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September 12, 2005

Mr. Kyle E. Rogers
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USEPA Region 5 - Superfund
77 West Jackson Boulevard
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Chicago, IL 60604-3507

Re: Revised Remedial Investigation/Feasibility Study Work Plan
Lake Calumet Cluster Sites, Chicago, Illinois

Dear Mr. Rogers:

On behalf of the Lake Calumet Cluster Sites Group (the "Group"), enclosed are five copies of the revised Remedial Investigation/Feasibility Study Work Plan for the Lake Calumet Cluster Sites in Chicago, Illinois (RI/FS Work Plan). The RI/FS Work Plan describes the work that will be performed by the Group towards completion of its RI/FS obligations under the provisions of the draft Administrative Order by Consent and Settlement Agreement (AOC/Settlement Agreement) currently being negotiated with the U.S. Environmental Protection Agency (USEPA). The RI/FS Work Plan has been revised from that transmitted to on May 16, 2005 in response to the USEPA comments that you discussed with Jack Kratzmeyer of ARCADIS G&M, Inc. on July 19, 2005 and which USEPA forwarded to the Group via email on August 3, 2005.

Appendix A to the RI/FS Work Plan is the Statement of Work (SOW). As we discussed by telephone on August 30, 2005, we have taken a second look at the SOW and have limited suggested revisions to those items needed to resolve potential conflicts between the RI/FS Work Plan and the SOW and where needed to ensure the SOW is consistent with the most-recent USEPA RI/FS and related guidance. In the re-drafted SOW, we also deleted reference to the Technical Assistance Plan (TAP), as issues related to the TAP are still under discussion in the AOC/Settlement Agreement negotiations.

We trust that this submittal satisfies your requirements at this time. If you have questions regarding this submittal or related project matters, please do not hesitate to contact me.

Respectfully submitted,

Leo M. Brausch
Technical Project Manager
Lake Calumet Cluster Sites Group

LMB:

cc: Lake Calumet Cluster Sites Group
S. M. Franzetti, Esq.

ARCADIS

Infrastructure, environment, buildings

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORK PLAN

LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

ORIGINAL: May 2005
REVISION NO. 1: August 2005

Part of a bigger picture

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Remedial Investigation/ Feasibility Study Work Plan

Lake Calumet Cluster Site
Chicago, Illinois

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Acronyms

ARARs	Applicable or Relevant and Appropriate Requirements
ASTM	American Society of Testing Materials
CERCLA	Comprehensive Environmental Response Compensation, and Liability Act
COPC	Constituent of Primary Concern
COPEC	Constituent of Potential Ecological Concern
DOE	Department of Environment
FS	Feasibility Study
FSP	Field Sampling Plan
Illinois EPA	Illinois Environmental Protection Agency
NCP	National Contingency Plan
RAGS	Risk Assessment Guidance for Superfund
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SITE GROUP	Lake Calumet Cluster Site Group
SOW	U.S. EPA Statement of Work
TAL	Target Analyte List
TBD	To Be Determined
U.S. EPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 Introduction

This Remedial Investigation/Feasibility Study Work Plan (the RI/FS Work Plan) for the Lake Calumet Cluster Site (Site) has been prepared by ARCADIS G&M, Inc. (ARCADIS) on behalf of the Lake Calumet Cluster Site Group (Site Group). The RI/FS Work Plan describes the work that will be performed by the Site Group towards completion of their RI/FS obligations under the terms and conditions of the MONTH 2005 Administrative Order by Consent and Settlement Agreement (AOC) and the Statement of Work (SOW) for the RI/FS at the Lake Calumet Cluster Site.

The Site is located in southeastern Chicago, Illinois, southeast of Lake Calumet and approximately two (2) miles northeast of Hegewisch, Illinois (Figure 1-1). The Site consists of the parcels commonly referred to as the Alburn/American Incineration, Inc., Site (Alburn Site); the U.S. Drum II Site, the Unnamed Parcel(s) Site; and a portion of the Paxton Avenue Lagoons site (Paxton Lagoons). The U.S. EPA conducted an emergency removal at the Paxton Lagoons in 1990, removing 60 drums of hazardous materials and 2,200 cubic yards of acidic soil. In or about 1992, the Paxton Lagoons parcel was closed by the Illinois Environmental Protection Agency (Illinois EPA) by drainage of the lagoons, thermal treatment of selected soils, and construction of an engineered clay cap over the closed lagoons. IEPA also constructed a pond on the southern border of the Paxton Lagoons site.

