approve, in writing, addenda or modifications to this HASP; and
- Suspend work or modify work practices, as necessary, for personal safety, protection of property, and regulatory compliance.

2.2.4 Health and Safety Supervisor

The health and safety supervisor (HSS) is responsible for field health and safety issues, including the execution of this HASP. Questions in the field regarding health and safety procedures, project procedures, and other technical or regulatory issues should be addressed by this individual. The HSS will advise the PM on health and safety issues, and will establish and coordinate the project air monitoring program if one is deemed necessary (see Section 6.1 - Air Monitoring). The HSS is the primary Site contact on health and safety matters. It is the responsibility of the HSS to perform the following duties:

- Provide onsite technical assistance, if necessary;
- Participate in all incident investigations (IIs), and confirm that they are reported to the HSO and PM within 24 hours;
- Coordinate Site and personal air monitoring, as required, including equipment maintenance and calibration;
- Conduct Site safety orientation training and safety meetings;
- Verify that ARCADIS BBL personnel and subcontractors have received the required physical examinations and medical certifications;
- Review Site activities with respect to compliance with this HASP;
- Maintain required health and safety documents and records;
- Assist the SS in instructing field personnel on project hazards and protective procedures; and
- Review SWO forms.

2.2.5 Site Supervisor

The SS is responsible for implementing this HASP, including communicating requirements to onsite personnel and subcontractors. The SS will be responsible for informing the PM of changes in the work plan, procedures, or Site conditions so that those changes may be addressed in this HASP. Other responsibilities are to perform the following duties:

- Consult with the HSS on Site health and safety issues;
- Conduct SWOs at the Site;

- Stop work, as necessary, for personal safety, protection of property, and regulatory compliance;
- Obtain a Site map, determine and post routes to medical facilities, and post emergency telephone numbers;
- Notify local public emergency representatives (as appropriate) of the nature of the Site operations and post their telephone numbers (e.g., local fire department personnel who would respond for a confined-space rescue);
- Observe onsite project personnel for signs of ill-health effects;
- Investigate and report any incidents to the HSS;
- Verify that all onsite personnel have completed applicable training;
- Verify that onsite personnel are informed of the physical, chemical, and biological hazards associated with the Site activities and the procedures and protective equipment necessary to control the hazards; and
- Issue/obtain any required work permits (hot work, confined space, etc.).

2.3 Subcontractors

Subcontractors and their personnel must understand and comply with applicable regulations and Site requirements established in this HASP. Subcontractors may prepare their own Site-specific HASP that must be consistent with the requirements of this HASP.

All subcontractor personnel will receive training in accordance with applicable regulations and be familiar with the requirements and procedures contained in this HASP prior to initiating Site activities. All subcontractor personnel will attend an initial hazard briefing prior to beginning work at the Site. Additionally, onsite subcontractor personnel must attend and participate in the daily Site safety meetings.

Subcontractors must designate individuals to function as the PM, HSO, HSS, and SS. In some firms, it is not uncommon for the duties of the HSO to be carried out by the PM. This is acceptable, provided that the PM has the required knowledge, training, and experience to properly address all hazards associated with the work, and to prepare, approve, and oversee the execution of the Site-specific HASP. A subcontractor may designate the same person to perform the duties of both the HSS and the SS. However, depending on the level of complexity of a contractor's scope of work, it may be infeasible for one person to perform both functions satisfactorily.

2.4 All Onsite Personnel

All onsite personnel including subcontractors must read and acknowledge their understanding of this HASP before commencing work, and abide by the requirements of the HASP. All onsite personnel must sign the HASP Acknowledgement Form after reviewing this HASP.

All ARCADIS BBL and subcontractor personnel will receive training in accordance with applicable regulations, and be familiar with the requirements and procedures contained in this HASP prior to initiating Site activities. In addition, all onsite personnel will attend an initial hazard briefing (prior to beginning work at the Site) and the daily safety meetings.

All onsite personnel must perform a risk self-assessment (RSA) prior to beginning each work activity. The RSA process involves determining worst-case scenarios for the tasks at hand and then ensuring that adequate steps are taken to eliminate or mitigate the risk. This process must be performed prior to beginning each activity and after any near-miss or other incident to determine if it is safe to proceed. Onsite personnel will immediately report the following to the SS or HSS:

- Personal injuries and illnesses, no matter how minor;
- Unexpected or uncontrolled release of chemical substances;
- Symptoms of chemical exposure;
- Unsafe or hazardous situations;
- Unsafe or malfunctioning equipment;
- Changes in Site conditions that may affect the health and safety of project personnel;
- Damage to equipment or property;
- Situations or activities for which they are not properly trained; and
- Near misses.

2.5 Visitors

All visitors to ARCADIS BBL work areas must check in with the SS. Visitors will be cautioned to avoid contact with any materials that may be impacted by constituents of concern (COCs).

Visitors requesting to observe work at the Site must don appropriate personal protective equipment (PPE) prior to entering the work area, and must have the appropriate training and medical clearances to do so.

2.6 Stop Work Authority

- Every ARCADIS BBL employee and ARCADIS BBL subcontractor is empowered, expected and has the responsibility to stop the work of another co-worker if the working conditions or behaviors are considered unsafe.

3. Project Hazards and Control Measures

3.1 Introduction

Field activities will include the following tasks:

- Mobilization;
- Onsite Observation Activities;
- Decommissioning Groundwater Monitoring Wells/Coreholes;
- Groundwater Sampling/Monitoring, including LNAPL Recovery;
- Fish sampling;
- Quarry Pond Water Treatment Systems Sampling and Monitoring;
- Decontamination; and
- Demobilization.

The following job safety analyses (JSAs) identify potential health, safety, and environmental hazards associated with each type of field activity listed above. Because of the complex and changing nature of field projects, supervisors must inspect the Site to identify hazards that may affect onsite personnel, the community, or the environment. The SS must be aware of these changing conditions and discuss them with the PM whenever these changes impact employee health, safety, the environment, or performance of the project. The SS will keep onsite personnel informed of the changing conditions and the PM will write and/or approve addenda or revisions to this HASP as necessary.

Each field activity is described below, and potential hazards and control measures for each activity are discussed.

3.2 Mobilization

Site mobilization will include establishing sampling locations, determining the location of utilities and other installations, and establishing work areas. A break area will be set up outside of regulated work areas. Mobilization may involve clearing areas for the support zone (SZ) and contamination reduction zone (CRZ). During this initial phase, project personnel will walk the Site to confirm the existence of anticipated hazards, and identify safety and health issues that may have arisen since the writing of this plan.

3.2.1 Hazards

Hazards associated with mobilization activities may include, but are not limited to:

- Manual materials handling;

- Installing temporary onsite facilities;

- Manual site preparation; and

- Powered equipment operations.

Manual materials handling and manual Site preparation may cause blisters, sore muscles, and joint and skeletal injuries; manual materials handling may also present eye, contusion, and laceration hazards. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Freezing weather hazards include frozen, slick, and irregular walking surfaces.

Environmental hazards include:

- Plants, such as poison ivy and poison oak;
- Aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes;
- Weather, such as sunburn, lightning, rain, and heat- or cold-related illnesses;
- Pathogens, such as rabies, Lyme disease, and blood-borne pathogens; and
- Powered equipment operations hazards include being struck by blades or by material thrown by powered equipment.

3.2.2 Control

Control procedures for these hazards are discussed in Section 4 - General Safety Practices. Control of hazards associated with vehicular traffic is outlined in Section 4.10.

3.3 Onsite Observation Activities

Observation activities will be provided by ARCADIS BBL during OM&M construction activities at the Site (e.g., soil backfilling and grading, fence installation, water treatment system maintenance, etc.). Observation activities may involve a potential for exposure to physical and health hazards. Hazards may be associated with the Site and the environmental conditions.

Physical Hazards: The physical hazards involved with observation work are primarily associated with the Site environment. There exists a potential for incidents involving personnel struck by or struck against objects resulting in fractures, cuts, punctures, or abrasions. Walking and working surfaces during activities may involve slip, trip, and fall hazards.

Working Surfaces: Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls. All personnel should frequently inspect working surfaces and keep working surface clear of debris.

Materials Handling: The most common type of accident that occurs in material handling operations is the "caught between" situation when a load is being handled and a finger or toe gets caught between two objects. Extreme care must be taken when loading and unloading material. Proper lifting technique must be employed.

Control: Prior to initiating activity, the Site conditions will be discussed with all onsite ARCADIS BBL employees. Hazards will be identified and protective measures will be explained. Equipment will be inspected and in proper working condition. Mechanical assistance should be provided for large lifting tasks. Avoidance of biological hazards as discussed in Section 4 will be implemented. Although OM&M construction activities will be conducted by others, ARCADIS BBL will be in close proximity to work areas.

3.4 Decommissioning Groundwater Monitoring Wells/Coreholes

This task includes decommissioning Site monitoring wells and coreholes at various locations. The decommissioning activities may involve the use of a drill rig. The equipment poses a hazard if it is not properly operated. The presence of overhead utilities and underground obstacles poses a hazard if boring equipment contacts them.

3.4.1 Drilling Hazards

The primary physical hazards for this activity are associated with the use of drilling equipment, since tools and equipment (such as elevators, cat lines, and wire rope) have the potential for striking, pinning, or cutting personnel.

- *Cat Lines* – Cat lines are used on drilling rigs to hoist material. Accidents that occur during cat-line operations may injure the employee doing the rigging, as well as the operator. Minimal hoisting control causes sudden and erratic load movements, which may result in hand and foot injuries.

- *Materials Handling* – The most common type of accident that occurs in material handling operations is the “caught between” situation when a load is being handled and a finger or toe gets caught between two objects. Rolling stock can shift and/or fall from a pipe rack or truck bed.

- *Rig Accidents* – Rig accidents can occur as a result of improperly placing the rig on uneven or unstable terrain, or failing to adequately secure the rig prior to starting operations.

- *Utility Lines* – Underground and overhead utility lines can create hazardous conditions if contacted by drilling equipment.

- *Wire Rope* – Worn or frayed wire rope presents a laceration hazard if loose wires protrude from the main bundle.

- *Working Surfaces* – Slippery work surfaces can increase the likelihood of back injuries, overexertion injuries, and slips and falls.

3.4.2 Controls

The following control procedures are required for this activity:

- *Drill Crews* – All drillers must possess required state or local licenses to perform drilling work. All members of the drill crew must receive Site-specific training prior to beginning work. The driller is responsible for the safe operation of the drill rig, as well as the crew’s adherence to the requirements of this HASP. The driller must confirm that all safety equipment is in proper condition and is properly used. The members of the crew must follow all instructions of the driller, wear appropriate PPE, and be aware of all hazards and control procedures. The drill crews must participate in the daily safety meetings and be aware of all emergency procedures.

- *Rig Inspection* – Each day, prior to starting work, the drill rig and associated equipment must be inspected by the driller and/or drill crew. The following items must be inspected:

    - vehicle condition;
    - proper equipment storage;
    - condition of all wire rope and hydraulic lines;
    - fire extinguisher; and
    - first-aid kit.

- *Drill Rig Set Up* – The drill rig must be properly blocked and leveled prior to raising the derrick. The wheels that remain on the ground must be chocked even if the rig's parking brake has been applied. The leveling jacks must not be raised until the derrick is lowered. The rig should be moved only after the derrick has been lowered.

- *Site Drilling Rules* – Before drilling activities commence, the existence and location of underground pipe, electrical equipment, and gas lines must be determined. The Underground Facility Protection Organization (UFPO) must be contacted at least 1 week, but no more than 2 weeks, prior to subsurface activities. ARCADIS BBL's SS will meet with electrical and natural gas locators onsite prior to marking out the underground utilities. During this meeting, ARCADIS BBL's SS will provide the electrical and natural gas locators with a Site figure showing the locations where excavation and drilling activities will be completed. ARCADIS BBL's SS will conduct a Site walkover with the electrical and natural gas locators to visually identify each location where excavation and drilling activities are to be completed during Site operations. The Underground/Overhead Utility Checklist (see Attachment A) will be used to document that nearby utilities have been marked on the ground and that the excavation and drilling areas have been cleared. The completed Underground/Overhead Utility Checklist will be in the possession of the SS prior to commencing any intrusive investigation.

    The following additional Site drilling rules apply to the Site.

    - Combustible gas readings of the general work area will be made regularly (see Section 6).

    - Operations must be suspended and corrective action taken if the airborne flammable concentration reaches 10% of the lower explosive limit (LEL) in the immediate area (a 1-foot radius) of the point of drilling, or near any other ignition sources.

    - Under no circumstances will personnel be permitted to ride the traveling block or elevators, nor will the cat line be used as a personnel carrier.

- *Overhead Electrical Clearances* – If drilling activities are conducted in the vicinity of overhead power lines, the power to the lines must be de-energized, tested de-energized, marked up, and guaranteed, or the equipment must be positioned such that no part (including the excavation boom) can come within the minimum clearances as shown below. See Table 3-1 (Minimum Overhead Electrical Clearances [All Equipment]) below.

Table 3-1
Minimum Overhead Electrical Clearances (All Equipment)

Nominal System Voltage	Minimum Required Clearance
0-50 kilovolt (kV)	10 feet
51-100kV	12 feet
101-200kV	15 feet
201-300kV	20 feet
301-500kV	25 feet
501-750kV	35 feet
751-1,000kV	45 feet

When the drill rig is in transit, with the boom lowered and no load, the equipment clearance must be at least 4 feet for voltages less than 50kV, 10 feet for voltages of 50kV to 345kV, and 16 feet for voltages above 345kV.

- *Rig Set Up* – The following three control procedures apply to rig set up.
  - All well Sites will be inspected by the driller prior to establishing the location of the rig to verify that a stable surface exists. This is especially important in areas where soft, unstable terrain is common.
  - All rigs will be properly blocked and leveled prior to raising the derrick. Blocking provides a more stable drilling structure by evenly distributing the weight of the rig. Proper blocking confirms that differential settling of the rig does not occur. Wheels remaining on the ground will be chocked and the parking brake will be applied.
  - When the ground surface is soft or otherwise unstable, wooden blocks at least 24 inches by 24 inches and 4 inches to 8 inches thick must be placed between the jack swivels and the ground. The emergency brake must be engaged and the wheels that are on the ground must be chocked.
- *Hoisting Operations* – The following control procedures apply to hoisting operations.
  - Drillers should never engage the rotary clutch without watching the rotary table so that it is clear of personnel and equipment.
  - Unless the drawworks is equipped with an automatic-feed control, the brake will not be left unattended without first being tied down.
  - Auger strings or casing will be picked up slowly.
  - During instances of unusual loading of the derrick or mast, such as when making an unusually hard pull, only the driller will be on the rig floor; no one else should be on the rig or derrick.
  - The brakes on the drawworks of the drill rig will be tested by the driller each day. The brakes will be thoroughly inspected by a competent individual each week.
  - A hoisting line with a load imposed will not be permitted to be in direct contact with any derrick member or stationary equipment unless it has been specifically designed for line contact.
  - Workers should never stand near the borehole whenever any wire-line device is being run.

  - Hoisting control stations will be kept clean and controls labeled as to their functions.

- *Cat-Line Operations* – The following control procedures apply to cat-line operations.

  - Only experienced workers will be allowed to operate the cathead controls. The kill switch must be clearly labeled and operational prior to operating the cat line. The cathead area must be kept free of obstructions and entanglements.

  - The operator will not use more wraps than necessary to pick up the load. More than one layer of wrapping is not permitted.

  - Personnel will not stand near, step over, or go under a cable or cat line that is under tension.

  - Employees rigging loads on cat lines must:

    - ✓ keep out from under the load;
    - ✓ keep fingers and feet where they will not be crushed;
    - ✓ be sure to signal clearly when the load is being picked up;
    - ✓ use standard visual signals only and not depend on shouting to coworkers for communication; and
    - ✓ make sure the load is properly rigged, since a sudden jerk in the cat line will shift or drop the load.

- *Wire Rope* – The following control procedures apply to the use of wire rope.

  - When two wires are broken, or rust or corrosion is found adjacent to a socket or end fitting, the wire rope must be removed from service or resocketed. Special attention must be given to the inspection of end fittings on boom support, pendants, and guy ropes.

  - Wire rope removed from service due to defects must be cut up or plainly marked as being unfit for further use as rigging.

  - Wire rope clips attached with U-bolts must have the U-bolts on the dead or short end of the rope; the clip nuts must be retightened immediately after initial load carrying use and at frequent intervals thereafter.

  - When a wedge socket fastening is used, the dead or short end of the wire rope must have a clip attached to it or looped back and secured to itself by a clip; the clip must not be attached directly to the live end.

  - Protruding ends of strands in splices on slings and bridles must be covered or blunted.

  - Except for eye splices in the ends of wires and for endless wire rope slings, wire rope used in hoisting, lowering, or pulling loads must consist of one continuous piece without knot or splice.

  - An eye splice made in any wire rope must have no less than five full tucks.

  - Wire rope must not be secured by knots. Wire rope clips must not be used to splice rope.

  - Eyes in wire rope bridles, slings, or bull wires must not be formed by wire clips or knots.

- *Auger Handling* - The following control procedures apply to auger handling.
    - Auger sections must be transported by cart or carried by two persons. Individuals should not carry auger sections without assistance.
    - Workers will not be permitted on top of the load while loading, unloading, or transferring rolling stock.
    - When equipment is being hoisted, personnel will not stand where the bottom end of the equipment could whip and strike them.
    - Augers stored in racks, catwalks, or on flatbed trucks will be secured to prevent rolling.

3.5 Groundwater Sampling/Monitoring, including LNAPL Recovery

Groundwater sampling/monitoring will involve uncapping, purging (pumping water out of the well), and sampling/monitoring monitoring wells/coreholes. Manual recovery of LNAPL (if any) will also be done using bailers or similar procedures. A mechanical pump may be utilized to purge the wells; the pump may be hand- or electric-operated. Water samples taken from the wells are then placed in containers and shipped to analytical laboratory for analysis. The physical hazards of these operations are primarily associated with the sample collection methods and procedures utilized.

Hazards: Inhalation and absorption (contact) of COCs are the primary routes of exposure associated with groundwater sampling due to the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. During the course of this project, different groundwater sampling methodologies may be utilized based on equipment accessibility and the types of materials to be sampled. These sampling methods may include hand or mechanical bailing. The primary hazards associated with these specific sampling procedures are not potentially serious; however, other operations in the area or the conditions under which samples must be collected may present chemical and physical hazards. The hazards directly associated with groundwater sampling procedures are generally limited to strains/sprains from hand bailing and potential eye hazards. Exposure to soil and water containing COCs is also possible. In addition to the safety hazards specific to sampling operations, hazards associated with the operation of vehicles, especially large vehicles with limited operator visibility, is a concern. Of particular concern will be the backing up of trucks or other support vehicles.

The flora and fauna of the Site may present hazards of poison ivy, poison oak, ticks, fleas, mosquitoes, wasps, spiders and snakes. The work area presents slip, trip and fall hazards from scattered debris and irregular walking surfaces. Freezing-weather hazards include frozen, slick and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces and unstable soil.

Control: To control dermal exposure during groundwater sampling/monitoring activities, a minimum of Modified Level D protection will be worn. Air monitoring may be conducted during groundwater sampling/monitoring activities to assess the potential for exposure to airborne COCs. If the results of air monitoring indicate the presence of organic vapors at a concentration causing concern, personnel will upgrade to Level C protection. Refer to Section 6 – Monitoring, for a description of air monitoring requirements and action levels. A description of each level of personal protection is included in Section 5 - Personal Protective Equipment. Control procedures for environmental and general hazards are discussed in Section 4 - General Safety Practices. Control of vehicular traffic hazards is presented in Section 4.10 - Traffic Safety.

3.6 Fish Sampling

Fish sampling will be conducted as part of the Biota Sampling and Analysis Program. Fish sampling will be conducted using electrofishing techniques at two locations (unnamed tributary and Cobleskill Creek). Fish samples will be packaged and placed in a container for shipping to analytical laboratory for analysis. The physical hazards associated with the sample collection method; procedures utilized, and environment.

Hazards: Inhalation and absorption (contact) of COCs are the primary routes of entry associated with resident fish sampling due to the manipulation of sample media and equipment, manual transfer of media into sample containers, and proximity of operations to the breathing zone. During the course of this project, several different resident fish sampling methodologies may be utilized based on equipment accessibility and the types of materials to be sampled. The primary hazards associated with these specific sampling procedures are not potentially serious; however, other operations in the area or the conditions under which samples must be collected may present chemical and physical hazards.

The physical hazards directly associated with resident fish sampling procedures are generally limited to strains/sprains and potential eye hazards. The work area also presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Further, rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil; and freezing weather may cause frozen, slick, and irregular walking surfaces.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

In addition to the safety hazards specific to sample collection, hazards associated with working near water will be a concern. Drowning hazards exist and will present potential hazards for employees working in or near water.

Sampling activities may be done using hip waders and the required level of PPE. Waders shall be inspected prior to donning for holes, punctures, tears or any other defect (e.g., missing straps) that would allow water to enter. Personnel must wear an USCG approved PFD or buoyant work vest during all activities conducted in water. Prior to each use, the PFD or work vest shall be inspected for defects that may alter its strength or buoyancy. Defective units shall be tagged “DO NOT USE” and removed from service. The “buddy system” will be strictly adhered to during any water-related activities. At no time will anyone enter the water without another individual readily available to contact emergency services.

In addition to the drowning hazards associated with working on or near the water, there exists the possibility for slips, trips, or falls caused by slippery, unstable, and irregular walking surfaces. Waders used for sampling activities shall be properly sized and provide the wearer with adequate traction.

The use of electrofishing equipment involves potential hazards related to the high voltage output. Since water is an excellent conductor of electricity, the operator of the electrofisher must observe certain precautions in order to avoid injury. The electrofisher operates by sending current through the cathode, through the water, and to the anode. The equipment operator must become part of the circuit in order to be shocked. Touching the cathode and anode simultaneously would complete the circuit and result in a severe electric shock. Although touching only one of the electrodes would not result in a shock, operators are not permitted to touch the electrodes. Symptoms of electric shock range from muscle contraction (unable to let go), potential lung paralysis, ventricular fibrillation, heart paralysis, severe burns, and death.

Control: To control dermal exposure during sampling activities, a minimum of Modified Level D protection will be worn. If necessary, based on field observations and site conditions, air monitoring may be conducted during sampling activities. A description of each level of personal protection is included in Section 5. Control procedures for environmental and general hazards are discussed in Section 4. Water safety procedures outlined in Section 3.1.3.8 shall be implemented. Additional general electrofishing safety procedures are described below.

3.6.1.1.1 General Electrofishing Safety Procedures

The following general safety procedures apply to all types of electrofishers, and should be observed at all times.

- Use electrical lineman gloves of at least 5,000 volt rating. If the gloves become very wet inside, stop electrofishing and dry them thoroughly.
- Remove wristwatch, rings, and other metal jewelry that is not protected by an insulated material.
- Use only dip nets with insulated or non-conductive handles.
- Make all electrical connections before turning on the power.
- Be sure all personnel are aware that electrofishing is going to begin and that they are clear of electrodes before turning on the power.
- Sampling must cease if persons, pets, or livestock are observed in the water or on shore within 40 ft (12 meters [m]) of the electrofishing equipment.
- The equipment must include a switch that keeps the circuit open unless actively and continuously closed. The operator also will have access to an emergency shut-off switch.
- Operate within acceptable power ranges to prevent overloading the equipment and minimize the potential of fire hazard.
- During electrofishing, the high voltage flashing light and/or audible tone generator must be working.
- Do not touch people, equipment, or metal objects with the anode or cathode probes/surfaces.
- Wear polarized sunglasses to detect sub-surface hazards and obstacles.
- Turn the power off immediately if a problem occurs and also when the unit is not in use.

The following safety procedures apply specifically to use of a backpack electrofishers (different type of electrofishing equipment) that may be used. These safety procedures, including the universal procedures listed previously, should be observed at all times.

- Use water-tight wading hip boots or chest waders. If the waders or boots become wet inside, stop electrofishing and dry them thoroughly.
- Operate slowly and carefully to prevent tripping on objects in the stream.
- Sampling must cease if persons, pets, or livestock are observed in the water or on shore within 40 ft (12 m) of the electrofishing unit.
- To prevent overloading the unit, do not touch the cathode with the anode.
- Check that the mercury tilt switch shuts off the power when the unit is tipped more than 45° from vertical.
- Backpack electrofishers add a burden to the user, requiring careful body positioning in order to avoid back strain.

3.7 Quarry Pond Water Treatment Systems Sampling and Monitoring

The monitoring and sampling activities associated with quarry pond water treatment systems include collecting water samples for PCB analysis and measuring pH.

Hazards:

- Potential contact with COCs (PCBs) during water treatment sampling and pH monitoring activities;
- Exposure to inclement weather (heat, cold, rain, snow, high wind, etc.);
- In winter, slipping on the ice;
- Uneven walking and working surfaces;
- Electrical shock/burns; and
- Exposure to noise.

Control:

- Don appropriate personal protective equipment;
- Wear proper attire for weather conditions;
- Sturdy work boots or shoes with a rugged sole will be used (ANSI approved footwear);
- Become familiar with the system components and only use the proper tools that are in good condition; and
- Wear proper ear protection (as necessary).

3.8 Decontamination

Equipment/materials cleaning will be performed to control the transfer of COCs from the Site. Equipment will be cleaned by either scrubbing with a mild detergent/citrus solvent or a high-pressure steam-wash to remove visible dirt and dust.

Hazards: Sources of chemical hazards from decontaminating equipment are decontamination detergents or solvents, foreign matter and COCs on the equipment prior to decontamination, and rinsate from the decontamination process. Physical hazards associated with this activity are back strain, slippery surfaces, cuts and burns from the high pressure steam wash and hearing loss due high levels of noise generated by the equipment.

Control: Control procedures for these hazards are discussed in Section 4 - General Safety Practices. Decisions regarding PPE will be based on the potential chemical and physical hazards on the Site, and measurements and observations made prior to and during work activities. Personnel involved in decontamination activities wear PPE typically one level lower than personnel working in the exclusion zone. PPE for this activity is specified in Section 5 - Personal Protective Equipment.

3.9 Demobilization

Demobilization involves the removal of all tools, equipment, supplies, and vehicles brought to the Site. The hazards of this phase of activity are associated with heavy equipment operation and manual materials handling.

Hazards: Manual materials handling may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion, and laceration hazards. Heavy equipment operation presents noise and vibration hazards, and hot surfaces, to operators. Personnel in the vicinity of heavy equipment operation may be exposed to physical hazards resulting in fractures, contusions, and lacerations and may be exposed to high noise levels. The work area presents slip, trip, and fall hazards from scattered debris and irregular walking surfaces. Rainy weather may cause wet, muddy, slick walking surfaces, and unstable soil. Freezing-weather hazards include frozen, slick, and irregular walking surfaces.

Environmental hazards include plants, such as poison ivy and poison oak; aggressive fauna, such as ticks, fleas, mosquitoes, wasps, spiders, and snakes; weather, such as sunburn, lightning, rain, and heat- or cold-related illnesses; and pathogens, such as rabies, Lyme disease, and blood-borne pathogens.

Control: Control procedures for these hazards are discussed in Section 4 - General Safety Practices.

3.10 Chemical Hazards

The chemical hazards associated with Site operations are related to inhalation of, ingestion of, and skin or eye contact with Site COCs. Constituents potentially present in environmental media at the Site are polychlorinated biphenyls (PCBs), arsenic, cadmium, chromium, lead. Select VOCs and SVOCs, including benzene, toluene, ethylbenzene, xylene, trichloroethene, 1,2-dichloroethene, naphthalene, and phenol have been detected only in groundwater samples collected from bedrock monitoring wells (C-12 and C-18) near Wallace's leachfield area located south of the concrete and metal building. As stated in the NYSDEC ROD, the VOCs and SVOCs detected in the leachfield area are not addressed by the NYSDEC's ROD because they are unrelated to the scope of the remedy implemented by National Grid (i.e., not attributable to National Grid's waste disposed at the Site-reference NYSDEC's Response 83 in the ROD). The NYSDEC's Spill Response Division provides oversight of activities related to the leachfield area.

The Chemical Hazard Information Table presented as Attachment C lists the chemical, physical, and toxicological properties of major Site COCs. Material Safety Data Sheets (MSDS) for the COCs are included as Attachment D. Based on chemical constituents in environmental media at the Site, levels of PPE associated with each work task were selected by ARCADIS BBL and are discussed in Section 5.

During certain tasks involving ground intrusive activities, air monitoring of potentially toxic and flammable atmospheres during such operations may be required. Air monitoring requirements for Site tasks are outlined in Section 6.1. The potential for inhalation of COCs during the Site activities identified herein is minimal. The potential for dermal contact with contaminated soil and water during these activities is minimal.

4. General Safety Practices

4.1 General Safety Rules

General safety rules for Site activities include, but are not limited to, the following:

- At least one copy of this HASP must be in a location at the Site that is readily available to personnel, and all project personnel must review the plan prior to starting work;
- Consume or use food, beverages, chewing gum, and tobacco products only in designated areas;
- Wash hands before eating, drinking, smoking, or using toilet facilities;
- Wear all PPE as required, and stop work and replace damaged PPE immediately;
- Upon skin contact with materials that may be impacted by COCs, remove contaminated clothing and wash the affected area immediately. Contaminated clothing must be changed. Any skin contact with materials potentially impacted by COCs must be reported to the SS or HSS immediately. If needed, medical attention should be sought;
- Practice contamination avoidance. Avoid direct contact with surfaces either suspected or known to be impacted by COCs, such as standing water, mud, or discolored subsurface soil;
- Remove PPE as required to limit the spread of COC-containing materials;
- At the end of each shift, or as required, dispose of all single-use coveralls and soiled gloves in receptacles designated for this purpose;
- Inspect all non-disposable PPE for contamination. Any PPE found to be contaminated must be decontaminated or disposed of appropriately;
- Recognize emergency signals used for evacuation, injury, fire, etc.;
- Report all injuries, illnesses, near misses, and unsafe conditions or work practices to the SS or HSS;
- Obey all warning signs, tags, and barriers. Do not remove any warnings unless authorized to do so;
- Use, adjust, alter, and repair equipment only if trained and authorized to do so and in accordance with the manufacturer's directions; and
- Personnel are to perform only tasks for which they have been properly trained, and will advise their supervisor if they have been assigned a task for which they are not trained.

The presence or consumption of alcoholic beverages or illicit drugs during the workday, including breaks, is strictly prohibited. Do not take prescription or over-the-counter drugs that can cause drowsiness or, indicate that heavy equipment should not be operated while taking the medication.

4.1.1 Incident Investigation

An incident includes any of the following events:

- First-aid cases;
- Injuries;
- Illnesses;
- Near misses;
- Spills or leaks;
- Equipment and property damage;
- Motor vehicle accidents;
- Regulatory violations;
- Fires; and
- Business interruptions.

All incidents must be investigated within 24 hours, and reported to the PM and the HSO.

IIs are conducted to prevent the recurrence of a similar hazardous event. IIs review all incidents in the same manner. Using the information gathered during an II, appropriate measures are to protect personnel from the hazard in question. The Incident/Near-Miss Investigation Report is included in Attachment E.

4.1.2 Safe Work Observation

The SS or the HSS will perform the SWO (Attachment F) to identify and correct potential hazards, and to positively reinforce behaviors and practices that are correct. The SS or HSS must identify potential deviations from safe work practices that could possibly result in an incident, and take prompt corrective action. The SWO process includes the following steps:

- Identify tasks that have the greatest potential for hazardous incidents.
- Be familiar with the proper procedure for completing the task.
- Discuss with the observed employee the task and the SS/HSS role in observing the task.
- Observe the employee completing the task.
- Document positive conditions and actions, and identify areas in need of improvement.

4.1.3 Job Safety Analysis

JSA is a tool used to identify potential hazards, and to develop corrective or protective systems to eliminate the hazard. A JSA lists all potential hazards associated with an activity. Hazards may be physical (such as lifting hazards or eye hazards), or environmental (such as weather). After identifying the hazards associated with an activity, control measures are evaluated and protective measures or procedures are then instituted. JSAs are reviewed periodically so that the procedures and protective equipment specified for each activity are current and technically correct. Any changes in Site conditions and/or scope of work may require review of and modification to the JSA in question. During this review process, comments on the JSA and its procedures should be obtained from personnel associated with the activity being analyzed. Completed JSAs for work tasks at the Site are included in Attachment G.

4.2 Heat Stress

Heat stress is caused by several interacting factors, including environmental conditions, clothing, and workload, as well as the physical and conditioning characteristics of the individual. Since heat stress is one of the most common illnesses associated with heavy outdoor work conducted with direct solar load and, in particular, because wearing PPE can increase the risk of developing heat stress, workers must be able to recognize the signs and symptoms of heat-related illnesses. Personnel must be aware of the types and causes of heat-related illnesses, and be able to recognize the signs and symptoms of these illnesses in themselves and their co-workers.

4.2.1 Heat Rashes

Heat rashes are one of the most common problems in hot work environments. Commonly known as prickly heat, a heat rash is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

4.2.2 Heat Cramps

Heat cramps are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused both by too much or too little salt.

Cramps appear to be related to a lack of water replenishment. Because sweat is a hypotonic solution (plus or minus 0.3% NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Drinking commercially available carbohydrate electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

4.2.3 Heat Exhaustion

Heat exhaustion occurs from increased stress on various body organs due to inadequate blood circulation, cardiovascular insufficiency, or dehydration. Signs and symptoms include:

- Pale, cool, moist skin;
- Heavy sweating;
- Dizziness;
- Nausea;
- Headache;
- Vertigo;
- Weakness;
- Thirst; and
- Giddiness.

Fortunately, this condition responds readily to prompt treatment.

Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, which is a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment, given fluid replacement, and be encouraged to get adequate rest.

4.2.4 Heat Stroke

Heat stroke is the most serious form of heat stress. Heat stroke occurs when the body's system of temperature regulation fails, and the body's temperature rises to critical levels. This condition is caused by a combination of highly variable factors and its occurrence is difficult to predict.

Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are:

- Confusion;
- Irrational behavior;

- Loss of consciousness;
- Convulsions;
- A lack of sweating (usually);
- Hot, dry skin; and
- An abnormally high body temperature (e.g., a rectal temperature of 41°C [105.8°F]).

If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of workload and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first-aid treatment.

Regardless of the worker's protestations, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

Proper training and preventive measures will help avert serious illness and loss of work productivity. Preventing heat stress is particularly important because once someone suffers from heat stroke or exhaustion, that person may be predisposed to additional heat injuries.

4.2.5 Heat Stress Safety Precautions

Heat-stress monitoring and work-rest cycle implementation should commence when the ambient adjusted temperature exceeds 72°F. A minimum work-rest regimen and procedures for calculating ambient adjusted temperature are described in Table 4-1, below.

TABLE 4-1
WORK AND REST SCHEDULE[1]

Adjusted Temperature[2]	Work and Rest Regimen Normal Work Ensemble[3]	Work and Rest Regimen Impermeable Ensemble
90ºF (32.2ºC) or above	After each 45 minutes of work	After each 15 minutes of work
87.5º-90ºF (30.8º-32.2ºC)	After each 60 minutes of work	After each 30 minutes of work
82.5º-87.5ºF (28.1º-30.8ºC)	After each 90 minutes of work	After each 60 minutes of work
77.5º-82.5ºF (25.3º-28.1ºC)	After each 120 minutes of work	After each 90 minutes of work
72.5º-77.5ºF (30.8º-32.2ºC)	After each 150 minutes of work	After each 120 minutes of work

Notes:

[1] For work levels of 250 kilocalories/hour (light to moderate type of work).

[2] Calculate the adjusted air temperature (ta adj) by using this equation: ta adj ºF = ta ºF + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100% sunshine = no cloud cover and a sharp, distinct shadow; 0% sunshine = no shadows.)

[3] A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

(Source: The information presented above was generated using the American Conference of Governmental Industrial Hygienists [ACGIH] *Threshold Limit Values [TLV] Handbook [ACGIH, 2002a].).*

To determine if the work-rest cycles are adequate for the personnel and specific-Site conditions, additional monitoring of individual heart rates will be conducted during the rest cycle. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one-third and maintain the same rest period.

Additionally, one or more of the following control measures can be used to help control heat stress and are mandatory if any Site worker has a heart rate (measure immediately prior to rest period) exceeding 115 beats per minute.

- Site workers will be encouraged to drink plenty of water and electrolyte replacement fluids throughout the day.
- Onsite drinking water will be kept cool (50 to 60°F).
- A work regimen that will provide adequate rest periods for cooling down will be established, as required.
- All personnel will be advised of the dangers and symptoms of heat stroke, heat exhaustion, and heat cramps.
- Cooling devices, such as vortex tubes or cooling vests, should be used when personnel must wear impermeable clothing in conditions of extreme heat.
- Employees should be instructed to monitor themselves and co-workers for signs of heat stress, and to take additional breaks as necessary.
- A shaded rest area must be provided. All breaks should take place in the shaded rest area.
- Employees must not be assigned to other tasks during breaks.
- Employees must remove impermeable garments during rest periods. This includes white Tyvek®-type garments.
- All employees must be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat-stress disorders.

4.2.6 Duration of Work Tasks

The duration of project activities involving the usage of PPE will be established by the HSO of his designee based upon ambient temperature and weather conditions, the capacity of personnel to work in the designated level of PPE (heat stress/cold stress), and limitations of the protective equipment (i.e., ensemble permeation rates, life expectancy of air-purifying respirator cartridges, etc.). As a minimum, rest breaks will be observed at the following intervals:

1. 15 minutes midway between shift startup and lunch;
2. ½ hour for lunch; and
3. 15 minutes in the afternoon, between lunch and shift end.

All rest breaks will be taken in a clean area (e.g., support zone) after full decontamination and PPE removal. Additional rest breaks will be observed based upon the heat stress monitoring guidelines in this HASP.

4.3 Biological Hazards

Biological hazards may include poison ivy, snakes, thorny bushes and trees, ticks, mosquitoes, ants and other pests.

4.3.1 Tick-Borne Diseases

4.3.1.1 Hazards

Lyme disease

This disease commonly occurs in summer and is transmitted by the bite of infected ticks. “Hot spots” in the United States include New York, New Jersey, Pennsylvania, Massachusetts, Connecticut, Rhode Island, Minnesota, and Wisconsin.

Erlichiosis

This disease also commonly occurs in summer and is transmitted by the bite of infected ticks. “Hot spots” in the United States include New York, Massachusetts, Connecticut, Rhode Island, Minnesota, and Wisconsin.

These diseases are transmitted primarily by the deer tick, which is smaller and redder than the common wood tick. The diseases may be transmitted by immature ticks, which are small and hard to see. The tick may be as small as a period on this page.

Symptoms of Lyme disease include a rash or a peculiar red spot, like a bull’s eye, which expands outward in a circular manner. The victim may have headache, weakness, fever, a stiff neck, and swelling and pain in the joints, and eventually, arthritis. Symptoms of erlichiosis include muscle and joint aches and flu-like symptoms, but there is typically no skin rash.

Rocky Mountain Spotted Fever (RMSF)

This disease is transmitted via the bite of an infected tick. The tick must be attached for 4 to 6 hours before the disease-causing organism (Rickettsia rickettsii) becomes reactivated and can infect humans.

The primary symptom of RMSF is the sudden appearance of a moderate-to-high fever. The fever may persist for 2 to 3 weeks. The victim may also have a headache, deep muscle pain, and chills. A rash appears on the hands and feet on about the third day and eventually spreads to all parts of the body. For this reason, RMSF may be confused with measles or meningitis. The disease may cause death, if untreated, but if identified and treated promptly, death is uncommon.

4.3.1.2 Control

Tick repellant containing diethyltoluamide (DEET) should be used when working in tick-infested areas, and pant legs should be tucked into boots. In addition, workers should search the entire body every 3 or 4 hours for attached ticks. Ticks should be removed promptly and carefully without crushing, since crushing can squeeze the disease-causing organism into the skin. A gentle and steady pulling action should be used to avoid leaving the head or mouth parts in the skin. Hands should be protected with surgical gloves when removing ticks.

4.3.2 Mosquitoes

4.3.2.1 Hazards

Personnel may be exposed to mosquitoes during work activities.

Typical exposure to mosquitoes does not present a significant hazard. However, if West Nile virus is prevalent in the area exposure to this virus is increased. West Nile virus results in flu-like symptoms and can be serious if not treated or in immune compromised individuals.

4.3.2.2 Control

To minimize the threat of mosquito bites all personnel working outside must be aware of the potential for encountering mosquitoes and implement the basic precautions listed below:

- Avoid working at dawn or dusk when mosquitoes are most active.
- Prevent accumulation of standing water at the work-site.
- Apply an insect repellent that contains DEET to exposed skin.
- Wear light colored clothes, preferably with long-sleeves and full-length pants.
- Do not touch any dead birds or animals that you encounter.

If dead birds are detected near the Site, report to the local County Health Department. If flu-like symptoms are present, contact your Doctor or the Health and Safety Officer for more information.

4.3.3 Poisonous Plants

4.3.3.1 Hazards

Poisonous plants may be present in the work area. Personnel should be alerted to their presence and instructed on methods to prevent exposure.

4.3.3.2 Control

The main control is to avoid contact with the plant, cover arms and hands, and frequently wash potentially exposed skin. Particular attention must be given to avoiding skin contact with objects or protective clothing that have touched the plants. Treat every surface that may have touched the plant as contaminated and practice contamination avoidance. If skin contact is made, the area should be washed immediately with soap and water and observed for signs of reddening.

4.3.4 Snakes

4.3.4.1 Hazards

The possibility of encountering snakes exists, specifically for personnel working in wooded or vegetated areas. Snake venoms are complex and include proteins, some of which have enzymatic activity. The effects produced by venoms include:

- Neurotoxic effects with sensory, motor, cardiac, and respiratory difficulties;
- Cytotoxic effects on red blood cells, blood vessels, heart muscle, kidneys, and lungs;
- Defects in coagulation; and
- Effects from local release of substances by enzymatic actions.

Other noticeable effects of venomous snakebites include swelling, edema, and pain around the bite, and the development of ecchymosis (the escape of blood into tissues from ruptured blood vessels).

4.3.4.2 Control

To minimize the threat of snakebites, all personnel walking through vegetated areas must be aware of the potential for encountering snakes and the need to avoid actions potentiating encounters, such as turning over logs. If a snake bite occurs, an attempt should be made to obtain markings, size and color for identification. The victim must be transported to the nearest hospital within 30 minutes. First aid consists of applying a constriction band and washing the area around the wound to remove any unabsorbed venom.

4.3.5 Spiders

4.3.5.1 Hazards

Personnel may encounter spiders during work activities. Two spiders of concern are the black widow and the brown recluse. Both prefer dark sheltered areas such as basements, equipment sheds and enclosures, and around woodpiles or other scattered debris. The black widow is shiny black, approximately 1-inch long, and found throughout the United States. There is a distinctive red hourglass marking on the underside of the black widow's body. The bite of a black widow is seldom fatal to healthy adults, but effects include respiratory distress, nausea, vomiting, and muscle spasms. The brown recluse is smaller than the black widow and gets its name from its brown coloring and behavior. The brown recluse is more prevalent in the Southern United States. The brown recluse has a distinctive violin shape on the top of its body. The bite of the brown recluse is painful, and the bite Site ulcerates and takes many weeks to heal completely.

4.3.5.2 Control

To minimize the threat of spider bites, all personnel walking through vegetated areas must be aware of the potential for encountering these arachnids. Personnel should avoid actions that may result in encounters, such as turning over logs and placing hands in dark places such as behind equipment or in corners of equipment sheds or enclosures. If a spider bite occurs, the victim must be transported to the nearest hospital as soon as possible. First aid consists of applying ice packs and washing the area around the wound to remove any unabsorbed venom.

4.4 Noise

4.4.1 Hazards

Exposure to noise louder than the appropriate action level can cause temporary impairment of hearing; prolonged and repeated exposure can cause permanent damage to hearing. The risk and severity of hearing loss increases with the intensity and duration of exposure to noise. In addition to damaging hearing, noise can impair voice communication, thereby increasing the risk of accidents on Site.

4.4.2 Control

All personnel must wear hearing protection, with a noise reduction rating (NRR) of at least 20, when noise levels exceed 85 dBA. When it is difficult to hear a co-worker at normal conversation distance, the noise level is approaching or exceeding 85 dBA and hearing protection is necessary. All Site personnel who may be exposed to noise must also receive baseline and annual audiograms, and training as to the causes and prevention of hearing loss.

Whenever possible, equipment that does not generate excessive noise levels will be selected. If using noisy equipment is unavoidable, barriers or increased distance will be used to minimize worker exposure to noise, if feasible.

4.5 Spill Control

All personnel must take every precaution to minimize the potential for spills during Site operations. All onsite personnel must immediately report any discharge, no matter how small, to the SS.

Spill control equipment and materials will be located on the vessel. All sorbent materials used to cleanup spills will be containerized and labeled appropriately. In the event of a spill, the SS will follow the provisions in Section 9 - Emergency Procedures, to contain and control released materials and to prevent their spread to offsite areas.

4.6 Sanitation

Site sanitation will be maintained according to appropriate federal, state, and local requirements.

4.6.1 Break Area

Breaks must be taken away from the active work area.

4.6.2 Potable Water

The following rules regarding potable water apply to all field operations.

- An adequate supply of potable water will be provided at each project Site. Potable water must be kept away from hazardous materials or media and contaminated clothing or equipment.

- Portable containers used to dispense drinking water must be capable of being tightly closed and must be equipped with a tap dispenser. Water must not be consumed directly from the container (drinking from the tap is prohibited) nor may it be removed from the container by dipping.

- Containers used for drinking water must be clearly marked and must not be used for any other purpose.

- Disposable drinking cups must be provided. A sanitary container for dispensing cups and a receptacle for disposing of used cups is required.

4.6.3 Sanitary Facilities

Access to facilities for washing before eating, drinking, or smoking, or alternate methods such as waterless hand cleaner and paper towels, will be provided.

4.6.4 Lavatory

Employees must have access to toilet facilities on Site or have transportation immediately available to nearby toilet facilities.

4.7 Emergency Equipment

Adequate emergency equipment for the activities being conducted on Site and as required by applicable sections of 29 CFR 1910 and 29 CFR 1926 will be on Site prior to commencing project activities. Personnel will be provided with access to emergency equipment including, but not limited to, the following:

- Fire extinguishers of adequate size, class, number, and location as required by applicable sections of 29 CFR 1910 and 1926;

- Industrial first-aid kits of adequate size for the number of personnel on Site; and

- Emergency eyewash and/or shower if required by operations being conducted on Site.

4.8 Electrical Safety

Electricity may pose a particular hazard to Site workers due to the use of portable electrical equipment. If wiring or other electrical work is needed, a qualified electrician must perform it.

General electrical safety requirements are presented below.

- All electrical wiring and equipment must be a type listed by Underwriters Laboratories (UL), Factory Mutual Engineering Corporation (FM), or other recognized testing or listing agency.

- All installations must comply with the National Electrical Safety Code (NESC), the National Electrical Code (NEC), or United States Coast Guard (USCG) regulations.

- Portable and semiportable tools and equipment must be grounded by a multiconductor cord having an identified grounding conductor and a multicontact polarized plug-in receptacle.

- Tools protected by an approved system of double insulation, or its equivalent, need not be grounded. Double-insulated tools must be distinctly marked and listed by UL or FM.

- Live parts of wiring or equipment must be guarded to prevent persons or objects from touching them.

- Electric wire or flexible cord passing through work areas must be covered or elevated to protect it from damage by foot traffic, vehicles, sharp corners, projections, or pinching.

- All circuits must be protected from overload.

- Temporary power lines, switchboxes, receptacle boxes, metal cabinets, and enclosures around equipment must be marked to indicate the maximum operating voltage.

- Plugs and receptacles must be kept out of water unless of an approved submersible construction.

- All extension cord outlets must be equipped with ground-fault-circuit interrupters (GFCIs).

- Attachment plugs or other connectors must be equipped with a cord grip and be constructed to endure rough treatment.

- Extension cords or cables must be inspected prior to each use and replaced if worn or damaged. Cords and cables must not be fastened with staples, hung from nails, or suspended by bare wire.

- Flexible cords must be used only in continuous lengths without splice, with the exception of molded or vulcanized splices made by a qualified electrician.

4.9 Lifting Safety

Using proper lifting techniques may prevent back strain or injury. The fundamentals of proper lifting include:

- Consider the size, shape, and weight of the object to be lifted. A mechanical lifting device or additional persons must be used to lift an object if it cannot be lifted safely alone;

- The hands and the object should be free of dirt or grease that could prevent a firm grip;

- Gloves must be used and the object inspected for metal slivers, jagged edges, burrs, or rough or slippery surfaces;

- Fingers must be kept away from points that could crush or pinch them, especially when putting an object down;

- Feet must be placed far enough apart for balance. The footing should be solid and the intended pathway should be clear;

- The load should be kept as low as possible, close to the body, with the knees bent;

- To lift the load, grip firmly and lift with the legs, keeping the back as straight as possible;

- A worker should not carry a load that he or she cannot see around or over; and

- When putting an object down, the stance and position are identical to that for lifting; the legs are bent at the knees and the back is straight as the object is lowered.

4.10 Traffic Safety

Work activities may be located adjacent to areas where exposure to vehicular traffic is likely. Traffic may also be encountered as vehicles enter and exit the area. To minimize the likelihood of project personnel and activities being affected by traffic, the following procedures will be implemented, if appropriate.

Cones must be placed along the shoulder of the roadway starting 100 feet from the work area to alert passing motorists to the presence of personnel and equipment. A “Slow” or “Men Working” sign must be placed at the first cone. Barricades with flashing lights should be placed between the roadway and the work area, as appropriate.

Where possible, vehicles should be aligned to provide physical protection of people and equipment. During activities along a roadway, equipment will be aligned parallel to the roadway to the extent feasible, facing into the oncoming traffic so as to place a barrier between the work crew and the oncoming traffic. All crewmembers must remain behind the equipment and the traffic barrier.

All Site personnel who are potentially exposed to vehicular traffic must wear an outer layer of orange warning garments, such as vests, jackets, or shirts. If work is performed in hours of dusk or darkness, workers will be outfitted with reflective garments either orange, white (including silver-coated reflective coatings or elements that reflect white light), yellow, fluorescent red-orange, or fluorescent yellow-orange.

5. Personal Protective Equipment

5.1 Levels of Protection

PPE is required to safeguard Site personnel from various hazards. Varying levels of protection may be required depending on COC levels and the degree of physical hazard. This section presents the various levels of protection and defines the conditions of use for each level. Table 5-1 summarizes the available levels of personal protection.

5.1.1 Level D Protection

The minimum level of protection that will be required of ARCADIS BBL personnel and subcontractors at the Site will be Level D, which will be worn when Site conditions or air monitoring indicates no inhalation hazard exists. The following equipment will be used:

- Work clothing as prescribed by weather;
- Steel toe work boots, meeting ANSI Z41;
- Safety glasses or goggles, meeting ANSI Z87;
- Hard hat, meeting ANSI Z89, when falling object hazards are present; and
- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used).

5.1.2 Modified Level D Protection

Modified Level D will be used when airborne contaminants are not present at levels of concern, but Site activities present an increased potential for skin contact with contaminated materials. Modified Level D consists of:

- Nitrile gloves worn over nitrile surgical gloves;
- Latex/PVC overboots when contact with COC-impacted media is anticipated;
- Steel toe work boots, meeting ANSI Z41;
- Safety glasses or goggles, meeting ANSI Z87;
- Face shield in addition to safety glasses or goggles when projectiles or splash hazards exist;
- Hard hat, meeting ANSI Z89 when falling object hazards are present;

- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used); and

- Tyvek® suit (polyethylene coated Tyvek® suits for handling liquids) when body contact with COC-impacted media is anticipated.

5.1.3 Level C Protection

Level C protection will be required when the airborne concentration of COCs reaches one-half of the OSHA Permissible Exposure Limit (PEL) or American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV). The following equipment will be used for Level C protection:

- Full-face, air-purifying respirator with combination organic vapor and HEPA cartridges;

- Polyethylene-coated Tyvek® suit, with ankles and cuffs taped to boots and gloves;

- Nitrile gloves worn over nitrile surgical gloves;

- Steel toe work boots, meeting ANSI Z41;

- Chemical resistant boots with steel toes or latex/PVC overboots over steel toe boots;

- Hard hat, meeting ANSI Z89; and

- Hearing protection (if noise levels exceed 85 dBA, then hearing protection with a USEPA NRR of at least 20 dBA must be used).

5.2 PPE Selection

PPE will be selected based on the potential for contact, Site conditions, ambient air quality, and the judgment of supervising Site personnel and health and safety professionals. The PPE used will be chosen to be effective against the COCs present on Site.

Specifically, the level of PPE selected will be based on air monitoring of the work environment, and an assessment by the SS and HSS of the potential for skin contact with COCs. The PPE selection matrix is presented in Table 5-1, below. This matrix is based on information available at the time this plan was written. The Airborne Contaminant Action Levels in Table 6-1 (provided in Section 6 - Monitoring) should be used to verify that the PPE prescribed in Table 5-1 is appropriate.

TABLE 5-1
PPE SELECTION MATRIX

Activity	PPE Selection
Mobilization	Level D
Onsite Observation	Level D
Monitoring Well/Corehole Decommissioning	Modified Level D
Groundwater Sampling/Monitoring	Modified Level D/Level C

Activity	PPE Selection
Quarry Pond Water Treatment System Monitoring and Sampling	Modified Level D
Decontamination	Modified Level D
Demobilization	Level D

5.3 Using PPE

Depending on the level of protection selected, specific donning and doffing procedures may be required. The procedures presented in this section are mandatory when Modified Level D or Level C is used. All personnel must put on the required PPE in accordance with the requirements of this HASP. PPE will be removed in accordance with the procedures listed to minimize the spread of COCs.

5.3.1 Donning Procedures

These procedures are mandatory when Modified Level D or Level C is used.

- Remove bulky outerwear;
- Remove street clothes and store in clean location;
- Put on work clothes or coveralls;
- Put on the required chemical-protective coveralls;
- Put on the required chemical-protective boots or boot covers;
- Tape the legs of the coveralls to the boots with duct tape;
- Put on the required chemical-protective gloves;
- Tape the wrists of the protective coveralls to the gloves; and
- Don remaining PPE, such as safety glasses or goggles and hard hat.

When these procedures are instituted, one person must remain outside the work area to confirm that each person entering has the proper protective equipment.

5.3.2 Doffing Procedures

The following procedures are mandatory when Modified Level D and Level C PPE are required for the Site. Whenever a person leaves the work area, the following decontamination sequence will be followed:

- Rinse contaminated materials from the boots or remove contaminated boot covers.

- Clean reusable protective equipment.
- Remove protective garments and equipment. All disposable clothing should be placed in plastic bags with contaminated-waste labels.
- Wash hands, face, and neck (or shower if necessary).
- Proceed to clean area and dress in clean clothing.
- Clean and disinfect respirator for next use.

All disposable equipment, garments, and PPE must be bagged in plastic bags labeled for disposal.

6. Monitoring

6.1 Air Monitoring

Air monitoring will be conducted, as necessary, to determine potential employee exposure to airborne COCs. Personal exposure monitoring may be necessary to evaluate employee exposures if direct reading instruments indicate general readings in excess of Site action levels. The monitoring results will dictate work procedures and the selection of PPE. The monitoring devices to be used as appropriate include but may not be limited to, a photoionization detector (PID) and a MiniRAM portable dust monitor (or equivalent). A combustible gas/oxygen/hydrogen sulfide/carbon monoxide meter will be used in the event of suspected flammable or explosive vapors.

Air monitoring will be conducted continuously with the LEL/O_2 meter if flammable/explosive vapors are suspected. Continuous real-time monitoring for organic vapors for the purpose of estimating worker exposure level will be conducted in the breathing zone with the PID during field activities which may generate organic vapors. During operation which may cause airborne particulate, a MIE MiniRAM portable dust monitor will be used to measure airborne concentrations of total particulate material. Particulate (dust) monitoring performed during remediation activities will be conducted in compliance with applicable specifications of NYSDEC Technical and Administrative Guidance Memorandum (TAGM) #4031. At a minimum, all readings will be manually recorded on an hourly basis on daily air monitoring logs (provided as Attachment H) or field notebooks.

All work activity must stop where tests indicate the concentration of flammable vapors exceeds 10% of the lower explosive limit (LEL) at a location with a potential ignition source. Such an area must be ventilated to reduce the concentration to an acceptable level.

6.2 Personal Air Monitoring for Lead

To quantify the potential exposure of Site personnel to lead in air (if any), a personal air sampling plan to determine airborne concentrations of lead will be implemented by each employee onsite if particulate levels (as measured with a MIE MiniRAM portable dust monitor) exceed Site action levels during ground intrusive activities. The following paragraphs outline the frequency, sampling, analytical, and recordkeeping requirements associated with personal air sampling during this project. The requirements of 29 CFR 1926.62 must also be met for lead.

Personal air sampling will be conducted during ground intrusive dust-generating activities (e.g., backfilling and grading, well decommissioning) where engineering controls are not sufficient for maintaining particulate levels below the Site action level. Personal air samples for lead will be collected (if necessary) for at least 20% of representative employees working in or around the Site activities. Monitoring frequency for lead also will be based on the requirements of 29 CFR 1926.62.

Personal samples for lead will be collected according to NIOSH Method #7300 or equivalent. Samples will be collected utilizing appropriate sampling equipment and media. All sampling equipment will be properly calibrated, and the sample collection flow rate will be in accordance with NIOSH Method #7300 (or equivalent).

All personal samples will be submitted to an independent American Hygiene Association-accredited laboratory for analysis. Accompanying media blanks will also be submitted to the laboratory for analysis at a rate of one blank for every five samples. Holding time requirements and field preparation procedures, as specified in the NIOSH (or equivalent) method will be followed.

6.3 Noise Monitoring

Noise monitoring may be conducted as required. Hearing protection is mandatory for all employees in noise hazardous areas, such as around heavy equipment. As a general rule, sound levels that cause speech interference at normal conversation distance should require the use of hearing protection.

6.4 Monitoring Equipment Maintenance and Calibration

All direct-reading instrumentation calibrations should be conducted under the approximate environmental conditions the instrument will be used. Instruments must be calibrated before and after use, noting the reading(s) and any adjustments which are necessary. All air monitoring equipment calibrations, including the standard used for calibration, must be documented on a calibration log or in the field notebook. All completed HS documentation/forms must be reviewed by the HSS and maintained by the SS.

All air monitoring equipment will be maintained and calibrated in accordance with the specific manufacturers' procedures. Preventive maintenance and repairs will be conducted in accordance with the respective manufacturers' procedures. When applicable, only manufacturer-trained and/or authorized personnel will be allowed to perform instrument repairs or preventive maintenance.

If an instrument is found to be inoperative or suspected of giving erroneous readings, the HSS must be responsible for immediately removing the instrument from service and obtaining a replacement unit. If the instrument is essential for safe operation during a specific activity, that activity must cease until an appropriate replacement unit is obtained. The HSS will be responsible for ensuring a replacement unit is obtained and/or repairs are initiated on the defective equipment.

6.5 Action Levels

Table 6-1 presents airborne constituent action levels that will be used to determine the procedures and protective equipment necessary based on conditions as measured at the Site.

6.6 Onsite Monitoring Plan and Response Activities

Some of the work activities to be conducted may have the potential to generate organic vapors and particulates. Air monitoring will be conducted in the worker breathing zone with a PID and portable dust monitor during field activities which may generate organic vapors and particulates to determine the level of protection required for personnel completing work activities. If action levels in the worker breathing zone are exceeded, air monitoring will be required at various onsite/perimeter locations to determine appropriate response activities that are protective of personnel onsite who are not directly involved with the work activities, personnel at adjacent commercial Sites, and the surrounding community in accordance with the NYSDOH's *Generic Community Air Monitoring Plan* (most current version). Additional monitoring (and appropriate response activities) to be implemented if the total organic vapor and particulate levels in the worker breathing zone exceed action levels are discussed below.

Total Organic Vapors

Air monitoring will be performed on an hourly basis.

If the sustained level of total organic vapors in the worker breathing zone exceeds 1 ppm above background, then the level of total organic vapors will be manually recorded at the downwind perimeter of the work area (i.e., exclusion zone) at 15-minute intervals. If the level of total organic vapors at the downwind perimeter of the work area exceeds 5 ppm above background, then work activities will be halted and additional downwind monitoring will be performed. Efforts will be undertaken to mitigate the source of organic vapors. The work area will be enlarged, if necessary, to keep personnel who are not involved with the Site-related activities from being exposed to organic vapor levels exceeding 1 ppm above background.

During the work activities, it is possible that the downwind perimeter of the work area will coincide with or exceed the Site perimeter. Site perimeters (for the purposes of this HASP) are defined by chain-link fencing around the Site. If, at any time, the level or total organic vapors adjacent to the downwind Site perimeter (or downwind work area perimeter if work activities are conducted beyond the Site boundaries) reaches 1 ppm above background, then the level of total organic vapors 200 feet downwind of the work area perimeter, or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less, but no less than 20 feet, will be monitored. Work activities can resume provided that the TOV level at this location is below 1 ppm over background. If after 30 minutes, the total organic vapor level at this location has not subsided below 1 ppm above background, then the HSS will inform the local emergency response contacts (in addition to project managers from National Grid, the NYSDEC, the NYSDOH, and ARCADIS BBL) listed in Section 9.7, and persons who may be exposed at the residential or commercial properties will be notified to evacuate. These persons will not be permitted to return to the residential or commercial properties until after the level of total organic vapors on the properties subsides to below 1 ppm above background.

Particulate

Air monitoring will be performed on an hourly basis.

If the level of particulate in the worker breathing zone exceeds 100 micrograms per cubic meter ($\mu g/m^3$) above background, then the level of particulate will be manually recorded at the downwind perimeter of the work area at 15-minute intervals. If the level of particulate at the downwind perimeter of the work area is 150 $\mu g/m^3$ or greater, or if airborne dust is observed leaving the work area, then work activities will cease and dust suppression techniques must be employed to maintain levels below 150 $\mu g/m^3$ and prevent dust migration. In addition, the work area will be enlarged, if necessary, to keep personnel who are not involved with the work activities (and the public) from being exposed to particulate levels greater than 150 $\mu g/m^3$.

TABLE 6-1
AIRBORNE CONSTITUENT ACTION LEVELS

Parameter	Reading	Action
Total Organic Vapors (TOV) (measured with a PID)	0 ppm to ≤ 1 ppm	Normal operations; manually record breathing zone monitoring measurements every hour.
	>1 ppm	Increase monitoring frequency to every 15 minutes and use benzene Drager tubes, or equivalent
	≥1 ppm to ≤5 ppm (benzene)	Upgrade to Level C PPE; continue screening for benzene
	>5 ppm (benzene)	Stop work; evacuate working area; investigate cause of reading; contact RHSC
	>5 ppm to 20 ppm	Upgrade to Level C PPE; Initiate monitoring at the downwind perimeter of the work area.
	>20 ppm	Stop work; evacuate confined spaces/work area; investigate cause of reading; contact RHSC.
Total Particulate (measured with MiniRAM)	0 to 100 µg/m^3	Normal operations.
	>100 µg/m^3 above background	Initiate dust control measures; upgrade to Level C if dust control measures do not control dust within 15 minutes. Initiate monitoring at the downwind perimeter of the work area. Initiate personal air monitoring for lead if not previously conducted.
	>150 µg/m^3 in breathing zone or at downwind perimeter of work area	Stop work; investigate cause of reading; contact ARCADIS BBL project manager and RHSC.
Oxygen	≤ 19.5%	Stop work; evacuate excavation/work area; investigate cause of reading; ventilate area; contact RHSC.
	>19.5% to <23.5%	Normal operations.
	≥ 23.5%	Stop work; evacuate excavation/work area; investigate cause of reading; ventilate area; contact RHSC.
Carbon Monoxide	<25 ppm	Normal operations.
	≥25 ppm	Stop work; evacuate excavation/work area; investigate source of vapors.
Hydrogen Sulfide	0 ppm to ≤5 ppm	Normal operations.
	>5 ppm	Stop work; evacuate excavation/work area; investigate cause of reading; ventilate area; contact RHSC.
Flammable Vapors (LEL)	<10% LEL	Normal operations.
	≥ 10% LEL	Stop work; ventilate area; investigate source of vapors.

7. Work Zones and Decontamination

7.1 Work Zones

7.1.1 Authorization to Enter

Only personnel with the appropriate training and medical certifications (if respirators are required) will be allowed to work at the project Site. The SS will maintain a list of authorized persons; only personnel on the authorized-persons list will be allowed to enter the Site work areas.

7.1.2 Site Orientation and Hazard Briefing

No person will be allowed in the work area during Site operations without first being given a Site orientation and hazard briefing. This orientation will be presented by the SS or HSS and will consist of a review of this HASP. This review must cover the chemical, physical, and biological hazards; protective equipment; safe work procedures; and emergency procedures for the project. Following this initial meeting, daily safety meetings will be held each day before work begins.

All people entering the Site work areas, including visitors, must document their attendance at this briefing, as well as the daily safety meetings, on the forms included with this plan.

7.1.3 Certification Documents

A training and medical file may be established for the project and kept on Site during all Site operations. Specialty training, such as first aid and cardiopulmonary resuscitation (CPR), as well as current medical clearances for all project field personnel required to wear respirators, will be maintained within that file. All ARCADIS BBL and subcontractor personnel must provide their training and medical documentation to the HSS prior to starting work.

7.1.4 Entry Log

A log-in/log-out sheet will be maintained on Site by the SS. Personnel must sign in and out on a log sheet as they enter and leave the work area, and the SS may document entry and exit in the field notebook.

7.1.5 Entry Requirements

In addition to the authorization, hazard briefing, and certification requirements listed above, no person will be allowed in any ARCADIS BBL work area unless they are wearing the minimum PPE as described in Section 5 - Personal Protective Equipment.

7.1.6 Emergency Entry and Exit

People who must enter the work area on an emergency basis will be briefed of the hazards by the SS. All activities will cease in the event of an emergency. People exiting the work area because of an emergency will gather in a safe area for a head count. The SS is responsible for confirming that all people who entered the work area have exited in the event of an emergency.

7.1.7 Contamination-Control Zones

Contamination-control zones are maintained to prevent the spread of contamination, and to prevent unauthorized people from entering hazardous areas.

7.1.7.1 Exclusion Zone

An EZ may consist of a specific work area or may be the entire area of potential contamination. All employees entering an EZ must use the required PPE, and must have the appropriate training and medical clearance for hazardous waste work. The EZ is the defined area where there is a possible respiratory and/or contact health hazard. Cones, caution tape, or a Site diagram will identify the location of each EZ. A wind direction indication device (i.e., flagging, windsock, etc.) will be mounted in the area of any EZ during Site activities.

7.1.7.2 Contamination-Reduction Zone

The CRZ or transition area will be established, if necessary, to perform decontamination of personnel and equipment. All personnel entering or leaving the EZ will pass through this area to prevent any cross-contamination. Tools, equipment, and machinery will be decontaminated in a specific location. All personnel will be decontaminated on Site adjacent to the EZ. Personal protective outer garments and respiratory protection will be removed in the CRZ and prepared for cleaning or disposal. This zone is the only appropriate corridor between the EZ and the SZ.

7.1.7.3 Support Zone

The SZ is a clean area outside the CRZ located to prevent employee exposure to hazardous substances. Eating and drinking will be permitted in the SZ only after proper decontamination. Smoking may be permitted in the SZ, subject to Site requirements.

7.1.8 Posting

Work areas will be prominently marked and delineated using cones, caution tape, or a Site diagram.

7.1.9 Site Inspections

The SS will conduct a daily inspection of Site activities, equipment, and procedures to verify that the required elements are in place. The Health and Safety Inspection Form in Attachment I may be used as a guide for daily inspections. A monthly SWO must also be completed and forwarded to the PM for review.

7.2 Decontamination

7.2.1 Personnel Decontamination

All personnel wearing Modified Level D must undergo personal decontamination. The personnel decontamination area will consist of the following stations, at a minimum.

- *Station 1*: Personnel leaving the contaminated zone will remove the gross contamination from their outer clothing and boots.
- *Station 2*: Personnel will remove their outer garment and gloves and dispose of them in properly labeled containers. Personnel will then decontaminate their hard hats and boots with an aqueous solution of detergent or other appropriate cleaning solution. These items are then hand carried to the next station.
- *Station 3*: Personnel will thoroughly wash their hands and face.

7.2.2 Equipment Decontamination

All equipment will be decontaminated prior to leaving the work area.

7.2.3 PPE Decontamination

Where and whenever possible, single-use, external protective clothing must be used. This protective clothing must be disposed of in properly labeled containers. Reusable protective clothing will be rinsed on Site with detergent and water. The rinsate will be collected for disposal.

8. Training and Medical Surveillance

8.1 Training

8.1.1 General

All onsite project personnel who work in areas where they may be exposed to Site contaminants must be trained as required by OSHA Regulation 29 CFR 1910.120 (HAZWOPER). Field employees also must receive a minimum of 3 days of actual field experience under the direct supervision of a trained, experienced supervisor. Personnel who completed their initial training more than 12 months prior to the start of the project must have completed an 8-hour refresher course within the past 12 months. The SS must have completed an additional 8 hours of supervisory training, and must have current first-aid and CPR certificates.

8.1.2 Basic 40-Hour Course

The following is a list of the topics typically covered in a 40-hour HAZWOPER training course:

- General safety procedures;
- Physical hazards (fall protection, noise, heat stress, cold stress);
- Names and job descriptions of key personnel responsible for Site health and safety;
- Safety, health, and other hazards typically present at hazardous waste Sites;
- Use, application, and limitations of PPE;
- Work practices by which employees can minimize risks from hazards;
- Safe use of engineering controls and equipment on Site;
- Medical surveillance requirements;
- Recognition of symptoms and signs that might indicate overexposure to hazards;
- Worker right-to-know (Hazard Communication OSHA 1910.1200);
- Routes of exposure to contaminants;
- Engineering controls and safe work practices;
- Components of a health and safety program and a Site-specific HASP;
- Decontamination practices for personnel and equipment;

- Confined-space entry procedures; and
- General emergency response procedures.

8.1.3 Supervisor Course

Managers and supervisors must receive an additional 8 hours of training, which typically includes:

- General Site safety and health procedures;
- PPE programs; and
- Air monitoring techniques.

8.1.4 Site-Specific Training

Site-specific training will be accomplished by onsite personnel reading this HASP or through a thorough Site briefing by the PM, SS, or HSS on the contents of this HASP before work begins. The review must include a discussion of the chemical, physical, and biological hazards; protective equipment and safety procedures; and emergency procedures.

8.1.5 Daily Safety Meetings

Daily safety meetings will be held to cover the work to be accomplished, hazards anticipated, PPE and procedures required to minimize Site hazards, and emergency procedures. The SS or HSS should present these meetings prior to beginning the day's fieldwork. No work will be performed before the daily safety meeting has been held. The daily safety meeting must also be held prior to new tasks and repeated if new hazards are encountered. The Safety Meeting Log is included in Attachment J.

8.1.6 First Aid and CPR

At least one employee current in first aid and CPR will be assigned to the work crew, and will be onsite during operations. Refresher training in first aid (triennially) and CPR (annually) are required to keep the certificate current. These individuals must also receive training regarding the precautions and protective equipment necessary to protect against exposure to blood-borne pathogens.

8.2 Medical Surveillance

8.2.1 Medical Examination

All personnel who are potentially exposed to Site contaminants must participate in a medical surveillance program as defined by OSHA at 29 CFR 1910.120(f).

8.2.2 Pre-Placement Medical Examination

All potentially exposed personnel must have completed a comprehensive medical examination prior to assignment and periodically thereafter, as defined by applicable regulations. The pre-placement and periodic medical examinations typically include the following elements:

- Medical and occupational history questionnaire;
- Physical examination;
- Complete blood count, with differential;
- Liver enzyme profile;
- Chest x-ray, at a frequency determined by the physician;
- Pulmonary function test;
- Audiogram;
- Electrocardiogram for persons older than 45 years of age, or if indicated during the physical examination;
- Drug and alcohol screening, as required by job assignment;
- Visual acuity; and
- Follow-up examinations, at the discretion of the examining physician or the corporate medical director.

The examining physician must provide the employee with a letter summarizing his or her findings and recommendations, confirming the worker’s fitness for work and ability to wear a respirator. Documentation of medical clearance will be available for each employee during all project Site work.

Subcontractors will certify that all their employees have successfully completed a physical examination by a qualified physician. The physical examinations must meet the requirements of 29 CFR 1910.120 and 29 CFR 1910.134. Subcontractors will supply copies of the medical examination certificate for each onsite employee.

8.2.3 Other Medical Examinations

In addition to pre-employment, annual, and exit physicals, personnel may be examined:

- At employee request after known or suspected exposure to toxic or hazardous materials; and
- At the discretion of the HSS, HSO, or occupational physician in anticipation of, or after known or suspected exposure to toxic or hazardous materials.

8.2.4 Periodic Exam

Following the placement examination, all employees must undergo a periodic examination similar in scope to the placement examination. For employees potentially exposed more than 30 days per year, the frequency of periodic examinations will be annual. For employees potentially exposed less than 30 days per year, the frequency for periodic examinations will be 24 months.