Extensive soil, surface water, and groundwater sampling have been conducted by the U.S. EPA, the City of Chicago Department of the Environment (CDOE) and the Illinois EPA at the Cluster Site to determine the extent of contamination. The results of the sampling were obtained in accordance with data Quality Assurance/Quality Control (QA/QC) procedures accepted by the U.S. EPA. The past work performed by the U.S. EPA, the CDOE and the Illinois EPA was considered during development of this RI/FS Work Plan.

The RI/FS Work Plan describes the additional site characterization activities needed to supplement the existing Site data in order to define the nature and extent of impacted media and perform a feasibility study to evaluate a focused list of potential remedial alternatives. The existing data are considered to have adequately defined the nature and extent of affected media at the Site for the purpose of evaluating potential remedial alternatives with the exception of groundwater. ARCADIS has reviewed the previous site characterization reports and identified a number of groundwater data gaps. The purpose of this RI/FS Work Plan is to supplement the existing groundwater data so that

groundwater flow, chemical constituent behavior, and geochemical conditions at the Site can be evaluated.

The RI/FS Work Plan has been organized into six sections. A brief description of each of the sections is provided below:

Section 1.0 – Introduction. The introduction addresses the purpose of the RI/FS Work Plan and the RI/FS Work Plan organization.

Section 2.0 – Background. The background section discusses the location, land use, and the physical setting of the Site. The background data reviewed includes Site geology, hydrogeology, and groundwater quality data. It also provides a brief summary of groundwater monitoring analytical results and identifies data gaps.

Section 3.0 – Remedial Investigation Activities. This section describes the remedial investigation tasks to be completed including installation of groundwater monitoring wells, site topographic survey, and groundwater sampling and analysis.

Section 4.0 – Remedial Investigation/Feasibility Study Report. This section describes the components of the RI and FS that will be addressed in the RI/FS Report.

Section 5.0 – Project Organization and Schedule. This section identifies the key personnel and organizations involved with the Lake Calumet Cluster Site RI/FS. This section also provides a preliminary schedule for the RI/FS activities.

Section 6.0 – References. This section lists documents that have been included or discussed in this report.

The supporting RI/FS documents, including a Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP), and a Health and Safety Plan (HSP) are provided as appendices to this RI/FS Work Plan. In addition, a copy of the SOW has been included for reference as Appendix A to the RI/FS Work Plan.

2.0 Background

This section provides a brief summary of Site conditions, Site groundwater, and overland flow. The information for this section was obtained through a review of Site-related reports listed in Section 6.0.

2.1 Location and Land Use

As previously stated, the Site is located in southeastern Chicago, Illinois, southeast of Lake Calumet and approximately two miles northeast of Hegewisch, Illinois (Figure 1-1). The Site is approximately 88-acres in size and consists of an aggregation of three separate parcels and portions of a fourth parcel. The Site as a whole has not been surveyed, nor have the parcels that make up the Site been surveyed. Accordingly, the size of the Site, and the size of each parcel within the Site, is an estimate.

The property is bounded to the west by Land and Lakes #3 Landfill, Paxton II Landfill to the northwest, Paxton I Landfill to the north, the Norfolk Southern Railroad right-of-way and Indian Ridge Marsh to the east, and 122nd Street to the south. The boundary with Paxton I Landfill to the north is not clearly defined by a fence line, differential land uses, or topographic inclination. A Site Plan is presented on Figure 2-1.

2.2 Physical Setting

The Site occupies approximately 88-acres of topographically level land. The Site slopes slightly to the east with occasional depressions and swampy areas across the Site. An open water pond previously existed at the Paxton I Landfill site. The pond at Paxton I has been filled in by the Illinois EPA as part of on ongoing cap construction project north of the Site. A smaller pond is present in the southeastern corner of the LCCS Site. An access road to the Paxton I and II landfill sites traverses north-south through the Site from 122nd Street. Vegetation on the Site ranges from sparse weeds and grasses, with very poor coverage, to very dense, tall Johnson grass in the northeastern quadrant. The Indian Ridge Marsh is located east of the Site.