8.2.5 Medical Restriction

When the examining physician identifies a need to restrict work activity, the employee's supervisor must communicate the restriction to the employee and the HSS. The terms of the restriction will be discussed with the employee and the supervisor.

9. Emergency Procedures

9.1 General

Prior to the start of operations, the work area will be evaluated for the potential for fire, contaminant release, or other catastrophic event. Unusual conditions or events, activities, chemicals, and conditions will be reported to the SS/HSS immediately.

The SS/HSS will establish evacuation routes and assembly areas for the Site. All personnel entering the Site will be informed of this route and the assembly area.

All ARCADIS BBL personnel will participate in scheduled Site emergency drills. The HSO will have radio or cell phone communication with any employees working on Site who are directly contracted to ARCADIS BBL.

9.2 Emergency Response

If an incident occurs, the SS or HS should take the following steps:

- Evaluate the incident and assess the need for assistance and/or evacuation;
- Call for outside assistance as needed;
- Confirm that the PM is notified promptly of the incident; and
- Take appropriate measures to stabilize the incident scene.

9.2.1 Fire

In the case of a fire on Site, the SS/HSS will assess the situation and direct firefighting activities. The SS/HSS will confirm that the PM is immediately notified of any fires. Site personnel will attempt to extinguish the fire with available extinguishers, if safe to do so. In the event of a fire that Site personnel are unable to safely extinguish with one fire extinguisher, the local fire department will be summoned.

9.2.2 Contaminant Release

In the event of a contaminant release, the following steps will be taken:

- Notify SS/HSS immediately;
- Evacuate immediate area of release;
- Conduct air monitoring to determine needed level of PPE; and

- Don required level of PPE and prepare to implement control procedures.

The SS/HSS has the authority to commit resources as needed to contain and control released material, and to prevent its spread to offsite areas.

9.3 Medical Emergency

All employee injuries must be promptly reported to the HSS/SS, who will:

- Confirm that the injured employee receives prompt first aid and medical attention;
- In emergency situations, the worker is to be transported by appropriate means to the nearest urgent care facility (normally a hospital emergency room); and
- If the injured person is an ARCADIS BBL employee, notify ClinNet (ARCADIS BBL's medical surveillance consultant), as soon as possible after an injured worker has left the Site. The caller should dial 1-800-229-3674 and follow the instructions for reaching the Injury Management Office. When the case manager answers, the caller should provide the information requested by the case manager.

9.3.1 Emergency Care Steps

Upon entering an accident area, Site personnel must follow these emergency care steps.

- Survey the scene. Determine if it is safe to proceed. Try to determine if the conditions that caused the incident are still a threat. Protect yourself from exposure before attempting to rescue the victim;
- Do a primary survey of the victim. Check for airway obstruction, breathing, and pulse. Assess likely routes of chemical exposure by examining the eyes, mouth, nose, and skin of the victim for symptoms;
- Phone emergency medical services (EMS). Give the location, telephone number used, caller's name, what happened, number of victims, victim's condition, and help being given;
- Maintain airway and perform rescue breathing as necessary;
- Perform CPR as necessary;
- Do a secondary survey of the victim. Check vital signs and do a head-to-toe exam; and
- Treat other conditions as necessary. If the victim can be moved, take him or her to a location away from the work area where EMS can gain access.

9.4 First Aid—General

All persons must report any injury or illness to their immediate supervisor or the SS. Trained personnel will provide first aid. Injuries and illnesses requiring medical treatment must be documented. The SS and HSS must conduct an II as soon as emergency conditions no longer exist, and first aid and/or medical treatment has been confirmed. IIs must be completed and submitted to the PM within 24 hours after the incident.

If first-aid treatment is required, first-aid kits are kept in the Contamination Reduction Zone. If treatment beyond first aid is required, the injured person(s) should be transported to the medical facility. If the injured person is not ambulatory or shows any sign of not being in a comfortable and stable condition for transport, then an ambulance and/or paramedics should be summoned. If there is any doubt as to the injured worker's condition, it is best to let the local paramedic or ambulance service examine and transport the worker.

9.4.1 First Aid—Inhalation

Any employee complaining of symptoms of chemical overexposure as described in Section 4 - General Safety Practices, will be removed from the work area and transported to the designated medical facility for examination and treatment.

9.4.2 First Aid—Ingestion

Call EMS and consult a poison control center for advice. If available, refer to the MSDS for treatment information. If the victim is unconscious, keep them on their side and clear the airway if vomiting occurs.

9.4.3 First Aid—Skin Contact

Project personnel, who have had skin contact with contaminants will, unless the contact is severe, proceed to the wash area. Personnel will remove any contaminated clothing and then flush the affected area with water for at least 15 minutes. The worker should be transported to the medical facility if he or she shows any sign of skin reddening, irritation, or if he or she requests a medical examination.

9.4.4 First Aid—Eye Contact

Project personnel who have had contaminants splashed in their eyes, or who have experienced eye irritation while in the EZ, must immediately proceed to the eyewash station. Do not decontaminate prior to using the eyewash. Remove whatever protective clothing is necessary to use the eyewash. Flush the eye with clean running water for at least 15 minutes. Arrange prompt transport to the designated medical facility.

9.5 Reporting Injuries, Illnesses, and Near-Miss Incidents

Injuries and illnesses, however minor, will be reported to the SS immediately. The SS will complete an injury report and submit it to the HSO and the PM within 24 hours.

Near-miss incidents are situations in which no injury or property damage occurred, but under slightly different circumstances an injury or property damage could have occurred. Near misses are caused by the same factors as injuries; therefore, they must be reported and investigated in the same manner. An RSA must be done immediately after an injury, illness, near miss, or other incident to determine if it is safe to proceed with the work.

9.6 Weather Monitoring

The HSO or SS will be responsible for checking weather forecasts for the next day and week of work to provide advance notification of any severe weather conditions. Severe weather conditions may cause unsafe conditions at the Site and in some situations work may have to be stopped. In case of thunder/lightning activity, the following actions will be taken:

- Cease work immediately;
- Shut down all powered equipment such as drill rigs and excavators; and
- Seek shelter inside nearby buildings or trailers. If there are no buildings nearby, seek shelter inside your vehicle. If you are caught outside, do not stand beneath tall, isolated trees or telephone poles. Avoid areas projecting above the landscape such as hill tops. In open areas, go to a low place such as a ravine or valley. Stay away from open water, metal equipment, wire fences and metal pipes. If you are in a group of people in the open, spread out, staying several yards apart. If you are caught in a level field or open area far from shelter and you feel your hair stand on end, lightning may be about to strike you. Drop to you knees and bend forward, putting your hands on your knees. **DO NOT LIE FLAT ON THE GROUND.**

Tornadoes usually develop from thunderstorms and normally occur at the trailing edge of the storm. Most tornadoes occur in the months of April, May, June and July. Monitor weather conditions on a radio when storms are predicted for the project area. A tornado watch is issued when favorable conditions exist for the development of a tornado. A tornado warning is issued by the local weather service office whenever a tornado has actually been sighted or is strongly indicated by radar.

If a tornado warning is issued, seek shelter immediately. If there are permanent buildings located on Site, go there immediately, moving toward interior hallways or small rooms on the lowest floor. If a tornado warning is issued and you are in a vehicle or Site trailer, leave and go to the nearest building. If there are not buildings nearby, go in the nearest ditch, ravine, or culvert, with your hands shielding your head. If a tornado is sighted or a warning issued while you are in open country, lie flat in a ditch or depression. Hold onto something on the ground such as a bush or wooden fence post if possible.

When snow or ice storms are predicted for the project area, Site personnel should monitor weather conditions on a radio. A winter storm watch is issued when a storm has formed and is approaching the area. A winter storm warning is issued when a storm is imminent and immediate action is to be taken. When a storm watch is issued, monitor weather conditions and prepare to halt Site activities. Notify the project manager of the situation. Seek shelter at Site buildings or leave the Site and seek warm shelter.

High winds may be encountered at the Site causing hazards that may affect Site personnel health and safety. Preventative measures that will be implemented if necessary are as follows:

- Restricted Site activity;
- Battening down light equipment or building materials;
- Partially enclosing work areas; and

- Reduction or stoppage of work.

9.7 Emergency Information

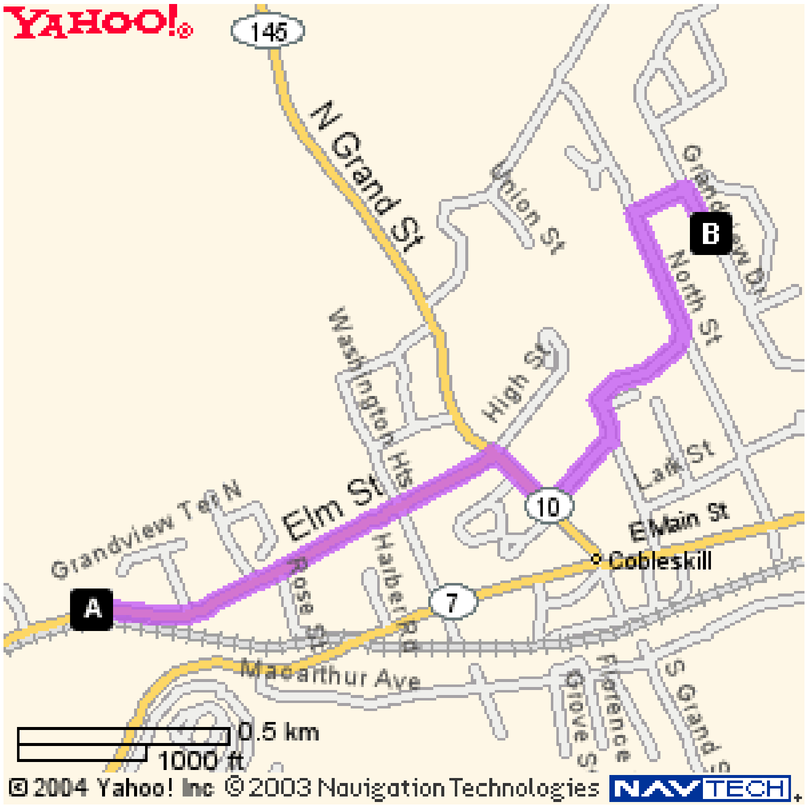
The means to summon local public response agencies such as police, fire, and ambulance will be reviewed in the daily safety meeting. These agencies are identified in Table 9-1 below.

TABLE 9-1
EMERGENCY CONTACTS

Agency	Telephone No.
Fire	911
Police	911
Ambulance	911
Hospital: Bassett Hospital 41 Grandview Drive Cobleskill, NY	(518) 254-3456
NYSDEC Project Manager Daniel Lightsey	(518) 357-2045
NYSDEC 24-Hour Spill hotline	(800) 457-7362
NYSDOH- TBD	(518) 402-7860
National Grid, James F. Morgan	(315) 428-3101
Chemtrec, Chemical Emergencies	(800) 424-9300

9.7.1 Directions and Map to Bassett Hospital

It is the responsibility of the HSS to verify the accuracy of these directions prior to the start of work.



1. Starting on ELM ST going towards GRANDVIEW TER - go 0.6 miles
2. Turn Right on N GRAND ST - go 0.1 miles
3. Turn Left on CHAPEL ST - go 0.1 miles
4. Turn Left on UNION ST - go < 0.1 miles
5. Continue on PROSPECT ST - go 0.2 miles
6. Bear Left on NORTH ST - go 0.2 miles
7. Turn Right on RIDGEWOOD RD - go 0.1 miles
8. Turn Right on GRANDVIEW DR - go 0.1 miles
9. Arrive at Bassett Hospital

10. References

This HASP follows the guidelines established in the references listed below.

ACGIH. 2003a. *Threshold Limit Values Handbook.*

ACGIH. 2003b. *Guide to Occupational Exposure Values*.

BBL. 2003. *Health and Safety Policies and Procedures Manual*.

Forsberg, K. and S.Z. Mansdorf. 1993. *Quick Selection Guide to Chemical Protective Clothing*, 2nd Edition.

NIOSH. 2003. Pocket Guide to Chemical Hazards. Pub. No. 90-117.

NIOSH, OSHA, USCG, and USEPA. 1985. *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*. 86116.

Title 29 of the Code of Federal Regulations (CFR), Parts 1910 and 1926.

USEPA. 1992. *Standard Operating Safety Guidelines*. Publication 9285.1-03.

Attachments

BBL®

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Attachment A

Underground/Overhead Utility Checklist

UNDERGROUND/OVERHEAD UTILITY CHECKLIST

Project Name______________________________________ Date

Location

Prepared By__________________________ Project Manager

This checklist must be completed for any intrusive subsurface work such as excavation or drilling. It documents that overhead and underground utilities in the work are identified and located. The Project Manager shall request utility markouts before that start of field operations to allow the client and utility companies sufficient time to provide them. If complete information is not available, a magnetometer or other survey shall be performed to locate obstacles prior to intrusive subsurface activities.

Procedure

A diagram of the work area depicting the proposal location of intrusive subsurface work sites (i.e., boring locations, excavation locations) must be attached to this form. The diagram must clearly indicate the areas checked for underground structures/utilities, and overhead power lines. This form and the diagram must be signed by the BBL Project Manager, the BBL Site Supervisor, and the client representative.

Checklist

Type of Structure	Present	Not Present	Method of Markout
Electric Power Line			
Natural Gas Line			
Telephone Line			
Water Line			
Product Line			
Sewer Line			
Steam Line			
Drain Line			
Underground Tank			
Underground Cable			
Overhead Power Line			
Overhead Product Line			
Other (Specify)			

Client Representative__________________________________ Date

BBL Project Manager___________________________________ Date

BBL Site Supervisor____________________________________ Date

Attachment B

Lockout/Tagout Equipment Specific Energy Control Procedure

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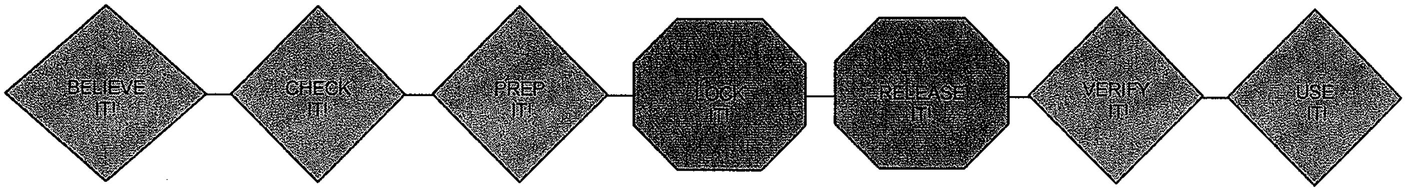
engineers & scientists

Lockout / Tagout Equipment-Specific Energy Control Procedure



Equipment Identification:

____

____

Hazardous Energy Source		Isolation Device			Verifying Lockout Means of Verification of Lockout
Type and Magnitude	Function	Type	Location	I.D. No.	
Electrical 120v					
Pneumatic					
Hydraulic					
Mechanical					
Potential					
Gravity					
Other					
Other					
Other					
Area:		**Date of Last Review:**			**Authorized by:**

Attachment C

Chemical Hazard Information Table

CHEMICAL HAZARD INFORMATION

Arsenic and soluble inorganic compounds (as As) [7740-38-2]	NA	NA	Inh Abs Ing Con	Ulceration of nasal septum; dermatitis; gastrointestinal disturbances; hyperpigmentation of skin (carcinogenic); peripheral neuropathy; respiratory irritation	Eye: Irrigate immediately (15 min) Skin: Soap wash immediately Swallow: Immediate medical attention	0.01 mg/m^3 0.01 mg/m^3 (Ca-29 CFR 1910.1018)	C0.002 mg/m^3	PEL TLV REL	Ca (5 mg/m^3)
Benzene [71-43-2]	9.24	34-119	Inh Abs Ing Con	Irritated eyes, nose, and respiratory system; giddiness; headache; nausea; staggered gait; fatigue; anorexia, lassitude; dermatitis; bone marrow depression – carcinogenic	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	1 ppm (0.5 ppm) NIC-0.1 skin 0.1 ppm	2.5 ppm	PEL TLV REL	Ca (500 ppm)* *OSHA 29 CFR 1910.1028
Cadmium dust (as Cd) [7440-43-9]	NA	NA	Inh Ing	Pulmonary edema, dyspnea, cough, chest tightness, substernal pain; headache; chills, muscular aches; nausea, vomiting, diarrhea; anosmia, emphysema, proteinuria, mild anemia – carcinogenic	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	0.005 mg/m^3 0.01 mg/m^3 Ca, lowest feasible concentration		PEL TLV REL	Ca (9 mg/m^3)
Chromium metal (as Crl) [7440-47-3]	NA	NA	Inh Ing	Histologic fibrosis of lungs	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	1 mg/m^3 0.5 mg/m^3 0.5 mg/m^3		PEL TLV REL	NE
1,2 Dichloroethylene (DCE) 540-59-0	9.65		Inh Ing Con	Irritated eyes, respiratory system; CNS depression	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	200 ppm 200 ppm 200 ppm		PEL TLV REL	1000 ppm
Ethylbenzene [100-41-4]	8.76	0.09-0.6	Inh Ing Con	Irritated eyes, mucous membranes; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush immediately Breath: Respiratory support Swallow: Immediate medical attention	100 ppm 100 ppm 100 ppm	125 ppm 125 ppm 125 ppm	PEL TLV REL	800 ppm
Gasoline			Inh Abs Ing Con	Skin irritation, respiratory irritation; headache; dizziness; nausea, vomitting; weakness, loss of coodination, blurred vision, drowsiness, confusion, or disorientation; central nervous system effects; respiratory depression; tremors, convultions, loss of consciousness, coma, death – carcinogen HIGHLY FLAMMABLE	Eye: Irrigate immediately Skin: Water flush immediately Breath: Respiratory support Swallow: Immediate medical attention	NA 300 ppm	NA 500	PEL TLV	
Lead, inorganic dusts and fumes (as Pb) [7439-92-1]	NA	NA	Inh Ing Con	Weakness, lassitude, insomnia; facial pallor; eye pallor; anorexia, low weight, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremors; wrist and ankle paralysis; brain damage; kidney damage; irritated eyes; hypotension	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	0.05 mg/m^3 0.05 mg/m^3 <0.1 mg/m^3 See 29 CFR 1910.1025		PEL TLV REL	100 mg/m^3

CHEMICAL HAZARD INFORMATION

Naphthalene [91-203]	8.12	ND	Inh Abs Ing Con	Irritated eyes; headache; confusion, excitement, malaise; nausea, vomiting, abdominal pain; irritated bladder, profuse sweating; jaundice, renal shutdown; dermatitis	Eye: Irrigate immediately Skin: Molten flush immediately/ sol-liq soap wash promptly Breath: Respiratory support Swallow: Immediate medical attention	10 ppm 10 ppm 10 ppm	 15 ppm	PEL TLV REL	250 ppm
Phenol [108-95-2]	8.5	0.040-3.0	Inh Abs Ing Con	Irritated eyes, nose, and throat; anorexia, low weight; weakness, muscular aches and pains; dark urine; cyanosis; liver and kidney damage; skin burns; dermatitis; ochronosis; tremors, convulsions, twitching	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	5 ppm (skin) 5 ppm (skin) 5 ppm (skin)	 C15.6 ppm	PEL TLV REL	250 ppm
Polychlorinated biphenyls (PCB) Aroclor 1242 [53469-21-9] and Aroclor 1254 [11097-69-1]	ND	ND	Inh Abs Ing Con	Aroclor 1242: irritated eyes; chloracne; acne-form dermatitis; mildly toxic by ingestion; poison by subcutaneous route – carcinogenic Aroclor 1254: irritated eyes and skin; acne-form dermatitis; poison by intravenous route; moderately toxic by ingestion and intraperitoneal routes – carcinogenic	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	Aroclor 1242: 1 mg/m^3 (skin) 1 mg/m^3 (skin) 0.001 mg/m^3 Aroclor 1254: 0.5 mg/m^3 (skin) 0.5 mg/m^3 (skin) 0.001 mg/m^3		 PEL TLV REL PEL TLV REL	 Ca (10 mg/m^3) Ca (5 mg/m^3)
Toluene [108-88-3]	8.82	0.16-37	Inh Abs Ing Con	Fatigue, weakness; confusion, euphoria, dizziness; headache; dilated pupils, lacrimation; nervousness, muscular fatigue, insomnia; paralysis; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	100 ppm 50 ppm (skin) 100 ppm	150 ppm 150 ppm	PEL TLV REL	500 ppm
Trichloroethylene (TCE, trichloroethene) [79-01-6]	9.45	21.4	Inh Ing Con	Headache, vertigo; visual disturbance, tremors, somnolence, nausea, vomiting; irritated eyes; dermatitis; cardiac arrhythmia, paresthesia – carcinogenic	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	100 ppm 50 ppm 25 ppm (10-hour)	C200 ppm C100 ppm C2 ppm (60 MIN)	PEL TLV REL	Ca (1,000 ppm)
Xylene (o-, m-, and p-isomers) [1330-20-7; 95-47-6; 108-38-3; 106-42-3]	8.56 8.56 8.44	1.1-20	Inh Abs Ing Con	Dizziness, excitement, drowsiness, incoordination, staggering gait; irritated eyes, nose, throat; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breath: Respiratory support Swallow: Immediate medical attention	100 ppm 100 ppm 100 ppm	150 ppm 150 ppm 150 ppm	PEL TLV REL	900 ppm

CHEMICAL HAZARD INFORMATION

Notes:

[1]IP = Ionization potential (electron volts).
[2]Route = Inh, Inhalation; Abs, Skin absorption; Ing, Ingestion; and Con, Skin and/or eye contact.
[3]TWA = Time-weighted average. The TWA concentration for a normal workday (usually 8 or 10 hours) and a 40-hour work week, to which nearly all workers may be repeatedly exposed, day after day without adverse effect.
[4]STEL = Short-term exposure limit. A 15-minute TWA exposure that should not be exceeded at any time during a workday, even if the TWA is not exceeded.
[5]PEL = Occupational Safety and Health Administration (OSHA) permissible exposure limit (29 CFR 1910.1000, Table Z).
[5]TLV = American Conference of Governmental Industrial Hygiene (ACGIH) threshold limit value – TWA.
[5]REL = National Institute for Occupational Safety and Health (NIOSH) recommended exposure limit.
[6]IDLH (NIOSH) = Immediately dangerous to life or health (NIOSH). Represents the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.
NE = None established. No evidence could be found for the existence of an IDLH (NIOSH Pocket Guide to Chemical Hazards, Pub. No. 90-117, 1990, 1997).
C = Ceiling limit value which should not be exceeded at any time.
Ca = Carcinogen.
NA = Not applicable.
ND = Not Determined.
LEL = Lower explosive limits.
LC_{50} = Lethal concentration for 50 percent of population tested.
LD_{50} = Lethal dose for 50 percent of population tested.
NIC = Notice of intended change (ACGIH).

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Attachment D

Material Safety Data Sheets

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Amsterdam, NY 12010
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Issue Date: 2002-02

Acetylene Dichloride
DIC4500

Section 1 - Chemical Product and Company Identification 54

Material Name: Acetylene Dichloride

CAS Number: 540-59-0

Chemical Formula: $C_2H_2Cl_2$

Structural Chemical Formula: ClCH=CHCl

Synonyms: ACETYLENE DICHLORIDE; CIS-ACETYLENE DICHLORIDE; TRANS-ACETYLENE DICHLORIDE; 1,2-DCE; 1,2-DICHLOR-AETHEN; 1,2-DICHLOROETHENE; 1,2-DICHLOROETHYLENE; CIS-TRANS-1,2-DICHLOROETHYLENE; DICHLORO-1,2-ETHYLENE; SYM-DICHLOROETHYLENE; TRANS-DICHLOROETHYLENE; DIOFORM; ETHENE,1,2-DICHLORO-; ETHYLENE,1,2-DICHLORO-

General Use: Solvent for organic materials, dye extraction, perfumes, lacquers, thermoplastics and organic syntheses. The trans-isomer being a "universal solvent" is more widely used than either the cis-isomer or the mixture.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
acetylene dichloride	540-59-0	>98

OSHA PEL
TWA: 200 ppm; 790 mg/m^3.

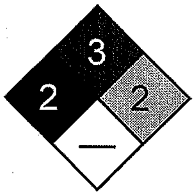
ACGIH TLV
TWA: 200 ppm, 793 mg/m^3.

NIOSH REL
TWA: 200 ppm, 790 mg/m^3.

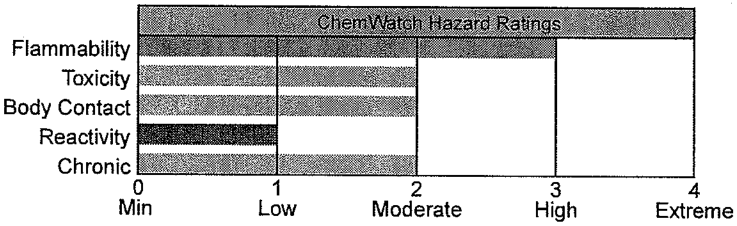
IDLH Level
1000 ppm.

DFG (Germany) MAK
TWA: 200 ppm, 800 mg/m^3; substances with systemic effects, onset of effect within 2 hours, half-life less than 2 hours.

Section 3 - Hazards Identification



Fire Diamond



HMIS
② Health
③ Flammability
① Reactivity

ANSI Signal Word
Warning!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; pleasant odor. Irritating to eyes/skin/respiratory tract. Also causes: narcosis, nausea, tremor, weakness, CNS depression, epigastric cramps. Can form explosive mixtures in air. Flammable.

Potential Health Effects

Target Organs: central nervous system (CNS), eyes, respiratory system

Primary Entry Routes: inhalation, ingestion, skin contact, eye contact

Acute Effects

Inhalation: There is a single report of an industrial poisoning, a fatality caused by the inhalation of a vapor in a small enclosure.

Acute intoxication by halogenated aliphatic hydrocarbons appears to take place over two stages. Signs of a reversible narcosis are evident in the first stage and in the second stage signs of injury to organs may become evident. A single organ alone is (almost) never involved.

Depression of the central nervous system is the most outstanding effect of most halogenated aliphatic hydrocarbons. Inebriation and excitation, passing into narcosis, is a typical reaction. In severe acute exposures there is always a danger of death from respiratory failure or cardiac arrest due to a tendency to make the heart more susceptible to catecholamines (adrenalin).

The most important effects of exposure are narcosis and irritation of the central nervous system. Liver responses may occur after repeated narcotic doses and involves fatty liver degeneration.

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Vapor exposure may produce central nervous system depression or in milder exposures, nausea, vomiting, weakness, tremor and epigastric cramps.

Recovery is usually rapid. In rats, single and repeated inhalation exposures to 200 ppm acetylene dichloride and its isomers lead to temporary inhibition of mixed function oxidase system (MFO), fatty infiltration of the liver and morphological alterations to the lung. The cis isomer which is more readily taken up by liver tissue is a more potent inhibitor of rat MFO whereas at higher concentrations the trans-isomer is twice as strong a CNS depressant (rats and humans).

Eye: The vapor when concentrated has pronounced eye irritation; this gives some warning of high vapor concentrations. If eye irritation occurs seek to reduce exposure with available control measures, or evacuate area.

Exposure to the trans isomer at 2200 ppm caused burning of the eyes, vertigo, nausea.

Reversible corneal clouding has been described in exposures to acetylene dichloride

Skin: The liquid may produce skin discomfort following prolonged contact.

Defatting and/or drying of the skin may lead to dermatitis. The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: The liquid is discomforting to the gastrointestinal tract and toxic if swallowed.

Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: The material may accumulate in the human body and progressively cause tissue damage.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treatment should follow that practiced in carbon tetrachloride exposures.

1.Acute exposures to carbon tetrachloride present, initially, with CNS depression followed by hepatic and renal disfunction.

2.Respiratory depression and cardiac dysrhythmias are an immediate threat to life.

3.Since a major fraction of absorbed carbon tetrachloride is exhaled in first hour, good tidal volumes should be maintained in severely poisoned patients; hyperventilation may be an additional therapeutic modality.

4.Ipecac syrup, lavage, activated charcoal or catharsis may all be used in the first 4 hours.

5.Since reactive metabolites may cause hepatorenal toxicity, administration of N-acetyl-L-cysteine may reduce complications.

Experience with this therapy is limited.

Section 5 - Fire-Fighting Measures

Flash Point: 2 °C

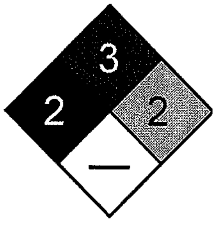
Autoignition Temperature: 460 °C

LEL: 9.7% v/v

UEL: 12.8% v/v

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.

Water spray or fog - Large fires only.



Fire Diamond

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.

Severe fire hazard when exposed to heat, flame and/or oxidizers.

Vapor forms an explosive mixture with air.

Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.

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Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO). Other combustion products include hydrogen chloride and phosgene.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
If safe, switch off electrical equipment until vapor or fire hazard removed.
Use water delivered as a fine spray to control the fire and cool adjacent area. Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protective location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights or ignition sources.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Check that containers are clearly labeled.
Packaging as recommended by manufacturer.
DO NOT use aluminum or galvanized containers.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Local exhaust ventilation usually required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment
Eyes: Safety glasses with side shields; or as required, chemical goggles.

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Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Butyl rubber gloves; Neoprene gloves.

Respiratory Protection:

Exposure Range >200 to <1000 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 1000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black

Other: Overalls. Barrier cream. Eyewash unit.

Glove Selection Index:

VITON.......................................Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless liquid with pleasant chloroform-like odor. A mixture of isomers typically comprising 60% cis-form and 40% trans-form.

Physical State: Liquid
Vapor Pressure (kPa): 36.66 at 20 °C
Vapor Density (Air=1): >1
Formula Weight: 96.94
Specific Gravity (H_2O=1, at 4 °C): 1.28
Water Solubility: 0.4% by weight
pH: Not applicable
pH (1% Solution): Not applicable
Boiling Point Range: 47.78 °C (118 °F)
Freezing/Melting Point Range: -50 °C (-58 °F)

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid reaction with oxidizing agents.

Acetylene dichloride in contact with solid caustic alkalies or their concentrated solutions will form chloracetylene which ignites in air.

Distillation of ethanol containing 0.25% of the halocarbon with aqueous sodium hydroxide gave a product which ignited in air.

Section 11 - Toxicological Information

TOXICITY
Oral (rat) LD_{50}: 770 mg/kg
Intraperitoneal (mouse) LD_{50}: 2000 mg/kg

IRRITATION
Skin (rabbit): 100 mg/24h - mod.

See NIOSH, *RTECS* KV 9360000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released on soil, it should evaporate readily and leach in soil very slowly. Biodegradation should occur. If released into water, it will be lost mainly through volatilization (half life 3 hr in a model river). Biodegradation, adsorption to sediment, and bioconcentration to aquatic organisms should not be significant. In the atmosphere, cis- and trans- will be lost by reaction with photochemically produced hydroxyl radicals (half lives 8 and 3.6 days, respectively) and scavenged by rain. Because it is relatively long lived in the atmosphere, considerable dispersal from source area should occur.

Ecotoxicity: No data found.
Henry's Law Constant: 0.00408
BCF: calculated at 15
Octanol/Water Partition Coefficient: log K_{ow} = calculated at 1.86
Soil Sorption Partition Coefficient: K_{oc} = 36 to 49

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

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Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: 1,2-DICHLOROETHYLENE
Hazard Class: 3.1
ID No.: 1150
Packing Group: II
Label: Flammable Liquid[3]

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Not listed
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Issue Date: 2002-02

Arsenic
ARS2340

Section 1 - Chemical Product and Company Identification 54

Material Name: Arsenic **CAS Number:** 7440-38-2
Chemical Formula: As
Structural Chemical Formula: As_4
Synonyms: ARSEN; ARSENIA; ARSENIC; ARSENIC-75; ARSENIC BLACK; ARSENICALS; COLLOIDAL ARSENIC; GRAY ARSENIC; GREY ARSENIC; METALLIC ARSENIC
General Use: In metallurgy for hardening copper, lead alloys. In the manufacture of certain types of glass.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Arsenic		>98

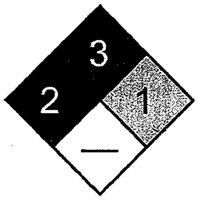
OSHA PEL
TWA: 0.01 mg/m^3.

NIOSH REL
Ceiling: 0.002 mg/m^3; 15 min.

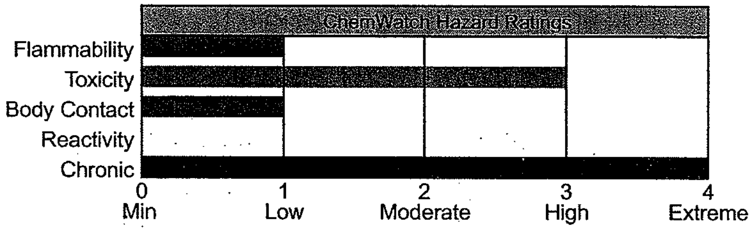
ACGIH TLV
TWA: 0.01 mg/m^3.

IDLH Level
5 mg/m^3; as As.

Section 3 - Hazards Identification



Fire Diamond



HMIS
③ Health
② Flammability
② Reactivity

ANSI Signal Word
Warning!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Brittle, crystalline, silvery-black metal. Irritating to eyes/skin/respiratory tract. Also causes: damage to blood-forming organs, nervous and cardiovascular systems. Cancer hazard. Generally found as a powder which is flammable.

Potential Health Effects

Target Organs: liver, kidneys, skin, lungs, lymphatic system
Primary Entry Routes: inhalation, ingestion of dust and fumes, skin absorption
Acute Effects
Inhalation: The dust is toxic and discomforting to the upper respiratory tract and lungs.
Acute inhalation exposure can cause cough, chest pain, shortness of breath, dizziness, headache, pulmonary edema and extreme general weakness.
Prolonged or repeated exposure can cause perforation of the nasal septum.
High exposures can cause poor appetite, nausea, vomiting and muscle cramps. Heart effects with abnormal EKG can also occur with very high exposures.
Eye: The dust may produce eye discomfort causing smarting, pain and redness.
Skin: The material is moderately discomforting to the skin and may be harmful.
Exposure may result in abnormal redness (caused by capillary congestion), burning, itching, swelling, skin eruptions and dermatitis.
Toxic effects may result from skin absorption.
Repeated skin contact can cause thickened skin and/or patchy areas of darkening and loss of pigment. Some persons develop white lines on the nails.
Ingestion: The solid/dust is discomforting to the gastrointestinal tract and is toxic and may be fatal if swallowed.

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Symptoms of acute poisoning by ingestion, which develop within 4 hours include epigastric pain, vomiting and watery diarrhea. Blood may appear in vomitus and stools. If amount ingested is sufficiently high, shock may develop, followed by death within 24 hours.

Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Class 1, Known to be a carcinogen; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A1, Confirmed human carcinogen; EPA - Class A, Human carcinogen; MAK - Class A1, Capable of inducing malignant tumors as shown by experience with humans.

Chronic Effects: Symptoms of chronic poisoning by inhalation include weight loss, nausea and diarrhea alternating with constipation, pigmentation and eruption of the skin, loss of hair, peripheral neuritis, blood disorders (anemia), striations on fingernails and toenails.

Long-term exposure can cause an ulcer or hole in the `bone' dividing the inner nose. Hoarseness and sore eyes also occur.

High or repeated exposure can cause nerve damage with `pins and needles', burning, numbness, and later weakness of arms and legs. Repeated exposure can also damage the liver, causing narrowing of the blood vessels, or interfere with the bone marrow's ability to make red blood cells.

Many cases of skin cancer have been reported among people exposed to arsenic through medical treatment with inorganic trivalent arsenic compounds. In some instances skin cancers have occurred in combination with other cancers, such as liver angiosarcoma, intestinal and urinary bladder carcinomas and meningioma. Epidemiological studies of cancer after medical treatment have shown an excess of skin cancers but no clear association with other cancers has been shown. An association between environmental exposure to arsenic through drinking water and skin cancer has been observed and confirmed. Epidemiological studies in areas where drinking water contained 0.35-1.14 mg/l arsenic elevated risks for cancers of the bladder, kidney, skin, liver, lung and colon in both men and women.

Occupational exposure to inorganic arsenic, especially in mining and copper smelting, has consistently been associated with an increased risk of cancer. An almost tenfold increase in the incidence of lung cancer was found in workers most heavily exposed to arsenic and relatively clear dose-response relationships have been obtained with regard to cumulative exposure. Other smelter worker populations have been shown to have consistent increases in lung cancer incidence, as well as increases of about 20% in the incidence of gastrointestinal cancer and of 30% for renal cancer and hematolymphatic malignancies.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air. Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and wash continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Quickly but gently, wipe material off skin with a dry, clean cloth.

Immediately remove all contaminated clothing, including footwear.

Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor.

Ingestion: Contact a Poison Control Center.

If swallowed, and if more than 15 minutes from a hospital, induce vomiting, preferably using Ipecac Syrup APF.

Note: DO NOT INDUCE VOMITING in an unconscious person

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short term repeated exposures to arsenic, soluble compounds:

Treat as per arsenic poisoning.

1. Acute skin lesions such as contact dermatitis usually do not require other treatment than removal from exposure.
2. If more severe symptoms of the respiratory system, the skin or the gastrointestinal tract occur, British Anti-Lewisite (BAL, dimercaprol) may be given. Prompt administration in such cases is vital; to obtain maximum benefit such treatment should be administered within 4 hours of poisoning.
3. In addition, general treatment such as prevention of further absorption from the gastrointestinal tract are mandatory.
4. General supportive therapy such as maintenance of respiration and circulation, maintenance of water and electrolyte balance and control of nervous system effects, as well as elimination of absorbed poison through dialysis and exchange transfusion, may be used if feasible.
5. Dimercaprol is given by deep intramuscular injection as a 5% solution in peanut oil (or a 10% solution with benzyl-benzoate in vegetable oil). It is usually given in a dose of 3 mg/kg, 4-hourly, for the first two days, or twice daily for up to seven days.
6. BAL Therapy is effective for hematological manifestations of chronic arsenic poisoning but not for neurological symptoms. Watch for side effects (e.g. urticaria, burning sensation in the lips, mouth and throat, fever, conjunctivitis etc).
7. Some relief results from administration of diphenhydramine (Benadryl) (1.5 mg/kg intramuscularly or by mouth every 6 hour).

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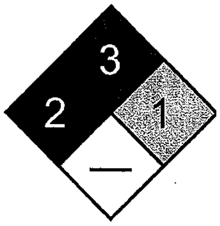
BIOLOGICAL EXPOSURE INDEX - BEI (Notice of Intent to Establish) BEIs represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Inorganic arsenic metabolites in urine	50 ug/g creatinine	End of workweek	B

B: Background levels occur in specimens collected from subjects NOT exposed
Consult specific documentation.

Section 5 - Fire-Fighting Measures

Flash Point: Noncombustible solid
Extinguishing Media: Use fire fighting procedures suitable for surrounding area.
General Fire Hazards/Hazardous Combustion Products: Solid which exhibits difficult combustion or is difficult to ignite.
Avoid generating dust, particularly clouds of dust in a confined or unventilated space. Dust may form an explosive mixture with air, and any source of ignition, i.e. flame or spark, will cause fire or explosion.



Fire Diamond

Dry dust can be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport. Build-up of electrostatic charge may be prevented by bonding and grounding.
Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.
Decomposes on heating and produces toxic fumes of arsenic oxides (AsO_x).
Fire Incompatibility: Avoid contact with acids, oxidizing agents, halogens.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
Wear breathing apparatus plus protective gloves for fire only. Prevent, by any means available, spillage from entering drains or waterways.
Use fire fighting procedures suitable for surrounding area.
Do not approach containers suspected to be hot.
Cool fire exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Wear protective clothing, impervious gloves and safety glasses. Increase ventilation.
Use a vacuum or a wet method to reduce dust during clean-up. DO NOT dry sweep.
Place in suitable containers for disposal.
Wash area down with large quantity of water and prevent runoff into drains.
Large Spills: POLLUTANT -contain spillage. Clear area of personnel and move upwind.
Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
If contamination of drains or waterways occurs, advise emergency services.
Shut off all possible sources of ignition and increase ventilation.
Stop leak if safe to do so.
Contain spill with sand, earth or vermiculite.
Use dry clean up procedures and avoid generating dust.
Collect recoverable product into labeled containers for recycling. Collect residues and seal in labeled drums for disposal.
Wash area down with large quantity of water and prevent runoff into drains.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Use good occupational work practice.
Avoid contact with skin and eyes.
Avoid generating and breathing dust.
Use in a well-ventilated area.
Wear protective clothing when risk of exposure occurs.

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Avoid sources of heat. Avoid contact with incompatible materials. Avoid physical damage to containers.
Keep containers securely sealed when not in use.
When handling, DO NOT eat, drink or smoke.
Wash hands with soap and water after handling.
Work clothes should be laundered separately: NOT at home.

Recommended Storage Methods: Glass container. Plastic drum. Polyethylene or polypropylene container. Steel drum. Metal drum.
Check that containers are clearly labeled.

Storage Requirements: Observe manufacturer's storing and handling recommendations.
Store in a cool, dry place. Store in a well-ventilated area. Store away from sources of heat or ignition/bare lights.
Avoid storage at temperatures higher than 60 °C. Store away from incompatible materials. Store away from foodstuff containers.
Protect containers against physical damage.
Keep containers securely sealed.
Check regularly for spills and leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required.
Use ventilated helmet or air-line hood to provide clean air at the breathing zone.
If risk of overexposure exists, wear NIOSH approved respirator. Correct fit is essential to obtain adequate protection.

Personal Protective Clothing/Equipment

Eyes: Safety glasses. Chemical goggles.
Full face shield.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Impervious, gauntlet length gloves; Rubber gloves. Neoprene gloves.
Rubber boots.

Respiratory Protection:
Exposure Range >0.01 to 0.1 mg/m^3: Air Purifying, Negative Pressure, Half Mask
Exposure Range >0.1 to 1 mg/m^3: Air Purifying, Negative Pressure, Full Face
Exposure Range >1 to <5 mg/m^3: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range 5 to unlimited mg/m^3: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: magenta (P100)

Other: Overalls. PVC apron. PVC protective suit may be required if exposure severe.
Eyewash unit. Ensure there is ready access to a safety shower.
* Preplacement and periodic medical examinations are essential for workers exposed to arsenic. Preplacement physical examinations should give particular attention to allergic and chronic skin lesions, eye disease, psoriasis, chronic eczematous dermatitis, hyperpigmentation of the skin, keratosis and warts, baseline weight, baseline blood and hemoglobin counts, baseline urinary arsenic determinations.
Annual physical examinations should give attention to general health, weight, skin condition, and any evidence of excessive exposure or absorption of arsenic.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Grey, shiny, brittle, metallic-looking rhombohedral crystals. Can be heated to burn in air with a bluish flame, giving off an odor of garlic and dense white fumes of arsenic trioxide. Loses its luster on exposure to air. Converted by nitric acid or hot sulfuric acid into arsenous or arsenic acid.
Brinell hardness: 147
Mohs' scale: 3.5

Physical State: Divided solid
Vapor Pressure (kPa): Not applicable
Vapor Density (Air=1): Not applicable
Formula Weight: 74.92
Specific Gravity (H_2O=1, at 4 °C): 5.73
Water Solubility: Insoluble
Evaporation Rate: Not applicable
pH: Not applicable

pH (1% Solution): Not applicable
Boiling Point Range: Sublimes
Freezing/Melting Point Range: 817 °C (1502.6 °F) at 28 atm
Volatile Component (% Vol): Not applicable

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Contact with acids liberates toxic gases. Presence of heat source and ignition source.
Product is considered stable under normal handling conditions. Hazardous polymerization will not occur.

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Storage Incompatibilities: Segregate from oxidizing agents, halogens.
Contact with acids produces toxic fumes.

Section 11 - Toxicological Information

TOXICITY	IRRITATION
Oral (man) TD_{Lo}: 7857 mg/kg/55 years	Nil reported
Oral (rat) LD_{50}: 763 mg/kg	
Tumorigenic - Carcinogenic by RTECS criteria.	

See NIOSH, *RTECS* CG 0525000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: Food chain concentration potential: Bioaccumulated by fresh water and marine aquatic organisms
BCF: bioaccumulated by aquatic organisms
Biochemical Oxygen Demand (BOD): none

Section 13 - Disposal Considerations

Disposal: Follow all federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: ARSENIC
Hazard Class: 6.1
ID No.: 1558
Packing Group: II
Label: Poison [6]

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed
CERCLA 40 CFR 302.4: Listed per CWA Section 307(a), per CAA Section 112 1 lb (0.454 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2002-02

Benzene
BEN2200

Section 1 - Chemical Product and Company Identification 54

Material Name: Benzene **CAS Number:** 71-43-2
Chemical Formula: C_6H_6
Structural Chemical Formula: C_6H_6
Synonyms: Benzene; BENZENE; (6)ANNULENE; BENZEEN; BENZEN; BENZIN; BENZINE; BENZOL; BENZOL 90; BENZOLE; BENZOLENE; BENZOLO; BICARBURET OF HYDROGEN; CARBON OIL; COAL NAPHTHA; CYCLOHEXATRIENE; EPA PESTICIDE CHEMICAL CODE 008801; FENZEN; MINERAL NAPHTHA; MOTOR BENZOL; NITRATION BENZENE; PHENE; PHENYL HYDRIDE; POLYSTREAM; PYROBENZOL; PYROBENZOLE
General Use: Manufacture of chemicals including styrene, dyes, and many other organic chemicals. Has been used in artificial leather, linoleum, oil cloth, airplane dopes, lacquers; as solvent for waxes, resins, oils etc.
May also be a minor component of gasoline, petrol.
Exposure should be minimized by use in closed systems.
Handling procedures and control measures should be evaluated for exposure before commencement of use in plant operations.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
benzene	71-43-2	99.9

OSHA PEL
TWA: 1 ppm; 3 mg/m^3; STEL: 5 ppm.

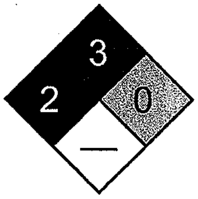
ACGIH TLV
TWA: 0.5 ppm, 1.6 mg/m^3; STEL: 2.5 ppm, 8 mg/m^3; skin.

NIOSH REL
TWA: 0.1 ppm; STEL: 1 ppm.

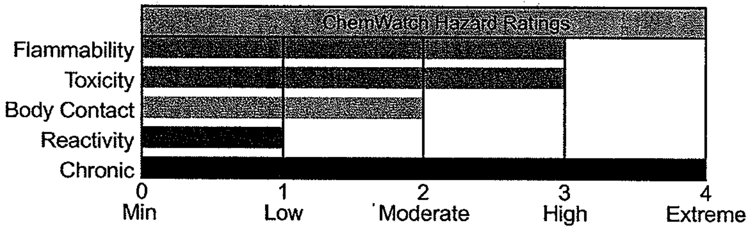
IDLH Level
500 ppm.

DFG (Germany) MAK
Skin

Section 3 - Hazards Identification



Fire Diamond



HMIS
③ Health
③ Flammability
⓪ Reactivity

ANSI Signal Word
Danger!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sweet odor. Irritating to eyes/skin/respiratory tract. Toxic. Also causes: headache, dizziness, drowsiness. Absorbed through the skin. Chronic: dermatitis, leukemia, bone marrow damage. Carcinogen. Reproductive effects. Flammable.

Potential Health Effects

Target Organs: blood, central nervous system (CNS), bone marrow, eyes, upper respiratory system, skin
Primary Entry Routes: inhalation, skin contact
Acute Effects
Inhalation: The vapor is discomforting to the upper respiratory tract and lungs and may be harmful if inhaled.
If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

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Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

Inhalation hazard is increased at higher temperatures.

The symptoms of acute exposure to high vapor concentrations include confusion, dizziness, tightening of the leg muscles and pressure over the forehead followed by a period of excitement. If exposure continues the casualty quickly becomes stupefied and lapses into a coma with narcosis.

Effects of inhalation may include nausea, vomiting headache, dizziness, drowsiness, weakness, sometimes preceded by brief periods of exhilaration, or euphoria, irritability, malaise, confusion, ataxia, staggering, weak and rapid pulse, chest pain and tightness with breathlessness, pallor, cyanosis of the lips and fingertips and tinnitus. Severe exposures may produce blurred vision, shallow, rapid breathing, delirium, cardiac arrhythmias, unconsciousness, deep anesthesia, paralysis and coma characterized by motor restlessness, tremors and hyperreflexia (occasionally preceded by convulsions). Polyneuritis and persistent nausea, anorexia, muscular weakness, headache, drowsiness, insomnia and agitation may also occur. Two-three weeks after the exposure, nervous irritability, breathlessness and unsteady gait may still persist; cardiac distress and an unusual dicoloration of the skin may be evident for up to four weeks.

Hemotoxicity is not normally a feature of acute exposures although anemia, thrombocytopenia, petechial hemorrhage, and spontaneous internal bleeding have been reported. Fatal exposures may result from asphyxia, central nervous system depression, cardiac and respiratory failure and circulatory collapse; sudden ventricular fibrillation may also be fatal.

Death may be sudden or may be delayed for 24 hours. Central nervous system, respiratory or hemorrhagic complications may occur up to five days after the exposure and may be lethal; pathological findings include respiratory inflammation with edema, and lung hemorrhage, renal congestion, cerebral edema and extensive petechial hemorrhage in the brain, pleurae, pericardium, urinary tract, mucous membrane and skin.

Exposure to toxic levels has also produced chromosome damage.

Eye: The liquid is highly discomforting to the eyes, may be harmful following absorption and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is moderately discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid may produce skin discomfort following prolonged contact.

Defatting and/or drying of the skin may lead to dermatitis. Open cuts, abraded or irritated skin should not be exposed to this material.

Toxic effects may result from skin absorption.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: The liquid is discomforting to the gastrointestinal tract and may be harmful if swallowed.

Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Class 1, Known to be a carcinogen; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class A, Human carcinogen; MAK - Class A1, Capable of inducing malignant tumors as shown by experience with humans.

Chronic Effects: Liquid is an irritant and may cause burning and blistering of skin on prolonged exposure.

Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes.

Benzene is a myelotoxicant known to suppress bone-marrow cell proliferation and to induce hematologic disorders in humans and animals.

Signs of benzene-induced aplastic anemia include suppression off leukocytes (leukopenia), red cells (anemia), platelets (thromocytopenia) or all three cell types (pancytopenia). Classic symptoms include weakness, purpura, and hemorrhage. The most significant toxic effect is insidious and often irreversible injury to the blood forming tissue. Leukemia may develop.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

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Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:

1.Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.

2.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.

3.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.

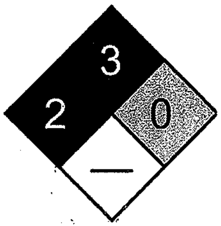
4.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.

5.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.

6.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.
Consider complete blood count. Evaluate history of exposure.

Section 5 - Fire-Fighting Measures

Flash Point: -11 °C Closed Cup
Autoignition Temperature: 562 °C
LEL: 1.3% v/v
UEL: 7.1% v/v



Fire Diamond

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.
Severe fire hazard when exposed to heat, flame and/or oxidizers.
Vapor forms an explosive mixture with air.
Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Pollutant - contain spillage. Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, bare lights or ignition sources. Increase ventilation.

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Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.

Storage Requirements: Store in original containers in approved flame-proof area.
No smoking, bare lights, heat or ignition sources.
DO NOT store in pits, depressions, basements or areas where vapors may be trapped. Keep containers securely sealed.
Store away from incompatible materials in a cool, dry well ventilated area.
Protect containers against physical damage and check regularly for leaks.
Observe manufacturer's storing and handling recommendations.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation usually required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment

Eyes: Chemical goggles. Full face shield.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Nitrile gloves; Neoprene gloves.
Safety footwear.
Do NOT use this product to clean the skin.

Respiratory Protection:
Exposure Range >1 to 10 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range >10 to 100 ppm: Air Purifying, Negative Pressure, Full Face
Exposure Range >100 to 1000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range >1000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Note: must change cartridge at beginning of each shift

Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.

Glove Selection Index:

PE/EVAL/PE	Best selection
PVA	Best selection
TEFLON	Best selection
VITON	Best selection
VITON/NEOPRENE	Best selection
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion

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BUTYL	Poor to dangerous choice for other than short-term immersion
NITRILE	Poor to dangerous choice for other than short-term immersion
NEOPRENE	Poor to dangerous choice for other than short-term immersion
PVC	Poor to dangerous choice for other than short-term immersion
NATURAL RUBBER	Poor to dangerous choice for other than short-term immersion
BUTYL/NEOPRENE	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, highly flammable liquid; floats on water. Characteristic aromatic odor. Highly volatile. Mixes with alcohol, chloroform, ether, carbon disulfide, carbon tetrachloride, glacial acetic acid, acetone and oils.

Physical State: Liquid
Vapor Pressure (kPa): 9.95 at 20 °C
Vapor Density (Air=1): 2.77
Formula Weight: 78.12
Specific Gravity (H_2O=1, at 4 °C): 0.879 at 20 °C
Water Solubility: 0.18 g/100 g of water at 25 °C
Evaporation Rate: Fast
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 80.1 °C (176 °F)
Freezing/Melting Point Range: 5.5 °C (41.9 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

TOXICITY
Oral (man) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 930 mg/kg
Inhalation (rat) LC_{50}: 10000 ppm/7h
Inhalation (human) LC_{Lo}: 2000 ppm/5m
Inhalation (man) TC_{Lo}: 150 ppm/1y - I
Inhalation (human) TC_{Lo}: 100 ppm
Reproductive effector in rats

IRRITATION
Skin (rabbit): 20 mg/24 hr - mod
Eye (rabbit): 2 mg/24 hr - SEVERE

See NIOSH, *RTECS* CY 1400000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be subject to rapid volatilization near the surface and that which does not evaporate will be highly to very highly mobile in the soil and may leach to groundwater. It may be subject to biodegradation based on reported biodegradation of 24% and 47% of the initial 20 ppm in a base-rich para-brownish soil in 1 and 10 weeks, respectively. It may be subject to biodegradation in shallow, aerobic groundwaters, but probably not under anaerobic conditions. If released to water, it will be subject to rapid volatilization; the half-life for evaporation in a wind-wave tank with a moderate wind speed of 7.09 m/sec was 5.23 hours; the estimated half-life for volatilization from a model river one meter deep flowing 1 m/sec with a wind velocity of 3 m/sec is estimated to be 2.7 hours at 20 °C. It will not be expected to significantly adsorb to sediment, bioconcentrate in aquatic organisms or hydrolyze. It may be subject to biodegradation based on a reported biodegradation half-life of 16 days in an aerobic river die-away test. In a marine ecosystem biodegradation occurred in 2 days after an acclimation period of 2 days and 2 weeks in the summer and spring, respectively, whereas no degradation occurred in winter. According to one experiment, it has a half-life of 17 days due to photodegradation which could contribute to removal in situations of cold water, poor nutrients, or other conditions less conductive to microbial degradation. If released to the atmosphere, it will exist predominantly in the vapor phase. Gas-phase will not be subject to direct photolysis but it will react with photochemically produced hydroxyl radicals with a half-life of 13.4 days calculated using an experimental rate constant for the reaction. The reaction time in polluted atmospheres which contain nitrogen oxides or sulfur dioxide is accelerated with the half-life being reported as 4-6 hours. Products of photooxidation include phenol, nitrophenols, nitrobenzene, formic acid, and peroxyacetyl nitrate. It is fairly soluble in water and is removed from the atmosphere in rain.

Ecotoxicity: LC_{50} Clawed toad (3-4 wk after hatching) 190 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Morone saxatilis (bass) 5.8 to 10.9 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Poecilia reticulata (guppy) 63 ppm/14 days /Conditions of bioassay not specified; LC_{50} Salmo trutta (brown trout yearlings) 12 mg/l/1 hr (static bioassay); LD_{50} Lepomis macrochirus (bluegill sunfish) 20 mg/l/24 to 48 hr /Conditions of bioassay not specified; LC_{100} Tetrahymena pyriformis (ciliate) 12.8 mmole/l/24 hr /Conditions of bioassay not specified; LC_{50} Cancer magister (crab larvae) stage 1, 108 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 20 ppm/96 hr /Conditions of bioassay not specified

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Henry's Law Constant: 5.3 x10^{-3}
BCF: eels 3.5
Biochemical Oxygen Demand (BOD): 1.2 lb/lb, 10 days
Octanol/Water Partition Coefficient: log K_{ow} = 2.13
Soil Sorption Partition Coefficient: K_{oc} = woodburn silt loam 31 to 143

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: BENZENE
Hazard Class: 3.1
ID No.: 1114
Packing Group: II
Label: Flammable Liquid[3]

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U019 Toxic Waste, Ignitable Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a), per CAA Section 112 10 lb (4.535 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Issue Date: 2003-02

Cadmium
CAD1500

Section 1 - Chemical Product and Company Identification 53/57

Material Name: Cadmium **CAS Number:** 7440-43-9

Chemical Formula: Cd

EINECS Number: 231-152-8

Synonyms: C I 77180; C.I. 77180; CADMIUM; CADMIUM DUST FUME; CADMIUM POWDER; COLLOIDAL CADMIUM; KADMIUM

Derivation: Cadmium is collected as dust or fume from roasting zinc ores, mixed with coal or coke and sodium or zinc chloride, and sintered. The cadmium fume is collected in an electrostatic precipitator, leached, fractionally precipitated, and distilled; collected as sludge from zinc sulfate purification; prepared from direct distillation of cadmium-bearing zinc; obtained by recovery from electrolytic zinc process; may be prepared from cadmium sulfate in the laboratory.

General Use: Cadmium is used as a constituent of easily fusible alloys; soft solder and solder for aluminum; in electroplating; as a deoxidizer for nickel plating; for process engraving; electrodes for cadmium vapor lamps; photoelectric cells; photometry of ultraviolet sun-rays; in Ni-Cd storage batteries; to charge Jones reductors; as an amalgam in dentistry; power transmission wire; TV phosphors; basis of pigments used in ceramic glazing, machinery enamels, baking enamels; Weston-standard-cell control of atomic fission in nuclear reactors; reactor control rods; fungicide; photography and lithography; selenium rectifiers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Cadmium		ca 99.5+% wt

Trace Impurities: < 10 ppm

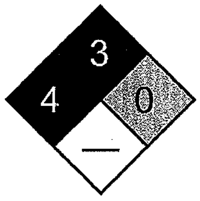
OSHA PEL
TWA: 0.005 mg/m^3; as Cd, see Table Z2.

ACGIH TLV
TWA: 0.01 mg/m^3; measured as inhalable fraction of the aerosol;
TWA: 0.002 mg/m^3; measured as respirable fraction of the aerosol.

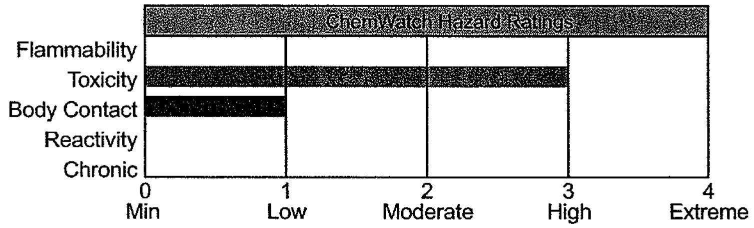
NIOSH REL
Lowest Feasible Concentration.

IDLH Level
9 mg/m^3; as Cd.

Section 3 - Hazards Identification



Fire Diamond



HMIS
③ Health
④ Flammability
⓪ Reactivity

ANSI Signal Word
Danger!


Explosive


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Cadmium is a lustrous metal solid of silver-white to bluish color without odor. It is toxic by inhalation. Cadmium is irritating to the respiratory tract and mildly irritating to the skin. Chronic health effects include kidney damage and obstructive lung disease. Cadmium dust ignites spontaneously in air. It is an experimental carcinogen and teratogen.

Potential Health Effects

Target Organs: Respiratory system, kidneys

Primary Entry Routes: Inhalation and ingestion

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Acute Effects

Inhalation: Initial signs/symptoms of cadmium poisoning resemble those of the flu. Inhalation of dust or fumes causes throat dryness, cough, headache, vomiting, chest pain, dyspnea (shortness of breath), central nervous system (CNS) effects, extreme restlessness and irritability, pneumonitis, possibly bronchopneumonia, pulmonary edema, and death due to respiratory failure in severe cases. Symptoms may be delayed up to 24 hours. Residual emphysema and fibrosis may result. Note: heating of cadmium may produce cadmium oxide, the inhalation of which can result in metal fume fever, characterized by fever, chills, malaise, headache, myalgias, fatigue, cough, thirst, and abdominal discomfort, with symptom onset about 3 to 10 hours after exposure. Symptoms do not usually last beyond 24 to 48 hours.

Eye: May cause irritation.

Skin: Contact may cause irritation, skin eruptions and pruritus. Significant dermal absorption rarely occurs.

Ingestion: Causes increased salivation, dry mouth, choking, nausea, vomiting, abdominal pain and cramping, blurred vision, anemia, kidney dysfunction, diarrhea, gastroenteritis, and substernal pain.

Carcinogenicity: NTP - Class 2A, Reasonably anticipated to be a carcinogen, limited evidence of carcinogenicity from studies in humans; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class B1, Probable human carcinogen based on epidemiologic studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.

Medical Conditions Aggravated by Long-Term Exposure: Kidney disorders, respiratory disorders.

Chronic Effects: Include chronic obstructive lung disease such as emphysema, kidney damage (renal tubular disorder and proteinuria (low molecular weight)), bone demineralization, microfractures and osteomalacia, respiratory cancer, gastrointestinal symptoms, anosmia (loss of sense of smell), rhinitis and discoloration of the teeth. It is implicated as the causative agent in Itai- Itai disease in Japan.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain or irritation persist.

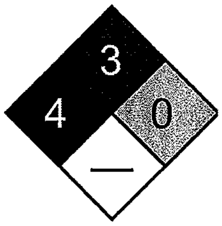
Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Consider a chest X-ray after acute exposure.

Section 5 - Fire-Fighting Measures



Fire Diamond

Flash Point: Data not found.

Autoignition Temperature: 482 °F (250 °C) (layer cadmium metal dust)

LEL: Data not found.

UEL: Data not found.

Flammability Classification: Flammable

Extinguishing Media: Extinguish with carbon dioxide, dolomite, dry powder, graphite, soda ash, sodium chloride, dry chemical, or sand.

General Fire Hazards/Hazardous Combustion Products: When heated to decomposition, toxic fumes of cadmium are emitted. The finely divided material is pyrophoric. The more finely divided the powder the greater the fire/explosion hazard.

Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Cleanup personnel should protect against exposure (Sec. 8). Prevent entry into water, sewers, basements or confined areas.

Small Spills: If in solid form, *do not* sweep! Absorb or cover with dry earth, sand or other noncombustible material. Carefully scoop up or vacuum (with a HEPA filter).

Large Spills: *Do not* release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120). Also 1910.1027 .

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Section 7 - Handling and Storage

Handling Precautions: Wear personal protective clothing and equipment to prevent dust inhalation and any contact with skin or eyes (Sec. 8). Wash thoroughly after handling cadmium.

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.

Recommended Storage Methods: Store in tightly closed containers in a cool, well-ventilated area away from heat, light, ignition sources, incompatibles, and air. Cadmium slowly oxidizes in air to form cadmium oxide.

Storage Requirements: Areas where cadmium is used or stored must be labeled according to 29 CFR 1910.1027.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid dust dispersion into the work area. Provide general or local exhaust ventilation systems to maintain airborne concentrations below exposure limits (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Educate workers about the health and safety hazards associated with this material. Train in work practices which minimize exposure. Consider preplacement and periodic medical exams with emphasis on kidney functions (including urine screening for micro-globulins), lungs and blood. Follow written procedures set forth by OSHA in 29 CFR 1910.1027.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent any skin contact. Butyl rubber, chlorinated polyethylene, and polyvinyl chloride are recommended materials. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not protective eye devices. Appropriate eye protection must be worn instead of, or in conjunction with, contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a NIOSH-approved respirator. Select respirator based on exposure range as follows. Exposure range >0.005 to 0.05 mg/m^3 use air purifying respirator, negative-pressure, half-mask; >0.05 to 0.5 mg/m^3 use air purifying respirator, negative-pressure, full-face; >0.5 to 5 mg/m^3/use supplied-air respirator, constant flow/pressure-demand, full-face; >5 mg/m^3/use a SCBA, pressure-demand, full-face. Use a magenta cartridge (P100). 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, cartridge change schedules, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Silver-white, blue-tinged. Odorless.

Physical State: Solid; lustrous metal or granular powder

Vapor Pressure (kPa): 1 mm Hg at 741 °F (394 °C)

Formula Weight: 112.41

Density: 8.642 at 77 °F (25 °C)

Refractive Index: 1.8 at 578 nm and 20 °C

Boiling Point: 1409 °F (765 °C)

Freezing/Melting Point: 609.8 °F (321 °C)

Ionization Potential (eV): 8.99367 eV

Water Solubility: Insoluble

Other Solubilities: Dissolved by acids; ammonium nitrate solution

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Cadmium is stable at room temperature in closed containers under normal storage and handling conditions. It slowly oxidizes in air to form cadmium oxide. Finely divided material is pyrophoric, i.e., it may ignite or explode spontaneously in air. Hazardous polymerization cannot occur. Avoid creation of dust clouds, contact with chemical incompatibles, heat, and sources of ignition.

Storage Incompatibilities: Include acids (reacts readily with dilute nitric acid, slowly with hydrochloric acid); explodes on contact with hydrazoic acid; violent or explosive reaction when heated with ammonium nitrate; tellurium; zinc; ammonia; sulfur; selenium; nitryl fluoride; oxidizing agents; metals.

Hazardous Decomposition Products: Thermal oxidative decomposition of cadmium can produce toxic fumes of cadmium and cadmium oxide.

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Section 11 - Toxicological Information

Acute Oral Effects:
Rat, oral, LD_{50}: 2330 mg/kg.
Mouse, oral, LD_{50}: 890 mg/kg.

Acute Inhalation Effects:
Rat, inhalation, LC_{50}: 25 mg/m^3/30 minutes produced dyspnea.
Human, inhalation, LC_{Lo}: 39 mg/m^3/20 minutes produced cardiac changes; respiratory depression.

Acute Skin Effects:
Rabbit, subcutaneous, LD_{Lo}: 6 mg/kg produced toxic effects: Effects on newborn - reduced weight gain and behavioral.

Other Effects:

Reproductive Effects: Rat, female, oral, 23 mg/kg administered on gestational days 1 - 22 produced specific developmental abnormalities - blood and lymphatic system (including spleen and marrow).

Rat, female, oral, 21.5 mg/kg administered to multigenerations produced toxic effects: Effects on fertility - preimplantation mortality; Effects on newborn - germ cell effects in offspring.

Rat, male, oral, 155 mg/kg administered 13 weeks prior to mating produced toxic effects: Effects on newborn - reduced weight gain and behavioral.

Mouse, micronucleus test, cell type - embryo: 6 µmol/L induced mutation.

Hamster, cytogenic analysis, cell type - ovary: 1 µmol/L induced mutation.

Tumorigenic Effects - Woman, inhalation, 129 µg/m^3/20 years, continuous produced toxic effects: carcinogenic by RTECS criteria; Lung, thorax or respiration - tumors.

Human, inhalation, TC_{Lo}: 88 µg/m^3/8.6 years produced proteinuria.

Rat, oral, 546 mg/kg administered for 26 weeks continuously produced toxic effects: changes in serum composition; transminases; weight loss or decreased weight gain.

Rat, oral, 1512 mg/kg administered for 48 weeks continuously produced toxic effects: changes to liver, kidneys, ureter and bladder.

Rat, subcutaneous, 3372 µg/kg produced toxic effects: carcinogenic by RTECS criteria, tumors at site of application.

See NIOSH, *RTECS* EU9800000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.

Ecotoxicity: *Dreisena polymorpha*, zebra mussels, chronic LC_{50}: 130 mcg/L; *Rivulus marmoratus*, mangrove fish, LC_{50} in fresh water: 2.96 mg/L; Steelhead trout, LC_{50}: 0.0009 ppm for 96 hours; *Daphnia magna*, 0.1 ppm lethal.

Section 13 - Disposal Considerations

Disposal: 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: Cadmium compounds
Hazard Class: 6.1
ID No.: UN2570
Packing Group: III
Label: Keep away from food

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed
CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 10 lb (4.535 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

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Section 16 - Other Information

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Issue Date: 2002-02

Chromium
CHR4520

Section 1 - Chemical Product and Company Identification

Material Name: Chromium **CAS Number:** 7440-47-3
Chemical Formula: Cr
Structural Chemical Formula: Cr
Synonyms: CHROM; CHROME; CHROMIUM; CHROMIUM METAL
General Use: Used in the manufacture of chrome-steel or chrome-nickel-steel alloys (stainless steel); for greatly increasing resistance and durability of metals; for chrome-plating of other metals.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
chromium	7440-47-3	> 99.5

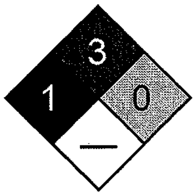
OSHA PEL
TWA: 1 mg/m^3; as Cr insoluble.

NIOSH REL
TWA: 0.5 mg/m^3.

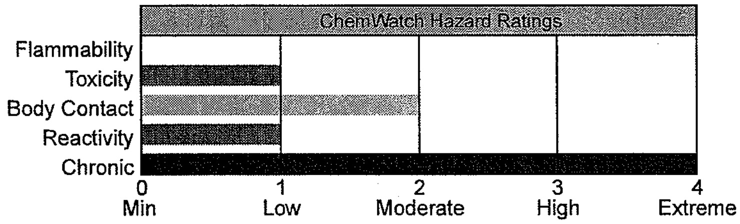
ACGIH TLV
TWA: 0.5 mg/m^3.

IDLH Level
250 mg/m^3; as Cr.

Section 3 - Hazards Identification



Fire Diamond



HMIS
① Health
④ Flammability
⓪ Reactivity

ANSI Signal Word
Warning!

Explosive Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Steel-gray, lustrous metal powder; odorless. Irritating to eyes/skin/respiratory tract. Chronic: exposure to chromium fumes can cause fibrosis of the lungs with decreased function. Flammable. Explosive in air.

Potential Health Effects

Target Organs: respiratory system
Primary Entry Routes: inhalation, skin absorption, ingestion
Acute Effects
Inhalation: The dust may be discomforting to the upper respiratory tract and may be harmful if inhaled.
Chrome fume is irritating to the respiratory tract and lungs.
Toxic effects result from over-exposure.
Asthmatic conditions may result as a consequence of the sensitizing action of chrome VI compounds.
Eye: The dust may produce eye discomfort and abrasive eye inflammation.
Skin: The material may be mildly discomforting to the skin and is capable of causing skin reactions which may lead to dermatitis.
Chrome fume, as the chrome VI oxide, is corrosive to the skin and may aggravate pre-existing skin conditions such as dermatitis and eczema.
As a potential skin sensitizer, the fume may cause dermatoses to appear suddenly and without warning. Absorption of chrome VI compounds through the skin can cause systemic poisoning effecting the kidneys and liver.
Ingestion: The material is moderately discomforting to the gastrointestinal tract and may be harmful if swallowed in large quantity.
Carcinogenicity: NTP - Listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Not listed; MAK - Not listed.

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Chronic Effects: Metallic dusts generated by the industrial process give rise to a number of potential health problems. The larger particles, above 5 micron, are nose and throat irritants. Smaller particles however, may cause lung deterioration. Particles of less than 1.5 micron can be trapped in the lungs and, dependent on the nature of the particle, may give rise to further serious health consequences.

Chromium(III) is considered an essential trace nutrient serving as a component of the "glucose tolerance factor" and a cofactor for insulin action. High concentrations of chromium are also found in RNA. Trivalent chromium is the most common form found in nature.

Chronic inhalation of trivalent chromium compounds produces irritation of the bronchus and lungs, dystrophic changes to the liver and kidney, pulmonary edema, and adverse effects on macrophages. Intratracheal administration of chromium(III) oxide, in rats, increased the incidence of sarcomas, and tumors and reticulum cell sarcomas of the lung. There is inadequate evidence of carcinogenicity of chromium(III) compounds in experimental animals and humans (IARC).

Chronic exposure to hexavalent chromium compounds reportedly produces skin, eye and respiratory tract irritation, yellowing of the eyes and skin, allergic skin and respiratory reactions, diminished sense of smell and taste, blood disorders, liver and kidney damage, digestive disorders and lung damage. There is sufficient evidence of carcinogenicity of chromium(VI) compounds in experimental animals and humans to confirm these as Class 1 carcinogens (IARC).

Exposure to chromium during chrome production and in the chrome pigment industry is associated with cancer of the respiratory tract. A slight increase in gastrointestinal cancer following exposure to chromium compounds has also been reported. The greatest risk is attributed to exposure to acid- soluble, water-insoluble hexavalent chromium which occurs in roasting and refining processes. Animal studies support the idea that the most potent carcinogenic compounds are the slightly soluble hexavalent compounds.

The cells are more active in the uptake of the hexavalent forms compared to trivalent forms and this may explain the difference in occupational effect. It is the trivalent form, however, which is metabolically active and binds with nucleic acid within the cell suggesting that chromium mutagenesis first requires biotransformation of the hexavalent form by reduction.

Hexavalent chromes produce chronic ulceration of skin surfaces (quite independent of other hypersensitivity reactions exhibited by the skin).

Water-soluble chromium(VI) compounds come close to the top of any published "hit list" of contact allergens (eczematogens) producing positive results in 4 to 10% of tested individuals. On the other hand only chromium(III) compounds can bind to high molecular weight carriers such as proteins to form a complete allergen (such as a hapten). Chromium(VI) compounds cannot.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Encourage patient to blow nose to ensure clear breathing passages. Rinse mouth with water. Consider drinking water to remove dust from throat.

Seek medical attention if irritation or discomfort persist.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Long term exposure to high dust concentrations may cause changes in lung function i.e. pneumoconiosis; caused by particles less than 0.5 micron penetrating and remaining in the lung. Prime symptom is breathlessness; lung shadows show on X-ray.

Section 5 - Fire-Fighting Measures

Flash Point: Noncombustible Solid

Autoignition Temperature: 580 °C (cloud)

LEL: Not applicable

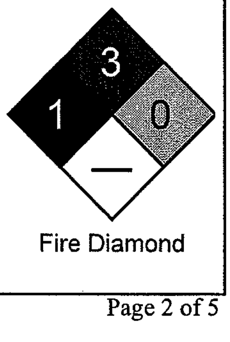
UEL: Not applicable

Extinguishing Media: Sand, dry powder extinguishers or other inerts should be used to smother dust fires.

These are the only suitable means for extinguishing metal dust fires.

Do NOT use water.

General Fire Hazards/Hazardous Combustion Products: Sand, dry powder extinguishers or other inerts should be used to smother dust fires.



Fire Diamond

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These are the only suitable means for extinguishing metal dust fires.
Do NOT use water.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Avoid contact with skin and eyes.
Wear impervious gloves and safety glasses.
Remove all ignition sources.
Use dry clean-up procedures and avoid generating dust.
Vacuum up or sweep up.
Place spilled material in clean, dry, sealable, labeled container.

Large Spills: Clear area of personnel.
Contact fire department and tell them location and nature of hazard.
Control personal contact by using protective equipment.
Prevent, by any means available, spillage from entering drains or water ways.
Moderate hazard.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so.
Avoid generating dust.
Collect recoverable product into labeled containers for recycling.
Collect residues and seal in labeled drums for disposal.
Wash area down with large quantity of water and prevent runoff into drains.
After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Limit all unnecessary personal contact.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. When handling DO NOT eat, drink or smoke.
Always wash hands with soap and water after handling.
Avoid physical damage to containers. Use good occupational work practices.
Observe manufacturer's storing and handling recommendations.

Recommended Storage Methods: Packaging as recommended by manufacturer.
Check that containers are clearly labeled.
Store in metal drums or safety cans.
Plastic container.
Metal can.
Metal drum.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Metal dusts must be collected at the source of generation as they are potentially explosive.

1. Vacuum cleaners, of flame-proof design, should be used to minimize dust accumulation.
2. Metal spraying and blasting should, where possible, be conducted in separate rooms. This minimizes the risk of supplying oxygen, in the form of metal oxides, to potentially reactive finely divided metals such as aluminum, zinc, magnesium or titanium.
3. Work-shops designed for metal spraying should possess smooth walls and a minimum of obstructions, such as ledges, on which dust accumulation is possible.
4. Wet scrubbers are preferable to dry dust collectors.
5. Bag or filter-type collectors should be sited outside the workrooms and be fitted with explosion relief doors.
6. Cyclones should be protected against entry of moisture as reactive metal dusts are capable of spontaneous combustion in humid or partially wetted state.
7. Local exhaust systems must be designed to provide a minimum capture velocity at the fume source, away from the worker, of 0.5 meter/sec.

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Special ventilation requirements apply for processes which result in the generation of barium, chromium, lead, or nickel fume and in those processes which generate ozone.

The use of mechanical ventilation by local exhaust systems is required as a minimum in all circumstances (including outdoor work).

(In confined spaces always check that oxygen has not been depleted by excessive rusting of steel or snowflake corrosion of aluminum). Local exhaust systems must be designed to provide a minimum capture velocity at the fume source, away from the worker, of 0.5 meter/sec.

Personal Protective Clothing/Equipment

Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: PVC gloves; Safety footwear.
Rubber gloves.

Respiratory Protection:
Exposure Range >1 to 10 mg/m^3: Air Purifying, Negative Pressure, Half Mask
Exposure Range >10 to 100 mg/m^3: Air Purifying, Negative Pressure, Full Face
Exposure Range >100 to <250 mg/m^3: Supplied Air, Constant Flow/Pressure Demand, Half Mask
Exposure Range 250 to unlimited mg/m^3: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: dust/mist filter (use P100 or consult supervisor for appropriate dust/mist filter)

Other: Overalls. Eyewash unit.

Section 9 - Physical and Chemical Properties

Appearance/General Info: A hard, brittle, lustrous, steel-grey metal which is very resistant to corrosion. Soluble in dilute sulphuric and hydrochloric acids. Welding flux grades typical sieve analysis (cumulative retention %):- 200 um 0, 150 um 10-40, 100 50-80, 75 um 80-95, 63 um 90-96, 43 um 97-100.

Physical State: Divided solid
Vapor Pressure (kPa): 0.13 at 1616 °C
Vapor Density (Air=1): 1.79
Formula Weight: 52.00
Specific Gravity (H_2O=1, at 4 °C): 7.2
Water Solubility: Insoluble in water
Evaporation Rate: Not applicable

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 2642 °C (4788 °F)
Freezing/Melting Point Range: 1900 °C (3452 °F)
Volatile Component (% Vol): Nil
Decomposition Temperature (°C): Not applicable

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Segregate from strong oxidizers, nitric oxide, potassium chlorate, sulfur dioxide, acids and strong alkalis.

Section 11 - Toxicological Information

No relevant toxicological data found at time of research.

See NIOSH, *RTECS* GB 4200000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: No data found.
BCF: snails 1 x10^6
Biochemical Oxygen Demand (BOD): 62.5 lb/lb, 5 days

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options. Follow applicable federal, state, and local regulations.
Bury residue in an authorized landfill.
Recycle containers if possible, or dispose of in an authorized landfill.

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Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: None
Hazard Class: None
ID No.: None
Packing Group: None
Label: No class label assigned

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed
CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 5000 lb (2268 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2002-02

Ethylbenzene
ETH3050

Section 1 - Chemical Product and Company Identification 54

Material Name: Ethylbenzene **CAS Number:** 100-41-4

Chemical Formula: C_8H_{10}

Structural Chemical Formula: $C_6H_5 \cdot C_2H_5$

Synonyms: AETHYLBENZOL; BENZENE,ETHYL-; EB; ETHYL BENZENE; ETHYLBENZEEN; ETHYLBENZENE; ETHYLBENZOL; ETILBENZENE; ETYLOBENZEN; PHENYLETHANE

General Use: Used in the manufacture of cellulose acetate, styrene and synthetic rubber; solvent or diluent; component of automotive and aviation gasoline.

Component of many petroleum hydrocarbon solvents, thinners.

The use of a quantity of material in an unventilated or confined space may result in increased exposure and an irritating atmosphere developing. Before starting consider control of exposure by mechanical ventilation.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
ethylbenzene	100-41-4	>95

OSHA PEL
TWA: 100 ppm; 435 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 100 ppm; 435 mg/m^3;
STEL: 125 ppm; 545 mg/m^3.

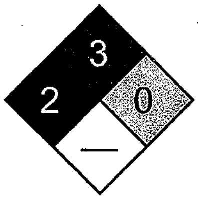
ACGIH TLV
TWA: 100 ppm, 434 mg/m^3;
STEL: 125 ppm, 543 mg/m^3.

NIOSH REL
TWA: 100 ppm, 435 mg/m^3;
STEL: 125 ppm, 545 mg/m^3.

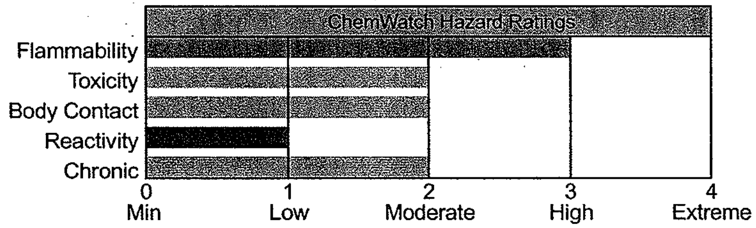
IDLH Level
800 ppm; 10% LEL.

DFG (Germany) MAK
Skin

Section 3 - Hazards Identification



Fire Diamond



HMIS
② Health
③ Flammability
⓪ Reactivity

ANSI Signal Word
Warning!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; pungent odor. Irritating to eyes/skin/respiratory tract. Also causes: chest constriction, vertigo, narcosis, cramps, respiratory paralysis. Chronic: fatigue, sleepiness, headache, blood disorders, lymphocytosis. Flammable.

Potential Health Effects

Target Organs: eyes, respiratory system, skin, central nervous system (CNS), blood

Primary Entry Routes: inhalation, skin contact, eye contact

Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract.

Inhalation hazard is increased at higher temperatures.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

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If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Inhalation of vapor may aggravate a pre-existing respiratory condition such as asthma, bronchitis, emphysema.

When humans were exposed to the 100 and 200 ppm for 8 hours about 45-65% is retained in the body. Only traces of unchanged ethyl benzene are excreted in expired air following termination of inhalation exposure.

Humans exposed to concentrations of 23-85 ppm excreted most of the retained dose in the urine (mainly as metabolites).

Guinea pigs that died from exposure had intense congestion of the lungs and generalized visceral hyperemia. Rats exposed for three days at 8700 mg/m^3 (2000 ppm) showed changes in the levels of dopamine and noradrenaline in various parts of the brain.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Two drops of the material in to the conjunctival sac produced only slight irritation of the conjunctival membrane but no corneal injury.

Skin: The liquid is discomforting to the skin if exposure is prolonged and is capable of causing skin reactions which may lead to dermatitis.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

The mean rate of absorption of liquid ethyl benzene applied to 17.3 cm2 area of the forearm of seven volunteers for 10-15 minutes was determined to be 38 mg/cm2/hr. Immersion of the whole hand in aqueous solutions of ethyl benzene (112-156 mg/l) for 1 hour yielded mean absorption rates of 118 and 215.7 ug/cm2/hr. The rate of absorption is thus greater than that of aniline, benzene, nitrobenzene, carbon disulfide and styrene.

Repeated application of the undiluted product to the abdominal area of rabbits (10-20 applications over 2-4 weeks) resulted in erythema, edema and superficial necrosis. The material did not appear to be absorbed through the skin in sufficient quantity to produce outward signs of toxicity.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid may produce considerable gastrointestinal discomfort and may be harmful or toxic if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Industrial workers exposed to a maximum level of ethyl benzene of 0.06 mg/l (14 ppm) reported headaches and irritability and tired quickly. Functional nervous system disturbances were found in some workers employed for over 7 years whilst other workers had enlarged livers.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Rinse mouth out with plenty of water. DO NOT induce vomiting.

Observe the patient carefully. Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.

Give water (or milk) to rinse out mouth. Then provide liquid slowly and as much as casualty can comfortably drink.

Transport to hospital or doctor without delay.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:

1. Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.

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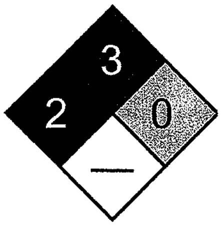
2.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
3.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance
4.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

Section 5 - Fire-Fighting Measures

Flash Point: 12.8 °C Closed Cup
Autoignition Temperature: 432 °C
LEL: 1.6% v/v
UEL: 7% v/v
Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
May emit clouds of acrid smoke.



Fire Diamond

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

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Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area.
General exhaust is adequate under normal operating conditions.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.
Personal Protective Clothing/Equipment
Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Barrier cream with polyethylene gloves or Nitrile gloves.
Protective footwear.
Respiratory Protection:
Exposure Range >100 to <800 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 800 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Other: Overalls. Eyewash unit.
Glove Selection Index:

VITON	Best selection
TEFLON	Best selection

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid; floats on water. Aromatic solvent odor. Soluble in alcohol, benzene, carbon tetrachloride and ether.

Physical State: Liquid
Vapor Pressure (kPa): 1.333 at 25.9 °C
Vapor Density (Air=1): 3.66
Formula Weight: 106.17
Specific Gravity (H_2O=1, at 4 °C): 0.8670 at 20 °C
Water Solubility: 0.01% by weight
Evaporation Rate: Fast
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 136.2 °C (277 °F) at 760 mm Hg
Freezing/Melting Point Range: -95 °C (-139 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid storage with oxidizers.

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Section 11 - Toxicological Information

TOXICITY
Oral (rat) LD_{50}: 3500 mg/kg
Inhalation (human) TC_{Lo}: 100 ppm/8h
Inhalation (rat) LC_{Lo}: 4000 ppm/4h
Intraperitoneal (mouse) LD_{50}: 2642 mg/kg~
Dermal (rabbit) LD_{50}: 17800 mg/kg~
Liver changes, utheral tract, effects on fertility, specific developmental abnormalities (musculoskeletal system) recorded.
NOTE: Substance has been shown to be mutagenic in various assays, or belongs to a family of chemicals producing damage or change to cellular DNA.

IRRITATION
Skin (rabbit): 15 mg/24h mild
Eye (rabbit): 500 mg - SEVERE

See NIOSH, *RTECS* DA 0700000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, it exist predominantly in the vapor phase based on its vapor pressure where it will photochemically degrade by reaction with hydroxyl radicals (half-life 0.5 to 2 days) and partially return to earth in rain. It will not be subject to direct photolysis. Releases into water will decrease in concentration by evaporation and biodegradation. The time for this decrease and the primary loss processes will depend on the season, and the turbulence and microbial populations in the particular body of water. Representative half-lives are several days to 2 weeks. Some may be adsorbed by sediment but significant bioconcentration in fish is not expected to occur based upon its octanol/water partition coefficient. It is only adsorbed moderately by soil. It will not significantly hydrolyze in water or soil.

Ecotoxicity: LC_{50} Cyprinodon variegatus (sheepshead minnow) 275 mg/l 96 hr in a static unmeasured bioassay; LC_{50} Pimephales promelas (fathead minnow) 12.1 mg/l/96 hr (confidence limit 11.5 - 12.7 mg/l), flow-through bioassay with measured concentrations, 26.1 °C, dissolved oxygen 7.0 mg/l, hardness 45.6 mg/l calcium carbonate, alkalinity 43.0 mg/l; Toxicity threshold (cell multiplication inhibition test): Pseudomonas putida (bacteria) 12 mg/l ; LC_{50} Palaemonetes pugio (grass shrimp, adult) 14,400 ug/l/24 hr in a static unmeasured bioassay; LC_{50} Palaemonetes pugio (grass shrimp, larva) 10,200 ug/l/24 hr in a static unmeasured bioassay; Toxicity threshold (cell multiplication inhibition test): Microcystis aeruginosa (algae) 33 mg/l; Scenedesmus quadricauda (green algae) > 160 mg/l

Henry's Law Constant: 8.44×10^{-3}
BCF: goldfish 1.9
Biochemical Oxygen Demand (BOD): theoretical 2.8%, 5 days
Octanol/Water Partition Coefficient: $\log K_{OW} = 3.15$
Soil Sorption Partition Coefficient: $K_{OC} = 164$

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: ETHYLBENZENE
Hazard Class: 3.1
ID No.: 1175
Packing Group: II
Label: Flammable Liquid [3]

Additional Shipping Information: PHENYL ETHANE

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per CWA Section 307(a) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

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Section 16 - Other Information

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Issue Date: 2002-02

Unleaded Petrol
AUT5000

Section 1 - Chemical Product and Company Identification 54

Material Name: Unleaded Petrol **CAS Number:** 8006-61-9
Chemical Formula: Mixture of hydrocarbons
Synonyms: AUTOMOTIVE GASOLINE, LEAD-FREE; GASOLINE; MOTOR FUEL; MOTOR SPIRITS; NATURAL GASOLINE; PETROL; UNLEADED PETROL
General Use: Lead free motor fuel for internal combustion engines, 2-stroke and 4-stroke.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
gasoline	8006-61-9	>90
benzene	71-43-2	5 max.

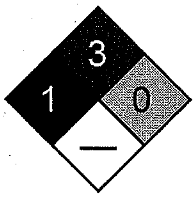
OSHA PEL
No data found.

NIOSH REL
No data found.

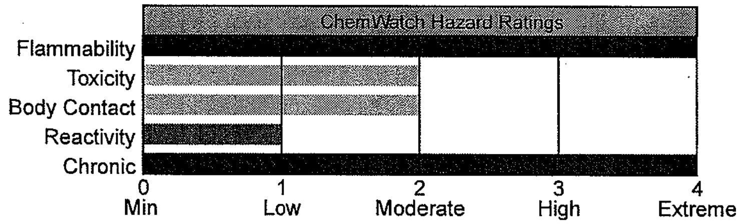
OSHA PEL Vacated 1989 Limits
TWA: 300 ppm; 900 mg/m^3;
STEL: 500 ppm; 1500 mg/m^3.

ACGIH TLV
TWA: 300 ppm, 890 mg/m^3;
STEL: 500 ppm, 1480 mg/m^3.

Section 3 - Hazards Identification



Fire Diamond



HMIS
② Health
③ Flammability
① Reactivity

ANSI Signal Word
Danger!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear liquid; distinctive odor. Irritating to eyes/skin/respiratory tract. Also causes: dizziness, drunkenness, unconsciousness. Absorbed through skin. Chronic: dermatitis. Possible cancer hazard. Flammable. Can form explosive mixtures in air.

Potential Health Effects

Target Organs: skin, eye, respiratory system, central nervous system (CNS)
Primary Entry Routes: inhalation, ingestion, skin contact

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Acute Effects

Inhalation: The vapor is discomforting to the upper respiratory tract and may be harmful if exposure is prolonged. Inhalation hazard is increased at higher temperatures. Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination. If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death. WARNING: Intentional misuse by concentrating/inhaling contents may be lethal. High inhaled concentrations of mixed hydrocarbons may produce narcosis characterized by nausea, vomiting and lightheadedness. Inhalation of aerosols may produce severe pulmonary edema, pneumonitis and pulmonary hemorrhage. Inhalation of petroleum hydrocarbons consisting substantially of low molecular weight species may produce irritation of mucous membranes, incoordination, giddiness, nausea, vertigo, confusion, headache, appetite loss, drowziness, tremors and anesthetic stupor. Massive exposures may produce central nervous system depression with sudden collapse and deep coma; fatalities have been recorded. Irritation of the brain and/or apneic anoxia may produce convulsions. Although recovery following overexposure is generally complete, cerebral micro- hemorrhage of focal post-inflammatory scarring may produce eleptiform seizures some months after the exposure. Pulmonary episodes may include chemical pneumonitis with edema and hemorrhage. The lighter hydrocarbons may produce kidney and neurotoxic effects. Liquid paraffins may produce anesthesia and depressant actions leading to weakness, dizziness, slow and shallow respiration, unconsciousness, convulsions and death. C_{5-7} paraffins may also produce polyneuropathy. Aromatic hydrocarbons accumulate in lipid-rich tissues (typically the brain, spinal cord and peripheral nerves) and may produce functional impairment manifested by nonspecific symptoms such as nausea, weakness, fatigue, vertigo; severe exposures may produce inebriation or unconsciousness. Many of the petroleum hydrocarbons are cardiac sensitizers and may cause ventricular fibrillations.

Eye: The liquid may produce eye discomfort and is capable of causing temporary impairment of vision and/or transient eye inflammation, ulceration. The vapor is discomforting to the eyes. Petroleum hydrocarbons may produce pain after direct contact with the eyes. Slight, but transient, disturbances of the corneal epithelium may also result. The aromatic fraction may produce irritation and lachrymation. The material may produce moderate eye irritation leading to inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The material is moderately discomforting to the skin if exposure is prolonged. The material contains a component that may be absorbed through the skin and may cause drying of the skin, which may lead to dermatitis from repeated exposures over long periods. Toxic effects may result from skin absorption. Open cuts, abraded or irritated skin should not be exposed to this material. The material may accentuate any pre-existing dermatitis condition.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments. The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis. Ingestion of petroleum hydrocarbons may produce irritation of the pharynx, esophagus, stomach and small intestine with edema and mucosal ulceration. Resulting symptoms include a burning sensation in the mouth and throat. Large amounts may produce narcosis with nausea and vomiting, weakness or dizziness, slow and shallow respiration, swelling of the abdomen, unconsciousness and convulsions. Myocardial injury may produce arrhythmias, ventricular fibrillation and electrocardiographic changes. Central nervous system depression may also occur. Light aromatic hydrocarbons produce a warm, sharp, tingling sensation on contact with taste buds and may anesthetize the tongue. Aspiration into the lungs may produce coughing, gagging, and a chemical pneumonitis with pulmonary edema and hemorrhage.

Carcinogenicity: NTP - Not listed; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Not listed; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes. Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following. Chronic poisoning may occur from vapor inhalation or skin absorption. The most significant toxic effect is insidious and irreversible injury to the blood-forming tissue by benzene. Leukemia may develop. Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes. Gasoline "sniffing" has caused severe nerve damage. Repeated or prolonged exposure to mixed hydrocarbons may produce narcosis with dizziness, weakness, irritability, concentration and/or memory loss, tremor in the fingers and tongue, vertigo, olfactory disorders, constriction of visual field, paresthesias of the extremities, weight loss and anemia and degenerative changes in the liver and kidney. Chronic exposure by petroleum workers to the lighter hydrocarbons has been associated with visual disturbances, damage to the central nervous system, peripheral neuropathies (including numbness and paresthesias), psychological and neurophysiological deficits, bone marrow toxicities (including hypoplasia, possibly due to benzene) and hepatic and renal involvement. Chronic dermal exposure to petroleum hydrocarbons may result in defatting which produces localized dermatoses. Surface cracking and erosion may also increase susceptibility to infection by microorganisms.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air. Lay patient down. Keep warm and rested. If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital, or doctor.

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Eye Contact: Immediately hold the eyes open and wash continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids. Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water). Wash affected areas thoroughly with water (and soap if available). Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center. If swallowed, do NOT induce vomiting. Give a glass of water.

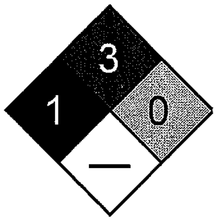
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short term repeated exposures to petroleum distillates or related hydrocarbons:

1. Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.
2. Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases ($pO_2 < 50$ mm Hg or $pCO_2 > 50$ mm Hg) should be intubated.
3. Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
4. A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5. Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6. Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

Section 5 - Fire-Fighting Measures

Flash Point: -43 °C
Autoignition Temperature: 280 °C
LEL: 1.4% v/v
UEL: 7.6% v/v



Fire Diamond

Extinguishing Media: Foam. Dry chemical powder. Bromochlorodifluoromethane (BCF) (where regulations permit). Carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable. Severe fire hazard when exposed to heat, flame and/or oxidizers. Vapor forms an explosive mixture with air. Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition. Heating may cause expansion/decomposition with violent rupture of containers. On combustion, may emit toxic fumes of carbon monoxide (CO).

Fire Incompatibility: Avoid contamination with oxidizing agents, i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc., as ignition may result.

Fire-Fighting Instructions: Alert fire department and tell them location and nature of hazard. May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or water ways. If safe, switch off electrical equipment until vapour fire hazard removed.

Use water delivered as a fine spray to control fire and cool adjacent area. Avoid spraying water onto liquid pools. Do not approach containers suspected to be hot. Cool fire exposed containers with water spray from a protected location. If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately. Avoid breathing vapors and contact with skin and eyes. Control personal contact by using protective equipment. Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Clear area of personnel and move upwind. Alert fire department and tell them location and nature of hazard. May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or water ways. No smoking, naked lights or ignition sources. Increase ventilation. Stop leak if safe to do so.

Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite. Use only spark-free shovels and explosion proof equipment. Collect recoverable product into labeled containers for recycling. Absorb remaining product with sand, earth or vermiculite. Collect solid residues and seal in labelled drums for disposal. Wash area and prevent runoff into drains.

If contamination of drains or waterways occurs, advise emergency services.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

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Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation. Wear protective clothing when risk of exposure occurs. Use in a well-ventilated area. Prevent concentration in hollows and sumps. DO NOT enter confined spaces until atmosphere has been checked. Avoid smoking, bare lights, heat or ignition sources. When handling, DO NOT eat, drink or smoke. Vapor may ignite on pumping or pouring due to static electricity. DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling. Avoid contact with incompatible materials. Keep containers securely sealed. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately. Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.

Recommended Storage Methods: Metal can, metal drum. Packing as recommended by manufacturer. Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area. If inhalation risk of overexposure exists, wear a NIOSH approved organic-vapor respirator. Correct respirator fit is essential to obtain adequate protection. In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus. Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment

Eyes: Safety glasses with side shields; or as required, chemical goggles.

Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Barrier cream with polyethylene gloves or PVC gloves. Safety footwear. Do NOT use this product to clean the skin.

Respiratory Protection:

Exposure Range >300 to 1000 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range >1000 to 15,000 ppm: Air Purifying, Negative Pressure, Full Face
Exposure Range >15,000 to 300,000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range >300,000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black

Other: Overalls. Ensure that there is ready access to eye wash unit. Ensure there is ready access to an emergency shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Purple, highly flammable, volatile liquid with characteristic sharp odor. Floats on water. Consists of a complex mixture of hydrocarbons with small amounts of residual benzene from the refining operations.

Physical State: Liquid
Vapor Pressure (kPa): 53.33 at 20 °C
Vapor Density (Air=1): > 2
Formula Weight: Not applicable.
Specific Gravity (H_2O=1, at 4 °C): 0.72-0.735 at 15 °C
Water Solubility: Insoluble
Evaporation Rate: Fast

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 38.89 °C (102 °F)
Freezing/Melting Point Range: Not available
Volatile Component (% Vol): 100
Decomposition Temperature (°C): Not available.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Presence of incompatible materials. Product is considered stable. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

TOXICITY	IRRITATION
Oral (rat) LD50: 18800 mg/kg	Skin (rabbit): 500 mg/24h mild

Section 12 - Ecological Information

Environmental Fate: No data found.
Ecotoxicity: No data found.
Biochemical Oxygen Demand (BOD): 8%, 5 days

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Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible. Follow all applicable federal, state, and local laws. Incinerate residue at an approved site. Recycle containers where possible, or dispose of in an authorized landfil.

BEWARE: Empty solvent, paint, lacquer and flammable liquid drums present a severe explosion hazard if cut by flame torch or welded. Even when thoroughly cleaned or reconditioned, the drum seams may retain sufficient solvent to generate an explosive atmosphere in the drum.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: MOTOR SPIRIT OR GASOLINE OR PETROL
Hazard Class: 3.1
ID No.: 1203
Packing Group: II
Label: Flammable Liquid[3]

Additional Shipping Information: PETROL

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Not listed
SARA 40 CFR 372.65: Not listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2002-02

Lead
LEA1000

Section 1 - Chemical Product and Company Identification 54

Material Name: Lead **CAS Number:** 7439-92-1
Chemical Formula: Pb
Structural Chemical Formula: Pb
Synonyms: C.I. 77575; C.I. PIGMENT METAL 4; GLOVER; KS-4; LEAD; LEAD FLAKE; LEAD INORGANIC; LEAD METAL; LEAD S2; LEAD SZ; OLOW; OMAHA & GRANT; PB-S 100; PLUMBUM
General Use: Used as a construction material in chemical reaction equipment (tank piping,etc.); manufacture of tetraethyl lead; pigments for paints.
Used in pottery glazes, glass, ceramics, bearing metal and alloys, solder and other lead alloys.
Also used in metallurgy of steel and other metals, cable sheathing, storage batteries, radiation shielding and ammunition.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
lead	7439-92-1	>99

OSHA PEL
TWA: 0.05 mg/m^3; as Pb inorganic.

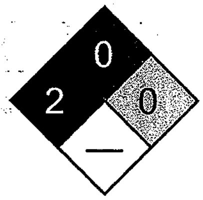
ACGIH TLV
TWA: 0.05 mg/m^3.

NIOSH REL
TWA: 0.05 mg/m^3.

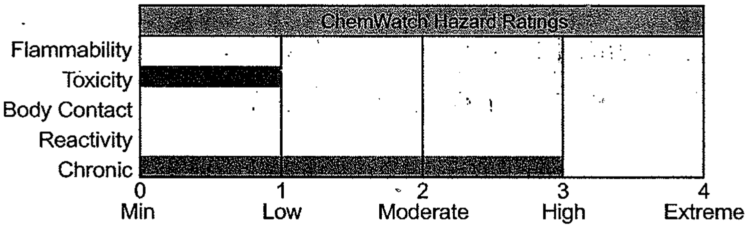
IDLH Level
100 mg/m^3; as Pb.

DFG (Germany) MAK
TWA: 0.1 mg/m^3; measured as inhalable fraction of the aerosol, substances with systemic effects, onset of effect greater than 2 hours, half-life greater than shift length, strongly cumulative.

Section 3 - Hazards Identification



Fire Diamond



HMIS
③ Health
① Flammability
⓪ Reactivity

ANSI Signal Word

Danger!

Poison

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Bluish-white, silvery, or gray metal. Cumulative poison. Repeated low exposures causes: severe neurological effects, blood/kidney damage. Possible cancer hazard. Reproductive damage (sterility, decreased fertility) and developmental damage to fetus.

Potential Health Effects

Target Organs: blood, central nervous system (CNS), peripheral nervous system, kidneys, gastrointestinal (GI) tract
Primary Entry Routes: inhalation, ingestion
Acute Effects
Inhalation: The dust may be discomforting to the upper respiratory tract and may be harmful if inhaled.
Eye: The dust may be discomforting to the eyes.
Skin: The material may be mildly discomforting to the skin.
Prolonged exposure may cause skin reactions.
Skin absorption is not considered a significant route of exposure.
Ingestion: The material is moderately discomforting to the gastrointestinal tract and may be harmful if swallowed.
In rats intestinal lead absorption is bidirectional and does not follow a linear relationship with oral dose.

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Acute effects of exposure are generally minor because of its relative insolubility and physical form. Unusual instances of exposure have been reported in inadequately ventilated indoor firing ranges (as fume), in the application of surma, a mascara-like cosmetic agent, to the conjunctival surfaces in Asian countries and in lead-smelting and associated occupations.

In humans lead metabolism fits into a three compartment model. The first compartment in which lead has a half-life of about 35 days includes the blood; it receives blood from the gut and delivers some of it to the urine and communicates with the other two pools. The second compartment in which lead has a similar half-life includes the soft tissues which contain about half the blood level; they share lead with hair, nails, sweat, saliva, bile and other digestive secretions. The skeleton is the third compartment and contains the vast bulk of the total body burden, possesses a very long half-life and demonstrates a difference between the dense and less dense components to bind lead.

Carcinogenicity: NTP - Not listed; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Not listed.

Chronic Effects: Symptoms of exposure include headache, fatigue, sleep disturbances, abdominal pains and decreased appetite. Overexposure to lead in the form of dust has toxic effects on the lungs and kidneys and on the nervous system resulting in mental disturbances and anemia.

Skin absorption is not considered to be a significant route of exposure.

Worker exposure to lead must be kept to a minimum, especially in cases where lead is worked at temperatures whereby lead vapors are evolved e.g. metal refining.

Lead is an accumulative poison and exposure even to small amounts can raise the body's content to toxic levels.

Potential adverse effects on the offspring of pregnant workers have been cited in the literature.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Rinse mouth out with plenty of water.

Seek medical attention if irritation or discomfort persist.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians:

1.Gastric acids solubilize lead and its salts and lead absorption occurs in the small bowel.

2.Particles of less than 1um diameter are substantially absorbed by the alveoli following inhalation.

3.Lead is distributed to the red blood cells and has a half-life of 35 days.

It is subsequently redistributed to soft tissue & bone-stores or eliminated.The kidney accounts for 75% of daily lead loss; integumentary and alimentary losses account for the remainder.

4.Neurasthenic symptoms are the most common symptoms of intoxication.

Lead toxicity produces a classic motor neuropathy.

Acute encephalopathy appears infrequently in adults.

Diazepam is the best drug for seizures.

5.Whole-blood lead is the best measure of recent exposure; free erythrocyte protoporphyrin (FEP) provides the best screening for chronic exposure. Obvious clinical symptoms occur in adults when whole-blood lead exceeds 80 ug/dL.

6.British Anti-Lewisite is an effective antidote and enhances fecal and urinary excretion of lead. The onset of action of BAL is about 30 minutes and most of the chelated metal complex is excreted in 4-6 hours, primarily in the bile.

Adverse reaction appears in up to 50% of patients given BAL in doses exceeding 5 mg/kg. CaNa2EDTA has also been used alone or in concert with BAL as an antidote.

D-penacillamine is the usual oral agent for mobilization of bone lead; its use in the treatment of lead poisoning remains investigational.

2-3-dimercapto-1-propanesulfonic acid (DMPS) and dimercaptosuccinic acid (DMSA) are water soluble analogues of BAL and their effectiveness is undergoing review.

As a rule, stop BAL if lead decreases below 50 ug/dL; stop CaNa2EDTA if blood lead decreases below 40 ug/dL or urinary lead drops below 2 mg/24 hrs.

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker who has been exposed at the Exposure Standard (ES or TLV):

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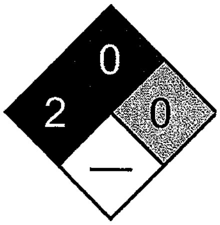
Determinant	Index	Sampling Time	Comments
Lead in blood	50 ug/100 mL	Not Critical	B
Lead in urine	150 ug/gm creatinine	Not critical	B
Zinc Protoporphyrin in blood	250 ug/100 mL erythrocytes OR 100 ug/100 mL blood	After 1 month exposure	B

B: Background levels occur in specimens collected from subjects NOT exposed.

Section 5 - Fire-Fighting Measures

Flash Point: Not available; probably noncombustible
Autoignition Temperature: Not applicable
LEL: Not applicable
UEL: Not applicable
Extinguishing Media: There is no restriction on the type of extinguisher which may be used.
General Fire Hazards/Hazardous Combustion Products: Noncombustible.
Not considered to be a significant fire risk; however, containers may burn.
Moderate fire hazard, in the form of dust, when exposed to heat or flames.
Decomposition products may include toxic lead dust and lead oxide fumes.



Fire Diamond

Fire Incompatibility: Incompatible with strong acids, oxidants, ammonium nitrate, chlorine trifluoride and sodium azide.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
Use fire fighting procedures suitable for surrounding area.
Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.
If safe to do so, remove containers from path of fire.
Cool fire-exposed containers with water spray from a protected location.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Clean up all spills immediately. Avoid contact with skin and eyes.
Wear protective clothing, gloves, safety glasses and dust respirator.
Use dry clean-up procedures and avoid generating dust.
Vacuum up.
Place spilled material in clean, dry, sealable, labeled container.
Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
Control personal contact by using protective equipment and dust respirator.
Prevent spillage from entering drains, sewers or waterways.
Recover product wherever possible. Avoid generating dust. Sweep / shovel up.
If required, wet with water to prevent dusting.
Put residues in labeled plastic bags or other containers for disposal.
Wash area down with large quantity of water and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Limit all unnecessary personal contact.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling.
Work clothes should be laundered separately.

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Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Recommended Storage Methods: Check that containers are clearly labeled.
Packaging as recommended by manufacturer.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: General exhaust is adequate under normal operating conditions.
If risk of overexposure exists, wear NIOSH-approved dust respirator.
Correct fit is essential to obtain adequate protection.

Personal Protective Clothing/Equipment

Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Impervious gloves; rubber gloves.
Rubber boots.
Protective footwear.

Respiratory Protection:
Exposure Range >0.05 to 0.5 mg/m^3: Air Purifying, Negative Pressure, Half Mask
Exposure Range >0.5 to 2.5 mg/m^3: Air Purifying, Negative Pressure, Full Face
Exposure Range >2.5 to 50 mg/m^3: Powered Air Purifying Respirator, Half or Full Facepiece or Hood
Exposure Range >50 to 100 mg/m^3: Supplied Air Respirator with Full Facepiece, Hood, Helmet, or Suit, operated in a Positive Pressure Mode
Exposure Range >100 to unlimited mg/m^3: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: magenta (P100)
Note: (29CFR 1910.1025) for general industry

Other: Overalls. Eyewash unit. Skin cleansing cream.
Provide adequate ventilation in warehouse or closed storage areas.
General and local exhaust ventilation usually required to maintain airborne dust levels to safety levels.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Bluish-white, silvery-gray metal. Malleable, lustrous when freshly cut and tarnishes when exposed to air. Reacts with strong acids like nitric acid, sulphuric or hydrochloric acid. Attacked by water in presence of oxygen. Poor electrical conductor. Lead fumes are formed at temperatures above 500-700 °C.

Physical State: Divided solid
Vapor Pressure (kPa): 0.24 at 1000 °C
Vapor Density (Air=1): Not applicable
Formula Weight: 207.19
Specific Gravity (H_2O=1, at 4 °C): 11.34
Water Solubility: Insoluble in water
Evaporation Rate: Not applicable

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 1740 °C (3164 °F)
Freezing/Melting Point Range: 327.4 °C (621.32 °F)
Volatile Component (% Vol): Not applicable

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Hazardous polymerization will not occur. Stable under normal storage conditions.

Storage Incompatibilities: Avoid storage with strong acids, oxidants, ammonium nitrate, chlorine trifluoride and sodium azide.

Section 11 - Toxicological Information

TOXICITY	IRRITATION
Oral (woman) TD_{Lo}: 450 mg/kg/6 years	Nil Reported
Inhalation (human) TC_{Lo}: 0.01 mg/m^3	

WARNING: Lead is a cumulative poison and has the potential to cause abortion and intellectual impairment to unborn children of pregnant workers.

See NIOSH, *RTECS* OF 7525000, for additional data.

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Section 12 - Ecological Information

Environmental Fate: If released or deposited on soil, it will be retained in the upper 2-5 cm of soil, especially soils with at least 5% organic matter or a pH 5 or above. Leaching is not important under normal conditions although there is some evidence to suggest that it is taken up by some plants. Generally, the uptake from soil into plants is not significant. It is expected to slowly undergo speciation to the more insoluble sulfate, sulfide, oxide, and phosphate salts. It enters water from atmospheric fallout, runoff or wastewater; little is transferred from natural ores. It is a stable metal and adherent films of protective insoluble salts form that protect the metal from further corrosion. That which dissolves tends to form ligands. It is effectively removed from the water column to the sediment by adsorption to organic matter and clay minerals, precipitation as insoluble salt (the carbonate or sulfate, sulfide), and reaction with hydrous iron and manganese oxide. Under most circumstances, adsorption predominates. It does not appear to bioconcentrate significantly in fish but does in some shellfish such as mussels. When released to the atmosphere, it will generally be in dust or adsorbed to particulate matter and subject to gravitational settling and be transformed to the oxide and carbonate.

Ecotoxicity: LC_{50} Japanese quail (Coturnix japonica), males or females, 14 days old, oral (5-day ad libitum in diet) >5,000 ppm; at 1000, 2236 & 5000 onset of toxic signs began at 7, 7 & 7 days and remissed at 11, 11 & 12 days, respectively, no mortality was observed; control references were dieldrin & dicrotophos; corn oil diluent was added to diet at ratio of 2:98 by wt; (extreme concentrations: 1,000-5,000 ppm)

BCF: freshwater fish 1.38 to 1.65

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: NONE
Hazard Class: None
ID No.: None
Packing Group: None
Label: No class label assigned

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed
CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 10 lb (4.535 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2003-02

Naphthalene
NAP1620

Section 1 - Chemical Product and Company Identification 50/57

Material Name: Naphthalene **CAS Number:** 91-20-3
Chemical Formula: $C_{10}H_8$
EINECS Number: 202-049-5
Synonyms: ALBOCARBON; CAMPHOR TAR; DEZODORATOR; FAULDING NAPHTHALENE FLAKES; MIGHTY 150; MIGHTY RD1; MOTH BALLS; MOTH FLAKES; MOTHBALLS; NAFTALEN; NAPHTHALENE; NAPHTHALIN; NAPHTHALINE; NAPHTHENE; TAR CAMPHOR; WHITE TAR
Derivation: From coal tar; from petroleum fractions after various catalytic processing operations.
General Use: Used as a moth repellent, an antiseptic, toilet bowl deodorant, heat transfer agent, fungicide, smokeless powder, cutting fluid, lubricant, wood preservative; an intermediate for naphthol, phthalic anhydride, chlorinated naphthalenes, Tertralin, Decalin, naphthyl and naphthol derivatives, and dyes; in synthetic resins, synthetic tanning, textile chemicals, scintillation counters, and emulsion breakers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Naphthalene	91-20-3	ca 100% wt.

Grade - By melting point, 165 °F (74 °C) min (crude) to greater than 174 °F (79 °C) (refined); scintillation 176-177 °F (80-81 °C)

OSHA PEL
TWA: 10 ppm; 50 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 10 ppm; 50 mg/m^3; STEL: 15 ppm; 75 mg/m^3.

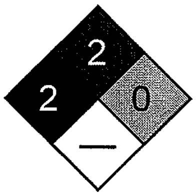
ACGIH TLV
TWA: 10 ppm, 52 mg/m^3; STEL: 15 ppm, 79 mg/m^3; skin.

NIOSH REL
TWA: 10 ppm, 50 mg/m^3; STEL: 15 ppm, 75 mg/m^3.

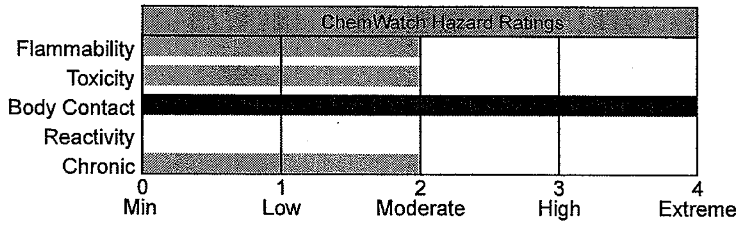
IDLH Level
250 ppm.

DFG (Germany) MAK
Skin

Section 3 - Hazards Identification



Fire Diamond



HMIS
② Health
② Flammability
⓪ Reactivity

ANSI Signal Word
Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Naphthalene is a white crystalline solid with a 'moth ball' or coal-tar odor. It is toxic by ingestion. Irritating to skin, eyes, and respiratory system. Naphthalene is a combustible solid. Dust may form explosive mixtures in air if subjected to an ignition source.

Potential Health Effects

Target Organs: Blood (red blood cell effects), eyes, skin, central nervous system (CNS), liver and kidneys
Primary Entry Routes: Inhalation, skin absorption, skin and/or eye contact
Acute Effects
Inhalation: Vapor inhalation causes headache, confusion, nausea, sometimes vomiting, loss of appetite, extensive sweating, dysuria (painful urination), hematuria (blood in the urine), and hemolysis (destruction of red blood cells).
Eye: Irritation, conjunctivitis, and corneal injury upon prolonged contact.
Skin: Irritation and hypersensitivity dermatitis.

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Ingestion: Unlikely. However, ingestion causes irritation of the mouth and stomach, hemolytic anemia with hepatic and renal lesions and vesical congestion, kidney failure, hematuria, jaundice, depression of CNS, nausea, vomiting, abdominal pain, blue face, lips, or hands, rapid and difficult breathing, headache, confusion, excitement, malaise, fever, perspiration, urinary tract pain, dizziness, convulsions, coma, and death. Symptoms may appear 2 to 4 hours after exposure.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Diseases of the blood, liver and kidneys; individuals with a hereditary deficiency of the enzyme glucose-6-phosphate dehydrogenase in red blood cells are particularly susceptible to the hemolytic properties of naphthalene metabolites.

Chronic Effects: May cause optical neuritis, corneal injuries, cataracts, kidney damage. There are two reports of naphthalene crossing the placenta in humans.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed. Contact a physician immediately if symptoms of systemic poisoning are present.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist if pain, irritation, swelling, or photophobia persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area thoroughly with soap and water. For reddened or blistered skin, consult a physician. Contact a physician immediately if symptoms of systemic poisoning are present.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting. Contact a physician immediately.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Obtain baseline CBC, electrolytes, liver and renal function rests, glucose-6-phosphatase dehydrogenase level, urinalysis, and benzidine dipstick to check for hemoglobinuria. Urinary metabolite, 1-naphthol or mercapturic acid, may help confirm the diagnosis.

Section 5 - Fire-Fighting Measures

Flash Point: 174 °F (79 °C) OC; 190 °F (88 °C) CC

Autoignition Temperature: 979 °F (526 °C)

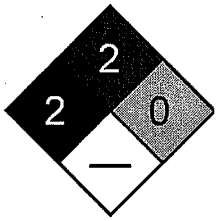
LEL: 0.9% v/v

UEL: 5.9% v/v

Flammability Classification: Combustible solid

Extinguishing Media: Use dry chemical, foam, carbon dioxide (CO_2), or water spray. Water or foam may cause frothing. Use water spray to keep fire-exposed containers cool.

General Fire Hazards/Hazardous Combustion Products: Toxic vapors including carbon monoxide. Volatile solid that gives off flammable vapors when heated. Dust may explode in air if an ignition source is provided.



Fire Diamond

Fire-Fighting Instructions: Move containers from the fire area if it can be done without risk. Otherwise cool fire-exposed containers until well after the fire is extinguished. *Do not* release runoff from fire control methods to sewers or waterways. 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. Wear full protective clothing (see Sec. 8). Structural clothing is permeable, remain clear of smoke, water fall out, and water run off.

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Stop leak if you can do it without risk. Use spark-proof tools and explosion proof equipment. Cleanup personnel should wear personal protective equipment to protect against exposure (see Sec. 8).

Small Spills: *Do not* sweep! Carefully scoop up or vacuum (with a HEPA filter). Absorb liquid spill with an inert, noncombustible absorbent such as sand or vermiculite.

Large Spills: For large spills, dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

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Section 7 - Handling and Storage

Handling Precautions: To avoid vapor inhalation use only with ventilation sufficient to reduce airborne concentrations to nonhazardous levels. Avoid skin and eye contact. Wear personal protective clothing and equipment to prevent any contact with skin and eyes (see Sec. 8). Practice good personal hygiene procedures to prevent inadvertently ingesting this material.

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.

Recommended Storage Methods: Store in tightly closed, explosion-proof containers in a cool, well-ventilated area away from heat, ignition sources, and incompatibles (see Sec. 10). May be stored under nitrogen gas. Protect containers against physical damage. Use monitoring equipment to measure the extent of vapor present in any storage facility containing naphthalene because of potential fire and explosion hazards.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid vapor and dust dispersion into the work area. Ventilate at the site of chemical release. During the fractional distillation of naphthalene and in any operation entailing the heating or volatilization of naphthalene, enclosed apparatus should be employed. 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.

Administrative Controls: Educate workers about the health and safety hazards associated with naphthalene. Train in work practices which minimize exposure. Consider preplacement and periodic medical exams with emphasis on the eyes, skin, liver, kidneys, CBC (RBC count, WBC count, differential count of a stained smear, hemoglobin, and hematocrit), and urinalysis including at a minimum specific gravity, albumin, glucose, and a microscopic examination on centrifuged sediment.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Teflon is recommended. *Do not* use butyl rubber, natural rubber, neoprene or polyvinyl chloride. Wear chemical dust-proof safety goggles and face shield, 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.

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. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove naphthalene from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: White volatile flakes, cakes, cubes, spheres, or powder; strong coal-tar or moth ball odor.

Physical State: Crystalline solid

Odor Threshold: 0.084 ppm to 0.3 ppm

Vapor Pressure (kPa): 0.05 mm Hg at 68 °F (20 °C); 1.0 mm Hg at 127 °F (53 °C)

Formula Weight: 128.2

Density: 1.145 g/cm^3 at 68 °F (20 °C)

Boiling Point: 424 °F (218 °C)

Freezing/Melting Point: 176 °F (80.2 °C)

Water Solubility: Insoluble [31.7 mg/L at 68 °F (20 °C)]

Other Solubilities: Benzene, absolute alcohol; very soluble in ether, chloroform, carbon disulfide, hydronaphthalenes, fixed and volatile oils

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Naphthalene is stable at room temperature in closed containers under normal storage and handling conditions. It volatilizes at room temperature. Hazardous polymerization cannot occur. Exposure to heat and ignition sources, incompatibles.

Storage Incompatibilities: Include aluminum chloride, benzoyl chloride, chromic acid, chromium trioxide, oxidizers. Explosive reaction with dinitrogen pentaoxide. Melted naphthalene will attack some forms of plastics.

Hazardous Decomposition Products: Thermal oxidative decomposition of naphthalene can produce toxic fumes including carbon monoxide.

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Section 11 - Toxicological Information

Acute Oral Effects:\
Rat, oral, LD_{50}: 490 mg/kg.\
Mouse, oral, LD_{50}: 533 mg/kg.\
Human (child), oral, LD_{Lo}: 100 mg/kg.\
Acute Inhalation Effects:\
Rat, inhalation, LC_{50}: >340 mg/m^3 produced lacrimation and somnolence.\
Irritation Effects:\
Rabbit, eye, standard Draize test: 100 mg produced mild irritation.\
Rabbit, skin, open Draize test: 495 mg produced mild irritation.\
Other Effects:\
Rat, oral: 4500 mg/kg administered on gestational days 6-15 produced fetotoxicity and other developmental abnormalities. \
Man, unreported, LD_{Lo}: 74 mg/kg.\
Mouse, inhalation: 30 ppm/6 hr/2 yr administered intermittently produced toxic effects: tumorigenic - neoplastic by RTECS criteria; lungs, thorax, or respiration - tumors.\
Hamster, ovary: 15 mg/L induced sister chromatid exchange.

See NIOSH, *RTECS* QJ0525000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, naphthalene rapidly photodegrades with a half-life of 3-8 hr. Volatilization, photolysis, adsorption, and biodegradation are important loss mechanisms for naphthalene discharged into water. Depending on local conditions, the half-lives range from a couple of days to a few months. If released on land, it is adsorbed moderately to soil, undergoes biodegradation; but in some cases biodegradation may still occur if conditions are aerobic. Bioconcentration occurs to a moderate extent, but is a temporary problem since depuration and metabolism readily proceed in aquatic organisms.

Ecotoxicity: *Oncorhynchus gorbuscha* (pink salmon): 1.37 ppm/96 hr at 39 °F (4 °C). *Pimephales promelas* (fathead minnow): 7.76 mg/L/24 hr.

Octanol/Water Partition Coefficient: log $K_{OW} = 3.30$

Section 13 - Disposal Considerations

Disposal: Consider rotary kiln or fluidized bed incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations. Handle empty containers carefully as hazardous residues may still remain.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Naphthalene, crude or
Naphthalene, refined
Hazard Class: 4.1
ID No.: UN1334
Packing Group: III
Label: FLAMMABLE SOLID

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U165 Toxic Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Issue Date: 2002-02

Phenol
PHE3200

Section 1 - Chemical Product and Company Identification 54

Material Name: Phenol **CAS Number:** 108-95-2
Chemical Formula: C_6H_6O
Structural Chemical Formula: C_6H_5OH
Synonyms: ACIDE CARBOLIQUE; BAKER'S P AND S LIQUID AND OINTMENT; BENZENOL; CARBOLIC ACID; CARBOLSAURE; FENOL; FENOLO; HYDROXYBENZENE; IZAL; MONOHYDROXYBENZENE; MONOPHENOL; OXYBENZENE; PHENIC ACID; PHENOL; PHENOL ALCOHOL; PHENOLE; PHENOL,MOLTEN; PHENYL ALCOHOL; PHENYL HYDRATE; PHENYL HYDROXIDE; PHENYLIC ACID; PHENYLIC ALCOHOL
General Use: Used as a general disinfectant, either in solution or mixed with slaked lime, etc., for toilets, stables, cesspools, floors, drains, etc.; for the manufacture of colorless or light-colored artificial resins.
Also used in many medicinal and industrial compounds and dyes; as a reagent in chemical analysis.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
phenol	108-95-2	>99

OSHA PEL
TWA: 5 ppm; 19 mg/m³; skin.

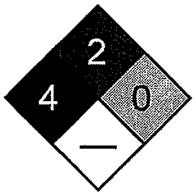
ACGIH TLV
TWA: 5 ppm, 19 mg/m³; skin.

NIOSH REL
TWA: 5 ppm, 19 mg/m³; Ceiling: 15.6 ppm; 60 mg/m³; 15-minute, skin.

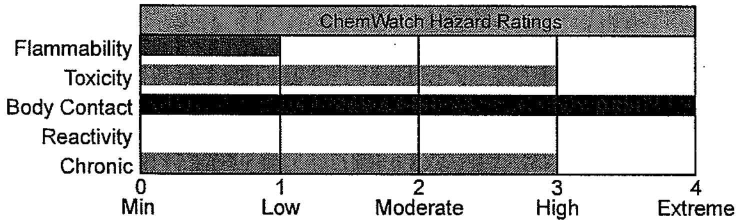
IDLH Level
250 ppm.

DFG (Germany) MAK
Skin

Section 3 - Hazards Identification



Fire Diamond



HMIS
③ Health
② Flammability
⓪ Reactivity

ANSI Signal Word
Danger!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

White, crystalline solid; medicinal odor. Poison! Corrosive, causes severe burns to the eyes (blindness)/skin/respiratory tract. Also causes: severe neurological effects (shock and coma), liver and kidney damage. Absorbed through the skin. Combustible.

Potential Health Effects

Target Organs: liver, kidneys, nervous system, skin
Primary Entry Routes: skin absorption, eye contact, ingestion, inhalation
Acute Effects
Inhalation: The vapor is extremely discomforting to the upper respiratory tract, may cause severe mucous membrane damage and may be harmful if inhaled.
Pulmonary absorption may lead to systemic toxicity affecting the cardiovascular and central nervous system.
Inhalation of phenol and some of its derivatives may produce profuse perspiration, intense thirst, nausea, vomiting, diarrhea, cyanosis, hyperactivity, stupor, falling blood pressure, hypernea, abdominal pain, hemolysis, convulsions, coma and pulmonary edema with pneumonia. Respiratory failure and kidney damage may follow.
Inhalation of the vapor causes a sore throat, coughing, shortness of breath and labored breathing.

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Systemic effects include paleness, weakness, headache, sweating, ringing of the ears, shock, cyanosis, excitement, dark colored urine, frothing of the nose and mouth.

Pulmonary inflammation and pneumonia, inflammation and necrosis of the myocardium, hepatic centro-lobular necrosis, renal proximal tube swelling and edema and globular degeneration and hind-limb paralysis was observed in guinea-pigs exposed 29 times for 7 hours/day, five days/week to concentrations ranging from 26 to 52 ppm.

Eye: The material is highly corrosive to the eyes and is capable of causing severe burns and capable of causing severe damage with loss of sight.

The vapor from heated material is highly discomforting to the eyes.

The vapor when concentrated has pronounced eye irritation; this gives some warning of high vapor concentrations. If eye irritation occurs seek to reduce exposure with available control measures, or evacuate area.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Some phenol derivatives may produce mild to severe eye irritation with redness, pain and blurred vision. Permanent eye injury may occur; recovery may also be complete or partial.

Skin: The solid/dust is corrosive to the skin, may cause blisters or burns or severe burns and is it is rapidly absorbed by the skin.

Toxic effects may result from skin absorption.

Phenol and some of its derivatives may produce mild to severe skin irritation on repeated or prolonged contact, producing second and third degree chemical burns. Rapid cutaneous absorption may lead to systemic toxicity affecting the cardiovascular and central nervous system.

Absorption through the skin may result in profuse perspiration, intense thirst, nausea, vomiting, diarrhea, cyanosis (following the formation of methemoglobin), hyperactivity, stupor, falling blood pressure, hypernea, abdominal pain, hemolysis, convulsions, coma and pulmonary edema followed by pneumonia. Respiratory failure and kidney damage may follow.

The material may produce severe skin irritation after prolonged or repeated exposure, and may produce a contact dermatitis (nonallergic).

This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis.

Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Prolonged contact is unlikely, given the severity of response, but repeated exposures may produce severe ulceration.

Contact with the skin causes a white, wrinkled discoloration followed by a severe burn or systemic poisoning if not promptly and properly removed.

Intense burning and pain from skin contact may be delayed. Extreme dangers are posed by percutaneous absorption.

In one case a 32 year old male who spilled a solution of phenol over his scalp, face, neck, shoulders and back, died 10 minutes later.

There was coagulation necrosis of the skin, left eye and acute dermatitis veneta with acute passive congestion of the lungs, liver, spleen, kidneys.

Skin absorption occurs at low vapor pressure, without apparent discomfort and proceeds with the same efficiency as absorption by inhalation.

Damage to the lungs has been described following percutaneous absorption.

Methemoglobinemia and hemolytic anemia are frequently documented.

Ingestion: The material is corrosive to the gastrointestinal tract, may cause severe mucous membrane damage and may be fatal if swallowed.

Ingestion may result in nausea, abdominal irritation, pain and diarrhea.

Ingestion of phenol causes blotches on the lips and in the mouth.

Some phenol derivatives may produce mild to severe damage within the gastrointestinal tract. Phenolic groups with ortho and para positions free from substitution are reactive; this is because the ortho and para positions on the aromatic ring are highly activated by the phenolic hydroxyl group and are therefore readily substituted.

Severe phenol ingestions cause hypotension, coma, ventricular dysrhythmias, seizures and white coagulative chemical burns.

Absorption may result in profuse perspiration, intense thirst, nausea, vomiting, diarrhea, cyanosis (following the formation of methemoglobin), hyperactivity, stupor, falling blood pressure, hypernea, abdominal pain, hemolysis, convulsions, coma and pulmonary edema followed by pneumonia.

Respiratory failure and kidney damage may follow. Phenol does not uncouple oxidative phosphorylation like dinitrophenol and pentachlorophenol and thus does not cause a heat exhaustion-like syndrome.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Prolonged exposure to some derivatives of phenol may produce dermatitis, anorexia, weight loss, weakness, muscle aches and pain, liver damage, dark urine, ochronosis, skin eruptions, diarrhea, nervous disorders with headache, salivation, fainting, increased skin and scleral pigmentation, vertigo and mental disorders. Liver and kidney damage may also ensue. Chronic phenol toxicity was first noted in medical personnel in the late 1800s when 5 and 10% phenol was used as a skin disinfectant. The term carbolic (phenol) marasmus was given to this syndrome.

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Chronic phenol poisoning is very rarely reported, but symptoms include vomiting, difficulty in swallowing, diarrhea, lack of appetite, headache, fainting, dizziness, dark urine, mental disturbances, and possibly skin rash. Death due to liver and kidney damage may occur.

Repeated exposure of animals to phenol vapor at concentrations ranging from 26 to 52 ppm has produced respiratory, cardiovascular, hepatic, renal and neurologic toxicity.

Administration of phenol in the drinking water of mice (2500 ppm for 103 weeks) produced an increased incidence of leukemia and lymphomas.

Phenol has been studied in initiation/promotion protocols with a number of polycyclic hydrocarbons and has been shown to have promoting activity in the two-stage skin model.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: If spilled on skin remove contaminated clothing, swab repeatedly with glycerin, PEG (polyethylene glycol), or PEG/ methylated spirit mixture or if necessary with methylated spirit alone.

Contamination of skin with phenol and some of its derivatives may produce rapid collapse and death. After skin contamination, keep patient under observation for at least 24-48 hours. Phenol-decontaminating fluid is more effective than water in removing phenol from the skin and retarding absorption; olive oil or vegetable oil may also be used; do not use mineral oil. Alcohols (methylated spirit, for example) may enhance absorption and their use alone may be ill-advised; some authorities, however, continue to advise the use of such treatment. Rapid water dilution of phenol burns may increase systemic absorption by decreasing the extent of the coagulum and thus allowing greater absorption.

Transport to hospital (or doctor).

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: * Provide preplacement and annual medical examinations for employees exposed to phenol. Persons with a history of convulsive disorders or abnormalities of the skin, respiratory tract, liver or kidneys would be expected to be at increased risk from exposure. Examination of the liver, kidneys and respiratory tract should be stressed. A urinalysis should be performed including at a minimum, specific gravity, albumin, glucose, and a microscopic on centrifuged sediment.

For acute or short-term repeated exposures to phenols/ cresols:

1.Phenol is absorbed rapidly through lungs and skin. Massive skin contact may result in collapse and death.

2.Ingestion may result in ulceration of upper respiratory tract; perforation of esophagus and/or stomach, with attendant complications, may occur. Esophageal stricture may occur.

3.An initial excitory phase may present. Convulsions may appear as long as 18 hours after ingestion. Hypotension and ventricular tachycardia that require vasopressor and antiarrhythmic therapy, respectively, can occur.

4.Respiratory arrest, ventricular dysrhythmias, seizures and metabolic acidosis may complicate severe phenol exposures so the initial attention should be directed towards stabilization of breathing and circulation with ventilation, intubation, intravenous lines, fluids and cardiac monitoring as indicated.

5.Vegetable oils retard absorption; do NOT use paraffin oils or alcohols. Gastric lavage, with endotracheal intubation, should be repeated until phenol odor is no longer detectable; follow with vegetable oil. A saline cathartic should then be given. ALTERNATELY: Activated charcoal (1g/kg) may be given. A cathartic should be given after oral activated charcoal.

6.Severe poisoning may require slow intravenous injection of methylene blue to treat methemoglobinemia.

7.Renal failure may require hemodialysis.

8.Most absorbed phenol is biotransformed by the liver to ethereal and glucoronide sulfates and is eliminated almost completely after 24 hours

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker who has been exposed to the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Total phenol in blood	250 mg/gm creatinine	End of shift	B, NS

B: Background levels occur in specimens collected from subjects NOT exposed

NS: Non-specific determinant; also seen after exposure to other materials.

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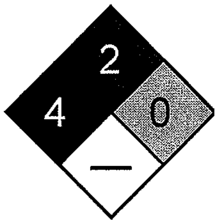
Section 5 - Fire-Fighting Measures



Fire Diamond

Flash Point: 79 °C Closed Cup
Autoignition Temperature: 715 °C
LEL: 1.7% v/v
UEL: 8.6% v/v
Extingushing Media: Carbon dioxide; dry chemical powder.
Alcohol stable foam.
General Fire Hazards/Hazardous Combustion Products: Combustible. Moderate fire hazard when exposed to heat, flame or oxidizers.
Vapor may readily form an explosive mixture with air.
Decomposes on heating and produces toxic fumes of carbon monoxide (CO), carbon dioxide (CO_2).
Fire Incompatibility: Avoid reaction with strong oxidizing agents and halogens.
Reaction with calcium hypochlorite is exothermic and produces toxic fumes which may ignite. Hot phenol is corrosive to many metals, including aluminum, lead, magnesium and zinc.
Do not heat phenol above 60 °C.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Use water delivered as a fine spray to control the fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: POLLUTANT -contain spillageEnvironmental hazard - contain spillage.
Wear protective clothing, impervious gloves and safety glasses.
Avoid breathing vapors and contact with skin and eyes.
Use dry clean-up procedures and avoid generating dust.
Place spilled material in clean, dry, sealable, labeled container.
Wash area down with large quantity of water and prevent runoff into drains.
Large Spills: POLLUTANT -contain spillageEnvironmental hazard - contain spillage.
Clear area of personnel and move upwind.
Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.
If contamination of drains or waterways occurs, advise emergency services.
Shut off all possible sources of ignition and increase ventilation.
Stop leak if safe to do so.
Use dry clean-up procedures and avoid generating dust.
Collect recoverable product into labeled containers for recycling.
Collect residues and seal in labeled drums for disposal.
Wash area down with large quantity of water and prevent runoff into drains.
After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Use good occupational work practices.
Avoid breathing vapors and contact with skin and eyes.
Use in a well-ventilated area.
Wear personal protective equipment when handling.
Avoid contact with incompatible materials.
Avoid smoking, bare lights or ignition sources.
Vapor may travel a considerable distance to source of ignition.
Avoid thermal shock.
Avoid physical damage to containers.
Handle and open container with care.
When handling, DO NOT eat, drink or smoke.
Wash hands with soap and water after handling.
Work clothes should be laundered separately: NOT at home.
Recommended Storage Methods: Polylined drum. Stainless steel.

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Steel drum.
Check that containers are clearly labeled.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in specific circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment

Eyes: Chemical goggles. Full face shield.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Neoprene gloves; PVC gloves.
Rubber boots.

Respiratory Protection:
Exposure Range >5 to 50 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range >50 to <250 ppm: Air Purifying, Negative Pressure, Full Face
Exposure Range 250 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black with dust/mist prefilter (use P100 or consult supervisor for appropriate dust/mist prefilter)

Other: Acid-resistant overalls.
PVC apron.
Hard hat with brim.
Ensure there is ready access to a safety shower.
Eyewash unit.

Glove Selection Index:

BUTYL	Best selection
BUTYL/NEOPRENE	Best selection
NATURAL+NEOPRENE	Best selection
NEOPRENE/NATURAL	Best selection
PE/EVAL/PE	Best selection
VITON	Best selection
VITON/NEOPRENE	Best selection
NEOPRENE	Best selection
TEFLON	Best selection
NATURAL RUBBER	Satisfactory; may degrade after 4 hours continuous immersion
NITRILE	Poor to dangerous choice for other than short-term immersion
NAT+NEOPR+NITRILE	Poor to dangerous choice for other than short-term immersion
PVA	Poor to dangerous choice for other than short-term immersion
PVC	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: White, crystalline solid with a characteristic sharp medicinal, sweet, tangy odor, which is detectable above 0.05 ppm. Phenol turns pink or red if it contains impurities, or if it is exposed to heat or light. Soluble in benzene. Very soluble in alcohol, chloroform, ether, glycerol, carbon disulfide, petrolatum, volatile and fixed oils, aqueous alkali hydroxides.

Physical State: Divided solid
Vapor Pressure (kPa): 101.33 at 181 °C
Vapor Density (Air=1): 3.24
Formula Weight: 94.11
Specific Gravity (H_2O=1, at 4 °C): 1.06 at 20 °C
Water Solubility: 1 g/15 ml water
Boiling Point Range: 181.8 °C (359 °F) at 760 mm Hg
Freezing/Melting Point Range: 40.9 °C (105.62 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable under normal handling conditions. Hazardous polymerization will not occur.

Storage Incompatibilities: Segregate from strong oxidizers, halogens, calcium hypochlorite, and metals such as aluminum, lead, zinc, magnesium.

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Section 11 - Toxicological Information

TOXICITY
Oral (rat) LD$_{50}$: 317 mg/kg
Oral (human) LD$_{Lo}$: 140 mg/kg
Inhalation (rat) LC$_{50}$: 316 mg/m^3
Dermal (rabbit) LD$_{50}$: 850 mg/kg

IRRITATION
Skin (rabbit): 500 mg/24hr - SEVERE
Skin (rabbit): 500 mg open -SEVERE
Eye (rabbit): 5 mg - SEVERE
Eye (rabbit): 100 mg rinse - mild

See NIOSH, *RTECS* SJ 3325000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the environment, the primary removal mechanism is biodegradation which is generally rapid (days). Since it is a benchmark chemical for biodegradability studies, there is a large body of information on its degradation which concludes that it rapidly degrades in sewage, soil, fresh water and seawater. Acclimation of resident populations of microorganisms is rapid. Under anaerobic conditions degradation is slower and microbial adaptation periods longer. If released to soil, it will readily leach and biodegrade. The biodegradation in soil is generally rapid with half-lives of under 5 days even in subsurface soils. Biodegradation is sufficiently rapid that most groundwater is generally free of this pollutant. The exception would be in the cases of spills where high concentrations destroy degrading microbial populations. Biodegradation is also the primary removal process when released into water (half-lives are of the order of hours to days) although sensitized photolysis may also be important. In one study using estuarine water, the combination of biodegradation and photolysis resulted in a half-life in summer and winter of 39 and 94 hr, respectively. Since the pKa is 9.994, it will be partially dissociated at higher pHs in water and moist soils and its transport and reactivity may be pH-dependent. It does not bioconcentrate in aquatic organisms. In the atmosphere, it occurs as a vapor and reacts with photochemically-produced hydroxyl radicals resulting in a half-life of approximately 15 hours. During the nighttime, it reacts with nitrate radicals with a resulting half-life of 12 minutes. It has also been shown to be readily removed from the atmosphere by rain.

Ecotoxicity: LC$_{50}$ Crangon crangon 5600 mg/l 3 min, 20 mg/l 1 hr, 80 mg/l 3 hr, 40 mg/l 6-24 hr, 30 mg/l 48-72 hr, 25 mg/l 96 hr in sea water at 15 °C /Conditions of bioassay not specified; LC$_{50}$ Rainbow trout 5.6-11.3 mg/l/24 hr in a static bioassay; LC$_{50}$ Ophicephalus punctatus 46.0 mg/l/48 hr in a static bioassay; TLm Mercenaria mercenaria (hard clam) egg 5.263 x10^4 ppb/48 hr in a static bioassay; Algae: Microcystis aeruginosa inhibition of cell multiplication noted at 4.6 mg/l /Conditions of bioassay not specified; Protozoa: Vorticella campanula perturbation level 3 mg/l /Conditions of bioassay not specified ; Arthropoda: LD$_0$ Daphnia magna 16 mg/l /Conditions of bioassay not specified; Arthropoda: TLm Daphnia magna (young) 17/7 mg/l 25-50 hr /Conditions of bioassay not specified ; TLm Roach 15 mg/l/24 hr /Conditions of bioassay not specified

Henry's Law Constant: 3.33 x10^{-7}

BCF: goldfish 1.9

Biochemical Oxygen Demand (BOD): 200%, 5 days

Octanol/Water Partition Coefficient: log K_{OW} = 1.46

Soil Sorption Partition Coefficient: K_{OC} = 1 to 3

Section 13 - Disposal Considerations

Disposal: Follow applicable federal, state, and local regulations.
Incinerate contaminated waste at an approved site.
Phenol may be recovered by charcoal absorption, solvent extraction or steam stripping. A concentration of 1% by weight is required for economical recovery.
Recycle containers wherever possible, otherwise dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: PHENOL, SOLID
Hazard Class: 6.1(a)
ID No.: 1671
Packing Group: II
Label: Poison[6]

Additional Shipping Information: CARBOLIC ACID, SOLID

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U188 Toxic Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: Listed

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SARA EHS 40 CFR 355: Listed
RQ: 1000 lb
TPQ: 500/10000 lb
TSCA: Listed

Section 16 - Other Information

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Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Polychlorinated Biphenyls (PCBs)
POL2140

Issue Date: 2002-02

Section 1 - Chemical Product and Company Identification 54

Material Name: Polychlorinated Biphenyls (PCBs) **CAS Number:** 1336-36-3
Chemical Formula: Unspecified or Variable
Structural Chemical Formula: $(C_{12}H_{10-x})Cl_x$
Synonyms: AROCLOR; AROCLOR 1221; AROCLOR 1232; AROCLOR 1242; AROCLOR 1248; AROCLOR 1254; AROCLOR 1260; AROCLOR 1262; AROCLOR 1268; AROCLOR 2565; AROCLOR 4465; AROCLOR 5442; 1,1'-BIPHENYL,CHLORO DERIVS; BIPHENYL,POLYCHLORO-; CHLOPHEN; CHLOREXTOL; CHLORINATED BIPHENYL; CHLORINATED DIPHENYL; CHLORINATED DIPHENYLENE; CHLORO 1,1-BIPHENYL; CHLORO 1,1-BIPHENYL-; CHLORO BIPHENYL; CLOPHEN; CLOPHEN A 60; DYKANOL; EPA PESTICIDE CHEMICAL CODE 017801; FENCLOR; FENCLOR 42; INERTEEN; KANECHLOR; KANECHLOR 300; KANECHLOR 400; MONTAR; MONTER; NOFLAMOL; PCB; PCBS; PHENOCHLOR; PHENOCLOR; POLYCHLORINATED BIPHENYL; POLYCHLORINATED BIPHENYLS; POLYCHLORINATED BIPHENYLS (PCB'S); POLYCHLOROBIPHENYL; PYRALENE; PYRANOL; SANTOTHERM; SANTOTHERM FR; SOVOL; THERMINOL; THERMINOL FR-1
General Use: Used as dielectric fluids in transformers and capacitors. Prior to 1972, were used as hydraulic and other industrial fluids (e.g., in vacuum pumps, as lubricants and cutting oils), in paints, inks and fire retardants.
Also used in heat transfer systems; gas-transmission turbines; carbonless reproducing paper; adhesives; as plasticizer in epoxy paints; fluorescent light ballasts; wax extenders; coolants; dedusting agents; pesticide extenders; surface treatment and coatings; sealants; caulking material.
This is one of a group of once widely used industrial chemicals whose high stability contributed both to their commercial usefulness and the long term deleterious environmental health effects. Consequently their use has been phased out. Their manufacture in the U.S.A. was discontinued in 1977.

Section 2 - Composition / Information on Ingredients

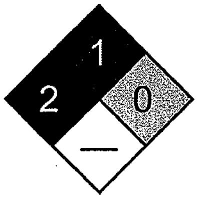
Name	CAS	%
polychlorinated biphenyls (PCB's)	1336-36-3	100

OSHA PEL
No data found.

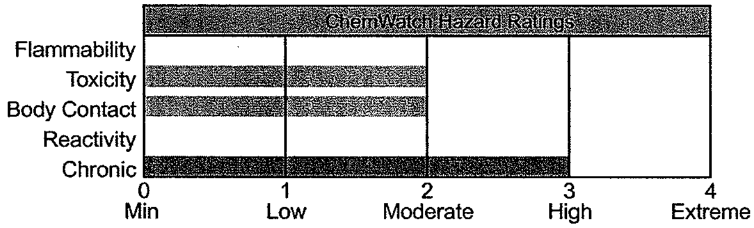
NIOSH REL
No data found.

ACGIH TLV
No data found.

Section 3 - Hazards Identification



Fire Diamond



HMIS
② Health
① Flammability
⓪ Reactivity

ANSI Signal Word
Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Oily liquid, white crystalline solid, or hard resin. Severely irritating. Suspect cancer hazard. Chronic: chloracne, GI disturbances, neurological symptoms, liver enlargement, menstrual changes, bronchitis. Possible reproductive and teratogenic effects.

Potential Health Effects

Target Organs: skin, liver, eyes, mucous membranes, respiratory system
Primary Entry Routes: inhalation, skin contact, ingestion

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Acute Effects

Inhalation: Not normally a hazard due to nonvolatile nature of product. Inhalation of vapor is more likely at higher than normal temperatures.

The vapor/mist is discomforting and may be extremely toxic if inhaled.

Eye: The vapor/liquid is moderately discomforting and may be harmful to the eyes.

Skin: The liquid is harmful to the skin, it is rapidly absorbed and is capable of causing skin reactions.

Exposure to material may result in a dermatitis, described as chloracne, a persistent acneiform characterized by comedones (white-, and black- heads), keratin cysts, and inflammed papules with hyperpigmentation and an anatomical distribution frequently involving the skin under the eyes and behind the ears. It occurs after acute or chronic exposure to a variety of chlorinated aromatic compounds by skin contact, ingestion or inhalation and may appear within days and months following the first exposure. Other dermatological alterations including hypertrichosis (the growth of excess hair), an increased incidence of actinic or solar elastosis (the degeneration of elastic tissue within muscles or loss of dermal elasticity produced by the effects of sunlight), and Peyrone's disease (a rare progressive scarring of the penile membrane).

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The material is moderately discomforting to the gastrointestinal tract and may be harmful if swallowed in large quantity.

Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Digestion may lead to nausea, vomiting, abdominal pain, anorexia, jaundice and liver damage, coma and death.

Headache, dizziness, lethargy, depression, nervousness, loss of libido, muscle, joint pains may be found.

Symptoms appear after a latent period of 5 to 6 months.

PCB's may appear in breast milk of exposed mothers and in newborn infants.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2A, Probably carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Not listed.

Chronic Effects: People occupationally exposed to PCB's have relatively high PCB residue levels in blood plasma.

Symptoms include chloracne dermatitis and degreasing the skin, pigmentation of skin and nails, excessive eye discharge, swelling of eyelids, transient visual disturbances, distinctive hair follicles, edema of the face and hands.

In common with other polyhalogenated aromatic hydrocarbons, the chlorinated biphenyls exhibit dioxin-like behavior.

Polyhalogenated aromatic hydrocarbons (PHAHs) comprise two major groups.

The first group represented by the halogenated derivatives of dibenzodioxins (the chlorinated form is PCDD), dibenzofurans (PCDF) and biphenyls (PCB) exert their toxic effect (as hepatoxicants, reproductive toxicants, immunotoxicants and procarcinogens) by interaction with a cytostolic protein known as the Ah receptor. In guinea pigs the Ah receptor is active in a mechanism which "pumps" PHAH into the cell whilst in humans the reverse appears to true. This, in part, may account for species differences often cited in the literature. This receptor exhibits an affinity for the planar members of this group and carries these to the cellular nucleus where they bind, reversibly, to specific genomes on DNA.

This results in the regulation of the production of certain proteins which elicit the toxic response. The potency of the effect is dependent on the strength of the original interaction with the Ah receptor and is influenced by the degree of substitution by the halogen and the position of such substitutions on the parent compound.

The most potent molecule is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) while the coplanar PCBs (including mono-ortho coplanars) possess approximately 1% of this potency. Nevertheless, all are said to exhibit "dioxin-like" behavior and in environmental and health assessments it has been the practice to assign each a TCDD-equivalence value.

The most subtle and important biological effects of the PHAHs are the effects on endocrine hormones and vitamin homeostasis. TCDD mimics the effect of thyroxin (a key metamorphosis signal during maturation) and may disrupt patterns of embryonic development at critical stages. Individuals from exposed wildlife populations have been observed to have altered sexual development, sexual dysfunction as adults and immune system suppression.

Immunotoxic effects of the PHAHs (including the brominated congener, PBB) have been the subject of several studies. No clear pattern emerges in human studies however with T-cell numbers and function (a blood marker for immunological response) increasing in some and decreasing in others.

Three incidences have occurred which have introduced abnormally high levels of dioxin or dioxin-like congeners to humans. The explosion at a trichlorophenol-manufacturing plant in Seveso, Italy distributed TCDD across a large area of the country-side, whilst rice-oil contaminated with heat-transfer PCBs (and dioxin-like contaminants) has been consumed by two groups, on separate occasions (one in Yusho, Japan and another in Yu-cheng, Taiwan). The only symptom which can unequivocally be related to all these exposures is the development of chloracne, a disfiguring skin condition, following each incident. Contaminated oil poisonings also produced eye-discharge, swelling of eyelids and visual disturbances. The Babies born up to 3 years after maternal exposure (so-called "Yusho-babies") were characteristically brown skinned, colored gums and nails and (frequently) produced eye-discharges. Delays in intellectual development have been noted. It has been estimated that Yu-cheng patients consumed an average level of 0.06 mg/kg body weight/day total PCB and 0.0002 mg/kg/day of PCDF before the onset of symptoms after 3 months. When the oil was withdrawn after 6 months they had consumed 1 gm total PCB containing 3.8 mg PCDF.

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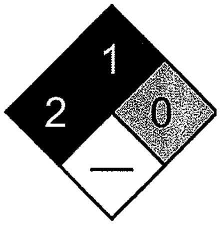
Preliminary data from the Yusho cohort suggests a six-fold excess of liver cancer mortality in males and a three-fold excess in women.
Recent findings from Seveso indicate that the biological effects of low level exposure (BELLEs), experienced by a cohort located at a great distance from the plant, may be hormetic, i.e. may be protective AGAINST the development of cancer.
TCDD induces carcinogenic effects in the laboratory in all species, strains and sexes tested. These effects are dose-related and occur in many organs.
Exposures as low as 0.001 ug/kg body weight/day produce carcinoma.
Several studies implicate PCBs in the development of liver cancer in workers as well as multi-site cancers in animals.
The second major group of PHAH consists of the non-planar PCB congeners which possess two or more ortho-substituted halogens. These have been shown to produce neurotoxic effects which are thought to reduce the concentration of the brain neurotransmitter, dopamine, by inhibiting certain enzyme-mediated processes.
The specific effect elicited by both classes of PHAH seems to depend on the as much on the developmental status of the organism at the time of the exposure as on the level of exposure over a lifetime.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.
Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.
Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).
Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.
Ingestion: Contact a Poison Control Center. DO NOT induce vomiting. Observe the patient carefully. Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious. Give water (or milk) to rinse out mouth. Then provide liquid slowly and as much as casualty can comfortably drink. Transport to hospital or doctor without delay.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Treat symptomatically. If large amounts are ingested, gastric lavage is suggested. For splash in the eyes, a petrolatum-based ophthalmic ointment may be applied to the eye to relieve the irritating effects of PCBs.
If electrical equipment arcs over, PCB dielectric fluids may decompose to produce hydrogen chloride (HCl), a respiratory irritant. [Monsanto] Preplacement and annual medical examinations of workers, with emphasis on liver function, skin condition, reproductive history, is recommended.

Section 5 - Fire-Fighting Measures



Fire Diamond

Flash Point: > 141 °C
Autoignition Temperature: 240 °C
LEL: Not applicable
UEL: Not applicable
Extinguishing Media: Foam.Alcohol stable foam.
Dry chemical powder.
General Fire Hazards/Hazardous Combustion Products: Noncombustible liquid.
POLLUTANT -contain spillage.
Decomposes on heating and produces acrid black soot and toxic fumes of aldehydes, hydrogen chloride (HCl), chlorides and extremely toxic polychlorinated dibenzofuran (PCDF), polychlorinated dibenzodioxin (PCDD).
Fire Incompatibility: Reacts vigorously with chlorine (Cl_2).
Fire-Fighting Instructions: POLLUTANT -contain spillage. Noncombustible.
Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.
Use fire fighting procedures suitable for surrounding area.
Cool fire-exposed containers with water spray from a protected location.
Avoid spraying water onto liquid pools.
If safe to do so, remove containers from path of fire.
Equipment should be thoroughly decontaminated after use.

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Section 6 - Accidental Release Measures

Small Spills: POLLUTANT -contain spillage. Clean up all spills immediately.
Environmental hazard - contain spillage.
Avoid breathing vapors and contact with skin and eyes.
Wear protective clothing, impervious gloves and safety glasses.
Contain spill with sand, earth or vermiculite.
Wipe up and absorb small quantities with vermiculite or other absorbent material.
Place spilled material in clean, dry, sealable, labeled container.
Large Spills: POLLUTANT -contain spillage. Clear area of personnel.
Contact fire department and tell them location and nature of hazard.
Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways.
Stop leak if safe to do so.
Contain spill with sand, earth or vermiculite.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect residues and seal in labeled drums for disposal.
After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
If equipment is grossly contaminated, decontaminate and destroy.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Do not allow clothing wet with material to stay in contact with skin Use good occupational work practices. Observe manufacturer's storing and handling recommendations.
Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Avoid all personal contact, including inhalation.
Wear protective clothing and gloves when handling containers.
Avoid physical damage to containers.
Use in a well-ventilated area and Use only in completely enclosed system.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Wash hands with soap and water after handling.
Work clothes should be laundered separately: NOT at home.
Recommended Storage Methods: Packaging as recommended by manufacturer.
Check that containers are clearly labeled.
Metal can or metal drum or Steel drum with plastic liner.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Provide adequate ventilation in warehouse or closed storage areas.
If inhalation risk of overexposure exists, wear NIOSH-approved organic-vapor respirator.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.
Personal Protective Clothing/Equipment
Eyes: Safety glasses with side shields; chemical goggles.
Full face shield.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Impervious gloves or Viton gloves or Polyethylene gloves or PVC gloves.
Protective footwear.

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Other: Impervious protective clothing. Overalls. Impervious apron.
Eyewash unit.
Ensure there is ready access to a safety shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, colorless to yellow-green, mobile oily to viscous liquid, or sticky to hard resin, or white crystalline solid, depending on degree of chlorination. Slightly soluble in glycerol and glycols. Soluble in organic solvents and lipids. Viscosity range: 71 - 2500 Saybolt unit sec. at 38 °C. PCBs are resistant to chemical and biological degradation and because of their solubility in fats and oils they tend to be concentrated in living organisms. The highly chlorinated PCBs are retained in animal's bodies longer and seems to delay the excretion of the lower chlorinated PCB's. They have become widely dispersed in the world-wide environment and in the food-chain since their introduction in 1929. They are now recognized internationally to be a major environmental pollutant, their persistence causing ecological damage via water pollution. Consequently loss of PCBs to the environment is to be avoided at all costs.

Physical State: Liquid
Vapor Pressure (kPa): Negligible
Formula Weight: 188.66 - 395
Specific Gravity (H_2O=1, at 4 °C): 1.18 - 1.8
Water Solubility: Solubility in water extremely low
Evaporation Rate: Non Vol. at 38 °C

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 340 °C (644 °F) to 375 °C (707 °F)
Decomposition Temperature (°C): 375-550

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid storage with oxidizers. Segregate from chlorine.
Avoid contamination of water, foodstuffs, feed or seed.

Section 11 - Toxicological Information

TOXICITY
Oral (human) LD_{Lo}: 500 mg/kg
Oral (rat) LD_{50}: 3980 mg/kg

IRRITATION
Nil reported

See NIOSH, *RTECS* TQ1350000, for additional data.

Section 12 - Ecological Information

Environmental Fate: PCBs are mixtures of different congeners of chlorobiphenyl and the relative importance of the environmental fate mechanisms generally depends on the degree of chlorination. In general, the persistence of PCBs increases with an increase in the degree of chlorination. Mono-, di- and trichlorinated biphenyls (Aroclor 1221 and 1232) biodegrade relatively rapidly, tetrachlorinated biphenyls (Aroclors 1016 and 1242) biodegrade slowly, and higher chlorinated biphenyls (Aroclors 1248, 1254, and 1260) are resistant to biodegradation. Although biodegradation of higher chlorinated congeners may occur very slowly on an environmental basis, no other degradation mechanisms have been shown to be important in natural water and soil systems; therefore, biodegradation may be the ultimate degradation process in water and soil.

If released to soil, PCBs experience tight adsorption with adsorption generally increasing with the degree of chlorination. PCBs will generally not leach significantly in aqueous soil systems; the higher chlorinated congeners will have a lower tendency to leach than the lower chlorinated congeners. In the presence of organic solvents PCBs may leach quite rapidly through soil. Vapor loss from soil surfaces appears to be an important fate mechanism with the rate of volatilization decreasing with increasing chlorination. Although the volatilization rate may be low, the total loss by volatilization over time may be significant because of persistence and stability. Enrichment of the low Cl PCBs occurs in the vapor phase relative to the original Aroclor; the residue will be enriched in the PCBs containing high Cl content.

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If released to water, adsorption to sediment and suspended matter will be an important fate process; PCB concentrations in sediment and suspended matter have been shown to be greater than in the associated water column. Although adsorption can immobilize PCBs (especially the higher chlorinated congeners) for relatively long periods of time, eventual resolution into the water column has been shown to occur. The PCB composition in the water will be enriched in the lower chlorinated PCBs because of their greater water solubility, and the least water soluble PCBs (highest Cl content) will remain adsorbed. In the absence of adsorption, PCBs volatilize relatively rapidly from water. However, strong PCB adsorption to sediment significantly competes with volatilization, with the higher chlorinated PCBs having longer half-lives than the lower chlorinated PCBs. Although the resulting volatilization rate may be low, the total loss by volatilization over time may be significant because of persistence and stability. PCBs have been shown to bioconcentrate significantly in aquatic organisms. If released to the atmosphere, PCBs will primarily exist in the vapor-phase; the tendency to become associated with the particulate-phase will increase as the degree of chlorination of the PCB increases. The dominant atmospheric transformation process is probably the vapor-phase reaction with hydroxyl radicals which has estimated half-lives ranging from 12.9 days for monochlorobiphenyl to 1.31 years for heptachlorobiphenyl. Physical removal from the atmosphere, which is very important environmentally, is accomplished by wet and dry deposition.

Ecotoxicity: Aquatic toxicity: 0.278 ppm/96 hr/bluegill/TLm/fresh water 0.005 ppm/336-1080 hr/pinfish/TLm/salt water; Waterfowl toxicity: LD_{50} 2000 ppm (mallard duck); Food chain concentration potential: High

Henry's Law Constant: 5×10^{-5}

BCF: bioconcentrate in tissue

Biochemical Oxygen Demand (BOD): very low

Soil Sorption Partition Coefficient: $K_{OC} = 510$ to 1.33×10^{4}

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.
Due to their environmental persistence and potential health hazards, PCBs cannot be disposed of in landfills or dumped at sea. The only environmentally acceptable method for the disposal of PCBs is by high temperature incineration.
All wastes and residues containing PCB's (e.g., wiping cloths, absorbent material, used disposable protective gloves, contaminated clothing, etc.) should be collected, placed in proper containers, labelled and disposed of in accordance with applicable regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: POLYCHLORINATED BIPHENYLS
Hazard Class: 9
ID No.: 2315
Packing Group: II
Label: Miscellaneous Dangerous Goods[9]

Additional Shipping Information: PCB'S

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per CWA Section 307(a) 1 lb (0.454 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2002-02

Toluene
TOL2320

Section 1 - Chemical Product and Company Identification 54

Material Name: Toluene **CAS Number:** 108-88-3
Chemical Formula: C_7H_8
Structural Chemical Formula: $C_6H_5CH_3$
Synonyms: ANTISAL 1A; BENZENE,METHYL-; CP 25; METHACIDE; METHANE,PHENYL-; METHYL BENZENE; METHYL BENZOL; METHYLBENZENE; METHYLBENZOL; PHENYL METHANE; PHENYLMETHANE; TOLUEEN; TOLUEN; TOLUENE; TOLUENO; TOLUOL; TOLUOLO; TOLU-SOL
General Use: Used as a solvent for paint, resins, lacquers inks & adhesives. Component of solvent blends and thinners; in gasoline and aviation fuel. Used in the manufacture of chemicals, dyes, explosives, benzoic acid.
Some grades of toluene may contain traces of xylene and benzene.
Odor threshold: 2 ppm approx. Odor is not a reliable warning property due to olfactory fatigue.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
toluene	108-88-3	> 99.5

OSHA PEL
TWA: 200 ppm; Ceiling: 300 ppm, 500 ppm, 10-minute maximum peak.

OSHA PEL Vacated 1989 Limits
TWA: 100 ppm; 375 mg/m^3;
STEL: 150 ppm; 560 mg/m^3.

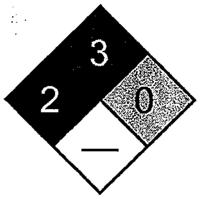
ACGIH TLV
TWA: 50 ppm, 188 mg/m^3; skin.

NIOSH REL
TWA: 100 ppm, 375 mg/m^3;
STEL: 150 ppm, 560 mg/m^3.

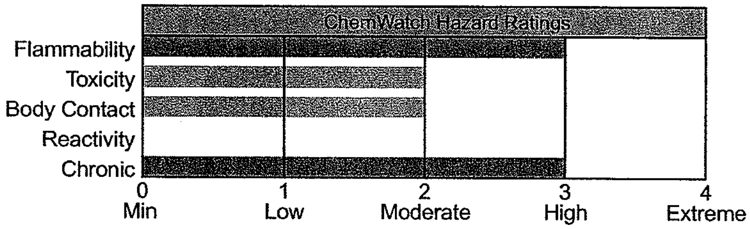
IDLH Level
500 ppm.

DFG (Germany) MAK
TWA: 50 ppm, 190 mg/m^3; skin, ceiling, substances with systemic effects, onset of effects within 2 hours, half-life two hours to shift length.

Section 3 - Hazards Identification



Fire Diamond



HMIS
② Health
③ Flammability
⓪ Reactivity

ANSI Signal Word
Danger!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆
Colorless liquid; sickly, sweet odor. Irritating to the eyes/skin/respiratory tract. Also causes: weakness, headache, dizziness, confusion, and insomnia. Chronic: liver and kidney damage. May cause birth defects. Flammable.

Potential Health Effects

Target Organs: Skin, liver, kidneys, central nervous system.
Primary Entry Routes: Inhalation, skin contact/absorbtion.
Acute Effects
Inhalation: The vapor is highly discomforting to the upper respiratory tract.
Inhalation hazard is increased at higher temperatures.
Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

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If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Central nervous system (CNS) depression may include nonspecific discomfort, symptoms of giddiness, headache, dizziness, nausea, anesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness.

Serious poisonings may result in respiratory depression and may be fatal.

Eye: The liquid produces a high level of eye discomfort and is capable of causing pain and severe conjunctivitis.

Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.

The vapor is discomforting to the eyes if exposure is prolonged.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid may produce skin discomfort following prolonged contact.

Defatting and/or drying of the skin may lead to dermatitis and it is absorbed by skin.

Toxic effects may result from skin absorption.

Open cuts, abraded or irritated skin should not be exposed to this material.

The material may accentuate any pre-existing skin condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Chronic toluene habituation occurs following intentional abuse (glue-sniffing) or from occupational exposure. Ataxia, incoordination and tremors of the hands and feet (as a consequence of diffuse cerebral atrophy), headache, abnormal speech, transient memory loss, convulsions, coma, drowsiness, reduced color perception, frank blindness, nystagmus (rapid, involuntary eye-movements), decreased hearing leading to deafness and mild dementia have all been associated with chronic abuse.

Peripheral nerve damage, encephalopathy, giant axonopathy, electrolyte disturbances in the cerebrospinal fluid and abnormal computer tomographic (CT) scans are common amongst toluene addicts. Although toluene abuse has been linked with kidney disease, this does not commonly appear in cases of occupational toluene exposures. Cardiac and hematological toxicity are however associated with chronic toluene exposure. Cardiac arrhythmia, multifocal and premature ventricular contractions and supraventricular tachycardia are present in 20% of patients who abused toluene-containing paints.

Previous suggestions that chronic toluene inhalation produced human peripheral neuropathy have largely been discounted. However central nervous system (CNS) depression is well documented where blood toluene levels exceed 2.2 mg%. Toluene abusers can achieve transient circulating concentrations of 6.5 mg%. Amongst workers exposed for a median time of 29 years to toluene no subacute effects on neurasthenic complaints and pyschometric test results could be established.

The prenatal toxicity of very high toluene concentrations has been documented for several animal species and man. Malformations indicative of specific teratogenicity have not generally been found. The toxicity described in the literature takes the form of embryo death or delayed fetal growth and delayed skeletal system development. Permanent damage of children has been seen only when mothers had suffered from chronic intoxication as a result of "sniffing".

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Following acute or short-term repeated exposures to toluene:

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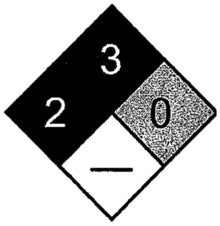
1. Toluene is absorbed across to alveolar barrier, the blood/air mixture being 11.2/15.6 (at 37 °C) The order of toluene, in expired breath, is of the order of 18 ppm following sustained exposure to 100 ppm.
The tissue/blood proportion is 1/3 except in adipose where the proportion is 8/10.
2.Metabolism by microsomal mono-oxygenation, results in the production of hippuric acid. This may be detected in the urine in amounts between 0.5 and 2.5 g/24hr which represents, on average 0.8 gm/gm of creatinine.
The biological half life of hippuric acid is in the order of 1-2 hours.
3.Primary threat to life from ingestion and/or inhalation is respiratory failure.
4.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
5.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
6.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
7.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
8.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.
BIOLOGICAL EXPOSURE INDEX - BEI
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Hippuric acid in urine	2.5 gm/gm creatinine	End of shift Last 4 hrs of shift	B,NS
Toluene in venous blood	1 mg/L	End of shift	SQ
Toluene in end-exhaled air		End of shift	SQ

NS: Non-specific determinant; also observed after exposure to other material
SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.
B: Background levels occur in specimens collected from subjects NOT exposed.

Section 5 - Fire-Fighting Measures

Flash Point: 4 °C Closed Cup
Autoignition Temperature: 480 °C
LEL: 1.2% v/v
UEL: 7.1% v/v
Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.
Severe fire hazard when exposed to heat, flame and/or oxidizers.
Vapor forms an explosive mixture with air.
Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO) and carbon dioxide (CO_2).
Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.
Nitric acid with toluene, produces nitrated compounds which are explosive.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.



Fire Diamond

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If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control the fire and cool adjacent area. Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protective location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Recommended Storage Methods: Metal can; Metal drum; Metal safety cans. Packing as supplied by manufacturer.
Plastic containers may only be used if approved for flammable liquid.
Check that containers are clearly labeled and free from leaks.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area; local exhaust ventilation may be required for safe working, i.e., to keep exposures below required standards; otherwise, PPE is required.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in special circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator. Correct fit is essential to ensure adequate protection.
Provide adequate ventilation in warehouses and enclosed storage areas.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.
Personal Protective Clothing/Equipment
Eyes: Safety glasses with side shields; chemical goggles. Full face shield.
DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Wear chemical protective gloves, eg. PVC. Wear safety footwear.

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Respiratory Protection:

Exposure Range >200 to <500 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 500 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black

Other: Overalls. Barrier cream. Eyewash unit.

Glove Selection Index:

PE/EVAL/PE	Best selection
VITON/CHLOROBUTYL	Best selection
VITON	Best selection
PVA	Best selection
TEFLON	Satisfactory; may degrade after 4 hours continuous immersion
SARANEX-23 2-PLY	Poor to dangerous choice for other than short-term immersion
CPE	Poor to dangerous choice for other than short-term immersion
VITON/NEOPRENE	Poor to dangerous choice for other than short-term immersion
SARANEX-23	Poor to dangerous choice for other than short-term immersion
NEOPRENE/NATURAL	Poor to dangerous choice for other than short-term immersion
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion
NITRILE	Poor to dangerous choice for other than short-term immersion
BUTYL	Poor to dangerous choice for other than short-term immersion
PVC	Poor to dangerous choice for other than short-term immersion
NEOPRENE	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid with a strong aromatic odor; floats on water. Mixes with most organic solvents.

Physical State: Liquid
Vapor Pressure (kPa): 2.93 at 20 °C
Vapor Density (Air=1): 3.2
Formula Weight: 92.14
Specific Gravity (H_2O=1, at 4 °C): 0.87 at 20 °C
Water Solubility: < 1 mg/mL at 18 °C
Evaporation Rate: 2.4 (BuAc=1)

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 111 °C (232 °F) at 760 mm Hg
Freezing/Melting Point Range: -95 °C (-139 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Segregate from strong oxidizers.

Section 11 - Toxicological Information

TOXICITY
Oral (human) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 636 mg/kg
Inhalation (human) TC_{Lo}: 100 ppm
Inhalation (man) TC_{Lo}: 200 ppm
Inhalation (rat) LC_{50}: > 26700 ppm/1h
Dermal (rabbit) LD_{50}: 12124 mg/kg
Reproductive effector in rats

IRRITATION
Skin (rabbit): 20 mg/24h-moderate
Skin (rabbit): 500 mg - moderate
Eye (rabbit): 0.87 mg - mild
Eye (rabbit): 2 mg/24h - SEVERE
Eye (rabbit): 100 mg/30sec - mild

See NIOSH, *RTECS* XS 5250000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be lost by evaporation from near-surface soil and by leaching to the groundwater. Biodegradation occurs both in soil and groundwater, but it is apt to be slow especially at high concentrations, which may be toxic to microorganisms. The presence of acclimated microbial populations may allow rapid biodegradation. It will not significantly hydrolyze in soil or water under normal environmental conditions. If released into water, its concentration will decrease due to evaporation and biodegradation. This removal can be rapid or take several weeks, depending on temperature, mixing conditions, and acclimation of microorganisms. It will not significantly adsorb to sediment or bioconcentrate in aquatic organisms. If released to the atmosphere, it will degrade by reaction with photochemically produced hydroxyl radicals (half-life 3 hr to slightly over 1 day) or be washed out in rain. It will not be subject to direct photolysis.

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Ecotoxicity: LC_{50} Aedes aegypti-4th instar (mosquito larvae) 22 mg/l /Conditions of bioassay not specified; LC_{50} Cyprinodon variegatus (sheepshead minnow) 277-485 mg/l 96 hr /Conditions of bioassay not specified; LC_{50} Calandra granaria (grain weevil) 210 mg/l /in air; LC_{50} Cancer magister (crab larvae stage I) 28 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 4.3 ppm 96 hr /Conditions of bioassay not specified; LC_{50} Artemia salina (brine shrimp) 33 mg/l 24 hr /Conditions of bioassay not specified; LC_{50} Morone saxatilis (striped bass) 7.3 mg/l 96 hr /Conditions of bioassay not specified; LC_{50} Pimephales promelas (fathead minnows) 55-72 mg/l (embryos), 25-36 mg/l (1-day posthatch protolarvae), and 26-31 mg/l (30-day-old minnows)/ 96 hour /Conditions of bioassay not specified

Henry's Law Constant: 0.0067

BCF: eels 13.2

Biochemical Oxygen Demand (BOD): 0%, 5 days

Octanol/Water Partition Coefficient: log $K_{ow} = 2.69$

Soil Sorption Partition Coefficient: K_{oc} = silty loam 37

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: TOLUENE

Hazard Class: 3.1

ID No.: 1294

Packing Group: II

Label: Flammable Liquid[3]

Additional Shipping Information: TOLUOL

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U220 Toxic Waste

CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 1000 lb (453.5 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

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1171 RiverFront Center
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(518) 842-4111

Issue Date: 2002-02

Trichloroethylene
TRI2710

Section 1 - Chemical Product and Company Identification

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Material Name: Trichloroethylene **CAS Number:** 79-01-6
Chemical Formula: C_2HCl_3
Structural Chemical Formula: $ClCH=CCl_2$
Synonyms: ACETYLENE TRICHLORIDE; ALGYLEN; ANAMENTH; BENZINOL; BLACOSOLV; BLANCOSOLV; CECOLENE; CHLORILEN; 1-CHLORO-2,2-DICHLOROETHYLENE; CHLORYLEA; CHLORYLEA,CHORYLEN,CIRCOSOLV,CRAWHASPOL,DOW-TRI,DUKERON,PER-A-CLOR,TRIAD,TRIAL,TRI-PLUS M,VITRAN; CHLORYLEN; CHORYLEN; CIRCOSOLV; CRAWHASPOL; DENSINFLUAT; 1,1-DICHLORO-2-CHLOROETHYLENE; DOW-TRI; DUKERON; EPA PESTICIDE CHEMICAL CODE 081202; ETHENE,TRICHLORO-; ETHINYL TRICHLORIDE; ETHYLENE TRICHLORIDE; ETHYLENE,TRICHLORO-; FLECK-FLIP; FLOCK FLIP; FLUATE; GEMALGENE; GERMALGENE; LANADIN; LETHURIN; NARCOGEN; NARKOGEN; NARKOSOID; NIALK; NSC 389; PERM-A-CHLOR; PERM-A-CLOR; PETZINOL; PHILEX; TCE; THRETHYLEN; THRETHYLENE; TRETHYLENE; TRI; TRIAD; TRIAL; TRIASOL; TRICHLOORETHEEN; TRICHLOORETHYLEEN,TRI; TRICHLORAETHEN; TRICHLORAETHYLEN,TRI; TRICHLORAN; TRICHLOREN; TRICHLORETHENE; TRICHLORETHYLENE; TRICHLORETHYLENE,TRI; TRICHLOROETHENE; 1,1,2-TRICHLOROETHYLENE; TRICHLOROETHYLENE; TRICHLOROETHYLENE; 1,2,2-TRICHLOROETHYLENE; TRI-CLENE; TRICLENE; TRICLORETENE; TRICLOROETILENE; TRIELENE; TRIELIN; TRIELINA; TRIELINE; TRIKLONE; TRILEN; TRILENE; TRILINE; TRIMAR; TRIOL; TRI-PLUS; TRI-PLUS M; VESTROL; VITRAN; WESTROSOL
General Use: Mainly used for vapor degreasing; solvent in textile and electronics industries; for adhesives, lubricants and consumer products (such as spot removers and rug cleaners).
Until recently, it was used to make hop extracts for beer, decaffeinated coffee and spice extracts.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
trichloroethylene	79-01-6	> 99

OSHA PEL
TWA: 100 ppm; Ceiling: 200 ppm, 300 ppm, 5-minute maximum peak in any 2 hours.

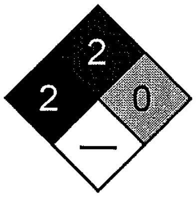
OSHA PEL Vacated 1989 Limits
TWA: 50 ppm; 270 mg/m^3; STEL: 200 ppm; 1080 mg/m^3.

ACGIH TLV
TWA: 50 ppm, 269 mg/m^3; STEL: 100 ppm, 537 mg/m^3.

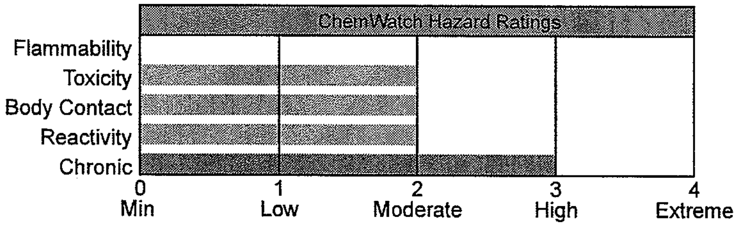
NIOSH REL
No data found.

IDLH Level
1000 ppm.

Section 3 - Hazards Identification



Fire Diamond



HMIS
② Health
② Flammability
⓪ Reactivity

ANSI Signal Word
Warning!


Flammable

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☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear, colorless liquid; sweet odor. Irritating to eyes/skin/respiratory tract. Inhalation: irregular heart beat, drunkenness. Chronic: heart, liver and kidney damage, dermatitis. Birth defects and cancer may occur based on animal studies. Flammable.

Potential Health Effects

Target Organs: respiratory system, central nervous system (CNS), peripheral nervous system, cardiovascular system, liver, kidneys, skin

Primary Entry Routes: inhalation, skin contact, eye contact, ingestion (rarely)

Acute Effects

Inhalation: The vapor is mildly discomforting to the upper respiratory tract.

Inhalation hazard is increased at higher temperatures.

Anesthetics and narcotic effects (with dulling of senses and odor fatigue) are a consequence of exposure to chlorinated solvents.

Individual response varies widely; odor may not be considered objectionable at levels which quickly induce central nervous system effects.

High vapor concentrations may give a feeling of euphoria. This may result in reduced responses, followed by rapid onset of unconsciousness, possible respiratory arrest and death.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Evidence of acute human toxicity comes mainly from the use of TCE as an anesthetic , Tachypnea and ventricular arrhythmias are experienced at inhaled concentrations exceeding 15000 ppm. Systemic toxicity is low following anesthesia. Occasional hepatotoxicity (liver dysfunction) has been reported; this is probably due to the breakdown of TCE to dichloroacetylene and phosgene by soda-lime present in some anesthetic devices. The effects of TCE appear to be enhanced in some individuals by simultaneous exposure to caffeine, ethanol and other drugs. "Degreasers Flush" describes a reddening of facial, neck, and back skin and is seen after intake of substantial quantities of ethanol by certain individuals after exposures to TCE.

Eye: The liquid is highly discomforting to the eyes and is capable of causing pain and severe conjunctivitis.

Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated.

The vapor is discomforting to the eyes.

The material may produce moderate eye irritation leading to inflammation.

Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid is discomforting to the skin and may cause drying of the skin, which may lead to dermatitis.

Toxic effects may result from skin absorption.

Bare unprotected skin should not be exposed to this material. The material may accentuate any pre-existing skin condition.

The material may produce severe skin irritation after prolonged or repeated exposure, and may produce a contact dermatitis (nonallergic).

This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis.

Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Repeated exposures may produce severe ulceration.

Localized application may produce pustular eruptions, pruritus and erythema. A permeability coefficient of 1.6×10^{-2} cm/hr has been calculated by the US EPA. Percutaneous absorption is unlikely to contribute significantly to total body burdens unless dermatitis is present.

Ingestion: The liquid is highly discomforting and toxic if swallowed.

Ingestion may result in nausea, abdominal irritation, pain and vomiting.

Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A5, Not suspected as a human carcinogen; EPA - Not listed; MAK - Class B, Justifiably suspected of having carcinogenic potential.

Chronic Effects: Sensitive humans may experience anesthetic effects from short exposures.

Chronic effects of exposure include fatigue, headache, irritability, vomiting, skin flush and intolerance to alcohol.

Liver, kidney, heart and neurological damage may also result from chronic overexposure.

Alcohol intake may increase the toxic effects of the material.

A variety of disturbances have been seen among workers exposed at concentrations ranging from 1 to 335 ppm. These disturbances increased with the length of exposure (to 5 years or more) and where more prominent when exposures exceeded 40 ppm. Increased complaints of alcohol intolerance, tremors, giddiness and anxiety were amongst symptoms recorded. Variation in effects in different occupational settings may be due to different physical workloads.

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There appeared to be no increase in the expected rates of congenital defects in children born to women exposed to TCE over a 13 year period.
Epidemiological studies consistently fail to show a link between cancers and TCE exposure. This is significant because of the tens of thousands of exposed workers monitored.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If available, administer medical oxygen by trained personnel.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.
Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.
Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).
Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.
Ingestion: Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.
Avoid giving milk or oils.
Avoid giving alcohol.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Treat symptomatically.
Do not administer sympathomimetic drugs as they may cause ventricular arrhythmias.
Following acute or short-term continued exposures to trichloroethylene:
1.Trichloroethylene concentration in expired air correlates with exposure. 8 hours exposure to 100 ppm produces levels of 25 ppm immediately and 1 ppm 16 hours after exposures.
2.Most mild exposure respond to removal from the source and supportive care.
Serious toxicity most often results from hypoxemia or cardiac dysrhythmias so that oxygen, intubation, intravenous lines and cardiac monitoring should be started initially as the clinical situation dictates.
3.Ipecac syrup should be give to alert patients who ingest more than a minor amount and present within 2 hours.
4.The efficacy of activated charcoal and cathartics is unclear.
5.The metabolites, trichloracetic acid, trichlorethanol and to a lesser degree, chloral hydrate, may be detected in the urine up to 16 days postexposure.
BIOLOGICAL EXPOSURE INDEX - BEI
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Trichloroacetic acid in urine	10 mg/gm creatinine	End of work-week	NS
Trichloroacetic acid AND Trichloroethanol in urine	300 mg/mg creatinine	End of shift at end of work-week	NS
Free Trichloroethanol in blood	4 mg/L	End of shift at end of work-week	NS
Trichloroethylene in end-exhaled air			SQ
Trichloroethylene in blood			SQ

NS: Non-specific determinant; also seen after exposure to other materials
SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.

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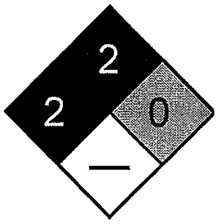
Section 5 - Fire-Fighting Measures



Fire Diamond

Flash Point: 32.222 °C Closed Cup

Autoignition Temperature: 420 °C

LEL: 8% v/v

UEL: 10.5% v/v

Extinguishing Media: Water spray or fog; foam, dry chemical powder, or BCF (where regulations permit).

Carbon dioxide.

General Fire Hazards/Hazardous Combustion Products: Vapor will burn when in contact with high temperature flame.

May form a flammable/explosive mixture in an oxygen enriched atmosphere. Heating may cause expansion/vaporization with violent rupture of containers. Decomposes on heating and produces corrosive fumes of hydrochloric acid, carbon monoxide and small amounts of toxic phosgene.

Fire Incompatibility: Avoid reaction with strong oxidizing agents (particularly oxygen in gas or liquid form and nitrogen dioxide), strong bases, sodium and sodium-potassium alloys. Powdered metals; magnesium, zinc and aluminum.

Contact with water may result in the slow formation of hydrochloric acid.

Attacks natural rubber.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

Use water delivered as a fine spray to control fire and cool adjacent area.

Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.

If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.

Avoid breathing vapors and contact with skin and eyes.

Control personal contact by using protective equipment.

Contain and absorb spill with sand, earth, inert material or vermiculite.

Wipe up. Place in a suitable labeled container for waste disposal.

Large Spills: Clear area of personnel and move upwind.

Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.

Increase ventilation.

No smoking or bare lights within area.

Stop leak if safe to do so.

Contain and absorb spill with sand, earth, inert material or vermiculite.

Collect and seal in labeled drums for disposal.

If contamination of drains or waterways occurs, advise emergency services.

After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.

Wear protective clothing when risk of overexposure occurs.

Use in a well-ventilated area. Prevent concentration in hollows and sumps.

DO NOT enter confined spaces until atmosphere has been checked.

DO NOT allow material to contact humans, exposed food or food utensils.

Avoid smoking, bare lights or ignition sources. When handling, DO NOT eat, drink or smoke. Avoid contact with incompatible materials.

Keep containers securely sealed when not in used. Avoid physical damage to containers. Always wash hands with soap and water after handling. Working clothes should be laundered separately.

Launder contaminated clothing before reuse.

Observe manufacturer's storing/handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.

Recommended Storage Methods: Inhibited grades may be stored in metal drums.

DO NOT use aluminum or galvanized containers. Check that containers are clearly labeled and free from leaks.

Packaging as recommended by manufacturer.

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Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Local exhaust ventilation usually required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area.

Personal Protective Clothing/Equipment

Eyes: Safety glasses with side shields; chemical goggles. Full face shield.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: PVA gloves. Polyethylene gloves.
Viton gloves.
PVC boots.

Respiratory Protection:
Exposure Range >100 to <1000 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask
Exposure Range 1000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Note: odor threshold unknown

Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.

Glove Selection Index:

PE/EVAL/PE	Best selection
PVA	Best selection
TEFLON	Best selection
VITON	Satisfactory; may degrade after 4 hours continuous immersion
VITON/NEOPRENE	Poor to dangerous choice for other than short-term immersion
VITON/NITRILE	Poor to dangerous choice for other than short-term immersion
HYPALON	Poor to dangerous choice for other than short-term immersion
NEOPRENE	Poor to dangerous choice for other than short-term immersion
PVC	Poor to dangerous choice for other than short-term immersion
NITRILE	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless liquid with a sweetish, chloroform-like odor, miscible with most organic solvents.

Physical State: Liquid
Vapor Pressure (kPa): 7.87 at 20 °C
Vapor Density (Air=1): 4.54
Formula Weight: 131.38
Specific Gravity (H_2O=1, at 4 °C): 1.47 at 15 °C
Water Solubility: < 1 mg/mL at 21 °C

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 87 °C (189 °F)
Freezing/Melting Point Range: -73 °C (-99.4 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Decomposes in the presence of moisture to produce corrosive acid.
Product is considered stable under normal handling conditions. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with strong oxidizers (particularly oxygen in gas or liquid form and nitrogen dioxide), strong bases, acetone, sodium/sodium-potassium alloys, magnesium, zinc and aluminum.
Avoid contact with water as the slow formation of hydrochloric acid results.
Attacks natural rubber.
Haloalkenes are highly reactive. Some of the more lightly substituted lower members are highly flammable; many members of the group are peroxidizable and polymerizable.

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Section 11 - Toxicological Information

TOXICITY

Oral (human) LD_{Lo}: 7000 mg/kg
Oral (man) TD_{Lo}: 2143 mg/kg
Oral (rat) LD_{50}: 5650 mg/kg
Inhalation (man) LC_{Lo}: 2900 ppm
Inhalation (human) TD_{Lo}: 812 mg/kg
Inhalation (human) TC_{Lo}: 6900 mg/m^3/10 m
Inhalation (man) TC_{Lo}: 2900 ppm
Inhalation (man) TC_{Lo}: 110 ppm/8h
Inhalation (man) TC_{Lo}: 160 ppm/83 m

See NIOSH, *RTECS* KX 4550000, for additional data.

IRRITATION

Skin (rabbit): 500 mg/24h - SEVERE
Eye (rabbit): 20 mg/24h - SEVERE

Section 12 - Ecological Information

Environmental Fate: No data found.

Ecotoxicity: LC_{50} Sheepshead minnow 20 mg/l/96 hr. /Conditions of bioassay not specified; LC_{50} Mexican axolotl (3-4 wk after hatching) 48 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Clawed toad (3-4 wk after hatching) 45 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Pimephales promelas (fathead minnow) 40.7 mg/l/96 hr (95% confidence limits 31.4-71.8 mg/l) /Flow-through test; EC_{10} Pimephales promelas (fathead minnow) 15.2 mg/l/24 hr; 16.9 mg/l/48 hr; 15.5 mg/l/72 hr; 13.7 mg/l/96 hr; Toxic effect for all concentrations specified: loss of equilibrium. /Flow-through bioassay; Toxicity Threshold (Cell Multiplication Inhibition Test) Scenedesmus quadricauda(green algae) >1000 mg/l /Time not specified, conditions of bioassay not specified; Toxicity Threshold (Cell Multiplication Inhibition Test) Pseudomonas putida (bacteria) 65 mg/l ; LC_{50} Grass shrimp 2 mg/l/96 hr. /Conditions of bioassay not specified

Henry's Law Constant: 1×10^{-2}
BCF: bluegill 17 to 39
Biochemical Oxygen Demand (BOD): 0%, 20 days
Octanol/Water Partition Coefficient: $\log K_{OW} = 2.29$
Soil Sorption Partition Coefficient: $K_{OC} = 2.0$

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.
Reclaim solvent at an approved site.
Evaporate or incinerate residue at an approved site.
Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: TRICHLOROETHYLENE
Hazard Class: 6.1(b)
ID No.: 1710
Packing Group: III
Label: Harmful[6]

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U228 Toxic Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2002-02

Xylene
XYL2260

Section 1 - Chemical Product and Company Identification 54

Material Name: Xylene **CAS Number:** 1330-20-7
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_4(CH_3)_2$
Synonyms: BENZENE,DIMETHYL-; COMPONENT 1 (83%): XYLENES; COMPONENT 2 (17%): ETHYL BENZENE; DIMETHYLBENZENE; DIMETHYLBENZENES; EPA PESTICIDE CHEMICAL CODE 086802; KSYLEN; METHYL TOLUENE; METHYLTOLUENE; VIOLET 3; XILOLI; XYLENE; XYLENEN; XYLOL; XYLOLE
General Use: A strong solvent for general use in the manufacture of paints, varnishes, lacquers, thinners, inks, rubber, pesticides, herbicides and paint strippers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
xylene	1330-20-7	> 95

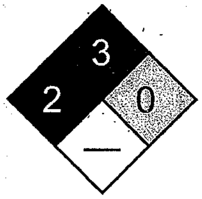
OSHA PEL
TWA: 100 ppm; 435 mg/m^3.

ACGIH TLV
TWA: 100 ppm, 434 mg/m^3;
STEL: 150 ppm, 651 mg/m^3.

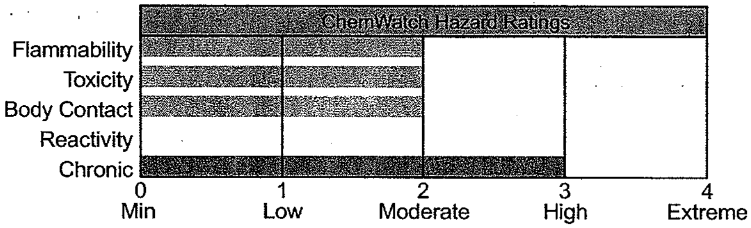
NIOSH REL
TWA: 100 ppm, 435 mg/m^3;
STEL: 150 ppm, 655 mg/m^3.

DFG (Germany) MAK
TWA: 100 ppm, 440 mg/m^3;
PEAK: 200 ppm, 880 mg/m^3;
skin, simple asphyxiant, substances with systemic effects, onset of effect within 2 hours.

Section 3 - Hazards Identification



Fire Diamond



HMIS
② Health
③ Flammability
⓪ Reactivity

ANSI Signal Word
Warning!

Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear, sweet smelling liquid. Irritating to the eyes/skin/respiratory tract. Also causes: dizziness, nausea, and drowsiness. Chronic: dermatitis, kidney/liver/peripheral nerve damage. May cause birth defects based on animal data. Flammable.

Potential Health Effects

Target Organs: central nervous system (CNS), eyes, gastrointestinal (GI) tract, liver, kidneys, skin
Primary Entry Routes: inhalation, skin absorption (slight), eye contact, ingestion
Acute Effects

Inhalation: Xylene is a central nervous system depressant. The vapor is discomforting to the upper respiratory tract and may be harmful if inhaled.
Inhalation hazard is increased at higher temperatures.
Toxic effects are increased by consumption of alcohol.
Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.
If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

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Headache, fatigue, lassitude, irritability and gastrointestinal disturbances (e.g., nausea, anorexia and flatulence) are the most common symptoms of xylene overexposure. Injury to the heart, liver, kidneys and nervous system has also been noted among workers. Transient memory loss, renal impairment, temporary confusion and some evidence of disturbance of liver function was reported in three workers overcome by gross exposure to xylene (10000 ppm). One worker died and autopsy revealed pulmonary congestion, edema, and focal alveolar hemorrhage.

Volunteers inhaling xylene at 100 ppm for 5 to 6 hours showed changes in manual coordination, reaction time and slight ataxia. Tolerance developed during the workweek but was lost over the weekend. Physical exercise may antagonize this effect. Xylene body burden in humans exposed to 100 or 200 ppm xylene in air depends on the amount of body fat with 4% to 8% of total absorbed xylene accumulating in human adipose tissues.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is highly discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Corneal changes have been reported in furniture polishers exposed to xylene.

Skin: The liquid is highly discomforting to the skin and may cause drying of the skin, which may lead to dermatitis and it is absorbed by the skin.

Toxic effects may result from skin absorption.

Open cuts, abraded or irritated skin should not be exposed to this material.

The material may accentuate any pre-existing skin condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Small excess risks of spontaneous abortion and congenital malformation was reported amongst women exposed to xylene in the first trimester of pregnancy. In all cases however the women had also been exposed to other substances.

Evaluation of workers chronically exposed to xylene has demonstrated a lack of genotoxicity. Exposure to xylene has been associated with increased risks of hemopoietic malignancies but, again simultaneous exposure to other substances (including benzene) complicate the picture. A long-term gavage study of mixed xylenes (containing 17% ethyl benzene) found no evidence of carcinogenic activity in rats and mice of either sex.

Exposure to the material for prolonged periods may cause physical defects in the developing embryo (teratogenesis).

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to xylene:

1.Gastrointestinal absorption is significant with ingestions.

For ingestions exceeding 1-2 mL (xylene)/kg, intubation and lavage with cuffed endotracheal tube is recommended.

The use of charcoal and cathartics is equivocal.

2.Pulmonary absorption is rapid with about 60-65% retained at rest.

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3.Primary threat to life from ingestion and/or inhalation is respiratory failure.

4.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.

5.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.

6.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.

7.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.

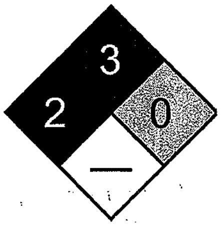
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.

BIOLOGICAL EXPOSURE INDEX - BEI

These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Methylhippuric acids in urine	1.5 gm/gm creatinine	End of shift	
	2 mg/min	Last 4 hrs of shift.	

Section 5 - Fire-Fighting Measures



Fire Diamond

Flash Point: 25.6 °C

Autoignition Temperature: 241 °C

LEL: 1.0% v/v

UEL: 7.0% v/v

Extinguishing Media: Alcohol stable foam; dry chemical powder; carbon dioxide.
Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
Other combustion products include carbon dioxide (CO_2).

Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.

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Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of overexposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights or ignition sources.
Avoid generation of static electricity. DO NOT use plastic buckets.
Ground all lines and equipment. Use spark-free tools when handling.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.
Plastic containers may only be used if approved for flammable liquids.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i.e., to keep exposures below required standards; otherwise, PPE is required.
CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in specific circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.
Personal Protective Clothing/Equipment
Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Barrier cream with polyethylene gloves; Butyl rubber gloves or Neoprene gloves or PVC gloves.
Safety footwear.
Do NOT use this product to clean the skin.
Other: Overalls. Impervious protective clothing.
Eyewash unit.
Ensure there is ready access to an emergency shower.
Glove Selection Index:

PE/EVAL/PE	Best selection
PVA	Best selection
VITON	Best selection
TEFLON	Best selection
PVDC/PE/PVDC	Poor to dangerous choice for other than short-term immersion
NATURAL+NEOPRENE	Poor to dangerous choice for other than short-term immersion
NEOPRENE/NATURAL	Poor to dangerous choice for other than short-term immersion
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion
HYPALON	Poor to dangerous choice for other than short-term immersion
NAT+NEOPR+NITRILE	Poor to dangerous choice for other than short-term immersion
BUTYL	Poor to dangerous choice for other than short-term immersion
BUTYL/NEOPRENE	Poor to dangerous choice for other than short-term immersion
NITRILE	Poor to dangerous choice for other than short-term immersion
NEOPRENE	Poor to dangerous choice for other than short-term immersion
PVC	Poor to dangerous choice for other than short-term immersion

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Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear colorless flammable liquid with a strong aromatic odor; floats on water. Mixes with most organic solvents.

Physical State: Liquid
Vapor Pressure (kPa): 0.5 at 15 °C
Vapor Density (Air=1): 3.66 at 15 °C
Formula Weight: 106.18
Specific Gravity (H_2O=1, at 4 °C): 0.87 at 15 °C
Water Solubility: Practically insoluble in water
Evaporation Rate: 0.7 Bu Ac=1
pH: Not applicable

pH (1% Solution): Not applicable.
Boiling Point Range: 137 °C (279 °F) to 140 °C (284 °F)
Freezing/Melting Point Range: -47 °C (-53 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

TOXICITY
Oral (human) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 4300 mg/kg
Inhalation (human) TC_{Lo}: 200 ppm
Inhalation (man) LC_{Lo}: 10000 ppm/6h
Inhalation (rat) LC_{50}: 5000 ppm/4h
Reproductive effector in rats

IRRITATION
Skin (rabbit):500 mg/24h moderate
Eye (human): 200 ppm irritant
Eye (rabbit): 87 mg mild
Eye (rabbit): 5 mg/24h SEVERE

See NIOSH, *RTECS* ZE 2100000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Most of the xylenes are released into the atmosphere where they may photochemically degrade by reaction with hydroxyl radicals (half-life 1-18 hr). The dominant removal process in water is volatilization. Xylenes are moderately mobile in soil and may leach into groundwater where they are known to persist for several years, despite some evidence that they biodegrade in both soil and groundwater. Bioconcentration is not expected to be significant.
Ecotoxicity: LC_{50} Rainbow trout 13.5 mg/l/96 hr /Conditions of bioassay not specified; LD_{50} Goldfish 13 mg/l/24 hr /Conditions of bioassay not specified
Henry's Law Constant: 0.22
BCF: estimated at 2.14 to 2.20
Octanol/Water Partition Coefficient: log K_{ow} = 3.12 to 3.20
Soil Sorption Partition Coefficient: K_{oc} = 48 to 68

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: XYLENES
Hazard Class: 3.2
ID No.: 1307
Packing Group: III
Label: Flammable Liquid[3]

Additional Shipping Information: XYLOLS

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U239 Ignitable Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001 100 lb (45.35 kg)
SARA 40 CFR 372.65: Listed

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SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

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Attachment E

Incident/Near-Miss Investigation Report

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Incident / Near-Miss Investigation Report

☐ OSHA Recordable	☐ First Aid Injury	☐ Fire	Date of Incident:
☐ Lost Workday Injury	☐ Vehicle Accident	☐ Spill / Leak	
☐ Restricted Duty Injury	☐ Equipment Damage	☐ Near Miss	Incident Number:

Every employee injury, accident, and near miss must be reported within 24 hours of the injury. If the incident results in hospitalization, an immediate report must be made by telephone to the Project Manager and the Health and Safety Officer.

Project Information

Project Name: | Project #

Location of Incident:

Employee

Name: | Employee Number:

Employment Status: ☐ Regular ☐ Part Time | How long in present job?

Injury or Illness Information

Where did the incident / near miss occur? (number, street, city, state, zip):

Employee's specific activity at the time of the incident / near miss:

Equipment, materials, or chemicals the employee was using when the incident / near miss occurred (e.g., the equipment employee struck against or that struck the employee; the vapor inhaled or material swallowed; what the employee was lifting, pulling, etc.):

Describe the specific injury or illness (e.g., cut, strain, fracture, etc.):

Body part(s) affected (e.g., back, left wrist, right eye, etc.):

Name and address of treatment provider (e.g., physician or clinic): | Phone No.:

If hospitalized, name and address of hospital: | Phone No.:

Date of injury or onset of illness: / / | Time of event or exposure: ☐ AM ☐ PM

Did employee miss at least one full shift's work? ☐ No ☐ Yes, 1st date absent (MM/DD/YYYY) / /

Has employee returned to work? ☐ Regular work ☐ Restricted work ☐ No
☐ Yes, date returned (MM/DD/YYYY) / /

To whom reported: | Other workers injured / made ill in this event? ☐ Yes ☐ No

Description of Incident / Near Miss: (Describe what happened and how it happened.)

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Incident / Near-Miss Investigation Report

Motor Vehicle Accident (MVA)

Company Vehicle?	☐ Yes ☐ No						
Accident Location (street, city, state)							
Vehicle Towed?	☐ Yes ☐ No	Other Vehicle?	☐ Yes ☐ No	# Vehicles Towed:		# of Injuries:	

Spill

Material Spilled:	Quantity:	Source:
Agency Notifications:		

Cost of Incident $

Third Party Incidents

Name of Owner:		Address:	Telephone:
Description of Damage:			
Witness Name:		Address:	Telephone:
Witness Name:		Address:	Telephone:

#	Root Cause and Contributing Factors: Conclusion (Describe in Detail Why Incident / Near Miss Occurred)
1	
2	
3	

Root Cause(s) Analysis (RCA):

1. Lack of skill or knowledge.
2. Lack of or inadequate operational procedures or work standards.
3. Inadequate communication of expectations regarding procedures or work standards.
4. Inadequate tools or equipment.
5. Correct way takes more time and / or requires more effort.
6. Short-cutting standard procedures is positively reinforced or tolerated.
7. Person thinks there is no personal benefit to always doing the job according to standards.
8. Uncontrollable.

#	RCA #	Solution(s): How to Prevent Incident / Near Miss From Reoccurring	Person Responsible	Due Date	Closure Date

Investigation Team Members

Name	Job Title	Date

Results of Solution Verification and Validation

Reviewed By

Name	Job Title	Date
	Project Manager	
	Health and Safety Reviewer	

Attachment F

Safe Work Observation Form

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Safe Work Observation (SWO) Form

Observer Name:	**Observer Title:**	**Contractor Company Name:**

Date: __________ **Time:** ____ ☐ **AM** ☐ **PM**	**Project Type / Task Observed:**

Background Information and Miscellaneous Comments

Observer's Positive Comments

Feedback Conducted By		**Date**		**Time**	☐ **AM** ☐ **PM**

Conclusion (Describe in Detail Why the Questionable Item Occurred). Add Any Employee Comments.

Root Cause(s) Analysis (RCA):

1. Lack of skill or knowledge.
2. Lack of or inadequate operational procedures or work standards.
3. Inadequate communication of expectations regarding procedures or work standards.
4. Inadequate tools or equipment.
5. Correct way takes more time and/or requires more effort.
6. Short-cutting standard procedures is positively reinforced or tolerated.
7. Person thinks there is no personal benefit to always doing the job according to standards.
8. Uncontrollable.

Questionable Item #	RCA #	Solution(s): How to Prevent Questionable Behavior From Reoccurring	Person Responsible	Due Date	Closure Date

Results of Solution Verification and Validation

Reviewed by	Date	Reviewed by	Date

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Environmental Operations

Safe Work Observation (SWO) Form

	PRE-TASK PREPARATION	Correct	Questionable	Comments
1.	Are Health and Safety Plan / MSDSs on site?			
2.	Is the employee familiar / trained on task?			
3.	OSHA-required training / medical surveillance?			
4.	Was utility mark out / check performed?			
5.	Was traffic hazard addressed / work area marked?			
6.	Are walking / working surfaces free of hazards?			
7.	Was the tailgate safety meeting performed?			
8.	Was SPSA performed prior to beginning work?			
9.	Communicates intentions to other personnel?			
10.	Knowledge of emergency procedures?			
11.	Distance between equipment and power lines?			
12.	Personal protective equipment?			
13.	Air monitoring equipment on site, calibrated?			
14.	Is a first aid kit / fire extinguisher on site?			
15.	Is one person trained in first aid / CPR?			
16.	Are work zones established and marked?			
	PERFORMING TASK			
17.	SPSA before beginning new task?			
18.	Correct body positioning?			
19.	Proper lifting / pushing / pulling techniques?			
20.	Keep hands / body away from pinch points?			
21.	Are walking / working surfaces kept clear of debris?			
22.	Faces traffic as appropriate?			
23.	Do vehicles / barricades exist to protect against traffic?			
24.	Is the drill rig located properly, blocked / chocked?			
25.	Is the drill rig moved only with derrick lowered?			
26.	Is the excavator located on stable			

	ground?			
27.	Is eye contact made with equipment operator?			
28.	Is spoil at least 2 feet back from edge of excavation?			
29.	Is the excavation shored / sloped / benched?			
30.	Is the excavation entry controlled?			
31.	Are equipment / tools used properly?			
32.	Is electrical equipment connected through GFCI?			
33.	Are power tools handled properly?			
34.	Are electrical cords inspected / in good condition?			
35.	Follows lockout / tagout procedures?			
36.	Air monitoring conducted / action levels understood?			
37.	Was equipment decontaminated properly?			
38.	Were personnel decontaminated prior to eating / drinking / smoking?			
39.	Was the decontamination effective?			
	POST – TASK			
40.	Procedures / JSA adequate?			
41.	Are equipment / tools stored properly?			
42.	Proper storage of soil / water / waste material?			
43.	Is the work area secured?			
44.	Other?			
	Total #			**% Safe:** (Total Correct/[Total Correct + Total Questionable]) * 100]

Attachment G

Completed JSAs

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Job Safety Analysis

JSA Type: ☒ SAR Operations ☐ Transport ☐Office ☐ Construction | New X Revised | Date: 09/30/01

Co: Dept: Div: Org Unit: Loc:

Work Type: Environmental | Work Activity: Monitoring Well Sampling/Gauging

Personal Protective Equipment (PPE):

Minimum PPE is Level D including: safety glasses or goggles, hard hat, steel-toed and shank boots, hearing protection, and gloves (type dependent on job-specific requirements)

Additional PPE may be required in the Health & Safety Plan (HASP). Also refer to the HASP for required traffic control, air monitoring, and emergency procedures.

Development Team	Position/Title	Reviewed By	Position/Title	Date

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). A tailgate safety meeting must be performed and documented at the beginning of each work day. Safe Performance Self Assessment (SPSA) procedures must be used throughout the project. Weather conditions (heat, cold, rain, lightning) must also be considered.

❶ Job Steps	❷ Potential Hazard	❸ Critical Actions
Mobilize with proper equipment/supplies for sampling.	Vehicle accident. Lifting hazards. Delay or improper/unsafe performance of work due to improper equipment onsite. Cross-contamination of wells.	Follow safe driving procedures. Use proper lifting techniques. Review work plan to determine equipment/supply needs. Make sure all sampling/gauging equipment is decontaminated. Bring ice for sample storage. Review HASP and gather necessary PPE.
Gauge water levels and product thickness (where applicable) in wells.	Back strain, inhalation or dermal exposure to chemical hazards, repetitive motion.	Don required PPE, and initiate air quality monitoring in accordance with the HASP. Maintain safe distance from well head. Bend at knees, not waist.
Purge well(s) and collect purge water.	Cross-contamination. Back strain, inhalation or dermal exposure to chemical hazards, slip and fall. Spilling potentially impacted water.	Decontaminate purging equipment between each sampling location (unless disposable). Use proper lifting techniques. Use PPE and monitoring in accordance with HASP. Keep work area clear of tripping or slipping hazards. Store purge water in appropriate containers.
Collect samples in accordance with sampling plan.	Cross-contamination. Back strain, inhalation or dermal exposure to chemical hazards, slip and fall. Improper labeling or storage, injury from broken sample bottle (cuts or acid burn).	Decontaminate sampling equipment between each well (unless disposable). Use proper lifting techniques. Use PPE in accordance with HASP. Label samples in accordance with sampling plan. Keep samples stored in proper containers, at correct temperature, and away from work area. Handle bottles carefully.
Dispose or store purge water onsite.	Back strain. Exposure to contaminants. If disposing through onsite treatment system, damage or injury from improper use of equipment. Improper storage or disposal.	Use proper equipment to transport water (pumps, drum dollies, etc.). Wear PPE in accordance with HASP. Review any necessary instructions for use of onsite treatment systems. Label storage containers properly and locate in isolated area away from traffic and other site functions. Coordinate offsite disposal (where applicable).
Clean site/demobilize.	Safety hazard left on site. Lifting hazard.	Leave site clean of refuse and debris. Use proper lifting technique.
Package and deliver samples to lab.	Bottle breakage, back strain.	Handle and pack bottles carefully (bubble wrap bags are helpful). Use proper lifting techniques.

Job Safety Analysis

JSA Type: ☒ SAR Operations ☐ Transport ☐Office ☐ Construction ☒ New ☐ Revised Date: 08/21/01

Co: Dept: Div: Org Unit: Loc:

Work Type: Environmental Work Activity: Well Repair/Abandonment

Personal Protective Equipment (PPE):

Minimum PPE is Level D including: safety glasses or goggles, hard hat, steel-toed and shank boots, hearing protection, and gloves (type dependent on job-specific requirements)

Additional PPE may be required in the Health & Safety Plan (HASP). Also refer to the HASP for required traffic control, air monitoring, and emergency procedures.

Development Team	Position/Title	Reviewed By	Position/Title	Date

Field staff must review job-specific work plan and coordinate with project manager to verify that all up-front logistics are completed prior to starting work including, but not limited to, permitting, access agreements, and notification to required contacts (e.g. site managers, inspectors, clients, subcontractors, etc.). Additionally, a tailgate safety meeting must be performed and documented at the beginning of each work day. Safe Performance Self Assessment (SPSA) procedures must be used during field activities. Also consider weather conditions (heat, cold, rain, lightning).

❶ Job Steps	❷ Potential Hazard	❸ Critical Actions
Coordinate well repair / abandonment activities.	Traffic hazards, overhead utiltities, property damage	Coordinate with property owner (or designee) to minimize potential conflicts. Review well construction specifications.
Mobilize with proper equipment/supplies for well repair / abandonment activities.	Vehicle accident. Lifting hazards. Delay or improper performance of work due to improper equipment onsite.	Follow safe driving procedures. Use proper lifting techniques. Verify that subcontractors are aware of their responsibilities for labor, equipment and supplies. Review HASP and permit conditions, and gather necessary PPE.
Set up necessary traffic control.	Struck by vehicle during placement. Vehicle accident as a result of improper traffic control equipment placement.	Use buddy system for placing traffic control. Reference traffic control plan section of HASP (may include specific requirements based on permits).
Set up grout mixing and pumping equipment.	Vehicle accident during equipment movement. Damage caused by equipment while accessing set-up location. Overhead utilities and structures. Soft terrain.	Verify clear pathway to work location and clearance for visible utilities. Provide as-needed hand signals and guidance to driver to place equipment. Visually inspect equipment (fire extinguisher on board, no oil or other fluid leaks, associated equipment in good condition, pressurized hoses secured with whip-checks or adequate substitute). Chock wheels.
Set up exclusion zone(s)	Struck by vehicle. Slip/fall hazards.	Implement exclusion zone set-up instructions of HASP. Set up work area with clear walking paths to and from support area(s).
Mix grout	Back strain, eye injury, noise, trip hazard. Equipment failure.	Use proper lifting techniques and PPE. Make sure equipment is in good condition and free of obstructions. Keep pathways from supplies to grout mixer clear of tripping hazards.
Pressure pump grout into well from bottom.	Back strain, eye injury, trip hazard. Failure of pressure hose. Issues associated with non-approved well abandonment procedures.	Use proper lifting techniques and PPE. Make sure equipment and hoses are in good condition and free of kinks or other obstruction. Keep pathways from well supplies to well clear of tripping hazards. Verify authorization by required inspectors for well grouting.
Cut and jack hammer pavement to remove well vault and pavement.	Moving blade, percussion equipment, eye hazards, exhaust from motor, noise, back strain. Traffic hazards.	Wear proper PPE. Employ proper lifting techniques or mechanical assistance. Keep work area clear of debris. Maintain traffic control and face oncoming traffic.
Remove/Repair well vault and pour new concrete/asphalt.	Back strain, eye injury, skin exposure to concrete/asphalt, particulate inhalation, trip hazard. Traffic hazards.	Use proper lifting technique and equipment to install well vault and in concrete preparation. Wear proper PPE . Complete concrete smooth to grade to eliminate trip hazard (if slightly elevated to prevent storm water intrusion, slope concrete skirt gradually). Maintain traffic control and face oncoming traffic.
Store debris properly in accordance with site-specific requirements.	Exposure to public. Traffic hazard or obstruction/inconvenience to station operation. Issues related to improper storage or disposal.	Have proper storage containment and labeling available onsite. Place materials in isolated location away from traffic and other site functions. Coordinate proper disposal offsite (where applicable).

Dispose or store "purge" water (if any) onsite	Back strain. Exposure to contaminants. If disposing through onsite treatment system, damage or injury from improper use of equipment. Improper storage or disposal.	Use proper equipment to transport water (pumps, drum dollies, etc.). Wear PPE in accordance with HASP. Review any instructions for use of onsite treatment systems. Label storage containers properly and locate in isolated area away from traffic and other site functions. Coordinate offsite disposal (where applicable).
Clean site/demobilize	Traffic. Safety hazard left on site. Lifting hazard.	Use buddy system as necessary to remove traffic control. Leave site clean of refuse and debris. Use proper lifting techniques. Clearly mark/barricade any former well heads that need later work or concrete curing. Notify station personnel of departure. Map well repair/abandonment locations, site structures, and location of wastes.

Attachment H

Air Monitoring Form

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Air Monitoring Log

Project:

Date:

Monitoring Instruments:

Air Monitor:

Activity:

Level of Protection:

Time	Location	Instrument Reading	Comments

Attachment I

Health and Safety Inspection Form

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Health and Safety Inspection Form

Project Name:	**Date:**
Project Number:	**Location:**
Prepared By:	**Project Manager:**
Auditor:	**HSS On Site:**

	YES	NO	N/A	COMMENTS
GENERAL				
Is the HASP on site?				
Is the HASP finalized and approved?				
Is the OSHA poster displayed?				
Are emergency telephone numbers posted?				
Is emergency eyewash immediately available?				
Is an emergency shower immediately available?				
Are emergency notification means available (radio, telephone)?				
Is a first-aid kit immediately available?				
Is the first-aid kit adequately stocked?				
Is there a proper sanitation facility on site?				
DOCUMENTATION AND RECORDKEEPING				
Are only personnel listed and approved in the HASP on site?				
Are all personnel properly trained? (Check company-issued wallet cards.)				
Is the daily field log kept by the Site Manager?				
Are levels of PPE recorded?				
Are contaminant levels recorded?				
Are site surveillance records kept by HSS?				
Is a copy of current fit test records on site?				
Are calibration records maintained for air monitoring equipment?				
Are accident / incident forms on site?				
Are field team review sheets signed?				
Are additional hospital route directions available?				
Is the visitors' logbook being accurately maintained?				
Are MSDSs available for all chemicals on site?				
Are HASP revisions recorded?				
Is the first-aid kit inspected weekly?				
Are daily safety meetings held?				
Are emergency procedures discussed during safety meetings?				

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Health and Safety Inspection Form

	YES	NO	N/A	COMMENTS
EMERGENCY RESPONSES				
Is a vehicle available on site for transportation to the hospital?				
Are fire extinguishers on site and immediately available at designated work areas?				
Is at least one person trained in CPR and first aid on site at all times during work activities?				
Do all personnel know who is trained in CPR / first aid?				
PERSONAL PROTECTIVE EQUIPMENT (PPE)				
Is proper PPE being worn as specified in HASP?				
Level of PPE being worn.				
Is PPE adequate for work conditions?				
If not, give reason.				
Upgrade/downgrade to PPE level.				
Does any employee have facial hair that would interfere with respirator fit?				
If yes, willing to shave, as necessary?				
Fit-tested within the last year? (Documentation present)				
If Level B, is a back-up / emergency person suited up (except for air)?				
Does the HSS periodically inspect PPE and equipment?				
Is the PPE not in use properly stored?				
Is all equipment required in the HASP on site?				
Properly calibrated?				
In good condition?				
Used properly?				
Other equipment needed?				
List.				
Is monitoring equipment covered with plastic to minimize contamination?				
PERSONNEL AND EQUIPMENT DECONTAMINATION				
Is the decontamination area properly designated?				
Is appropriate cleaning fluid used for known or suspected contaminants?				
Are appropriate decontamination procedures used?				
Are decontamination personnel wearing proper PPE?				

Is the equipment decontaminated?				

Health and Safety Inspection Form

	YES	NO	N/A	COMMENTS
PERSONNEL AND EQUIPMENT DECONTAMINATION (continued)				
Are sample containers decontaminated?				
Are disposable items replaced as required?				
WORK PRACTICES				
Was proper collection and disposal of potentially contaminated PPE performed?				
Was proper collection and disposal of decontamination fluid performed?				
Is water available for decontamination?				
Is the buddy system used?				
Is equipment kept off drums and the ground?				
Is kneeling or sitting on drums or the ground prohibited?				
Do personnel avoid standing or walking through puddles or stained soil?				
Are work zones established?				
If night work is conducted, is there adequate illumination?				
Is smoking, eating, or drinking in the exclusion or CRZ prohibited?				
To the extent feasible, are contaminated materials handled remotely?				
Are contact lenses not allowed on site?				
Is entry into excavations not allowed unless properly shored or sloped?				
Is a competent person on site during excavation?				
Are all unusual situations on site listed in HASP?				
If not, when?				
Action taken?				
HASP revised?				
CONFINED SPACE ENTRY				
Are employees trained according to 1910.146 – Confined Space Entry?				
Are all confined spaces identified? If not, list:				
Is all appropriate equipment available and in good working order?				
Is equipment properly calibrated?				
Are confined space permits used?				
Are confined space permits completely and correctly filled out?				

*N/A = Not Applicable

Attachment J

Safety Meeting Log

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engineers & scientists

Safety Meeting Log

Project:	**Location:**
Date / Time:	**Activity:**

1. Work Summary

2. Physical Chemical Hazards

3. Protective Equipment/Procedures

4. Emergency Procedures

Does anyone have any medical issues that the rest of us should know about? (For example: allergic to bees or ants and requires an autoinjector)

5. Signatures of Attendees