2.2.1 Climate

The area climate is characteristic of the northern mid-continent. The National Climate Data Center has gathered mean temperatures and precipitation data at Chicago's Midway Airport and the data is provided on the Midwestern Climate Center website (Midwestern Climate Center 2000). Based on data collected from 1971 to 2000, the coldest mean monthly temperature is in January (23.5 °F) and the warmest mean monthly temperature is in July (75.5 °F). The mean annual temperature is 51 °F. The average annual precipitation is 38.25 inches.

2.2.2 Regional Geology

The Site is located within the Chicago/Calumet Lacustrine Plain, which is a glacially formed, low crescent-shaped flat surface that slopes gently to Lake Michigan which is located two miles east of the Site. The Lacustrine plain is primarily a wave-scoured ground moraine with fine lake silts and clays covering the surface in former back-barrier settings. Prominent depositional features on the plain are sand and gravelly sand spits, mainland beaches, and beach-ridge/dune complexes. This lowland region drains into Lake Michigan. The bedrock geology consists of Precambrian-age crystalline rock overlain by gently dipping Paleozoic sedimentary bedrock units. The uppermost bedrock consist of eastward gently dipping Silurian dolomite. The bedrock surface topography is an undulating plain as a result of glacial and some lake erosion in which scattered steep valleys and low bedrock hills occur. The bedrock is overlain by approximately 50 to 100 feet of unconsolidated Quaternary-age deposits. The Site is filled with a dark gray, silty clay till that is correlative to the Wadsworth Foundation.

2.2.3 Local Geology

Investigative activities indicate the following stratigraphy is present at the Site: the lowermost unit is composed of gray/brown silty clay with trace fine sand and gravel. Gray silty sand composed of varying percentages of medium to fine grained sand with silt exhibiting brown to gray characteristics overlays the silty clay unit. Fill composed of various and household wastes overlays the silty sand unit. A maximum thickness of 23 feet of fill was encountered during monitoring well installation activities at the Site. The solid waste found throughout the Site varied from industrial/demolition debris (i.e., metal pieces, bricks, tires, wood, concrete, cinders, etc.), to household waste (i.e., garbage bags newspapers, clothing, shoes, rags, etc.).

2.2.4 Regional Hydrogeology

The four (4) primary aquifers recognized in the Chicago area are: 1) the Sand and Gravel Aquifers within the Glacial Drift, 2) the Shallow Bedrock Aquifers mainly Silurian in age, 3) the Cambrian-Ordovician Aquifer, and 4) the Mt. Simon Aquifer. The uppermost aquifer system identified in the vicinity of the Site is the Glacial Drift Aquifer within the Sand and Gravel Aquifer consisting of sands overlaying and interbedded with glacial till.

2.2.5 Local Hydrogeology

Previous investigative reports have suggested that the fill aquifer at the Site is semi-confined and has a vertical head between one to four feet. The water table is generally at shallow depths and has been encountered two feet below ground surface (bgs) during some investigation activities. Groundwater has been inferred to discharge to the Indian Ridge Marsh to the east and the Big Marsh to the north based on radial contours constructed by Ecology and Environment (E&E) in their 1999 report.

Additional groundwater elevation contours were constructed as part of the Illinois EPA groundwater monitoring activities performed during 2002. The Illinois EPA monitoring event included wells from the Paxton II and Land and Lakes Landfill. Accordingly, a greater number of wells were used to create groundwater contours in the area surrounding the Site. Groundwater flow direction was shown to be to the east and southeast within the Site boundaries.

The hydraulic gradient estimated from both sets of contour maps ranges from 0.004 feet per foot (ft/ft) (E&E 1999) to 0.007 ft/ft (Illinois EPA 2002a). No hydraulic conductivity tests have been conducted at the Site.

2.3 Site Soil

Previous site investigations have been conducted to characterize the nature and extent of impacts to soil and sediment at the Site (i.e., Alburn, U.S. Drum, and Unnamed Parcels). These investigations included Phase I, Phase II, and Phase III samplings conducted by USEPA's contractor Ecology and Environment, Inc. (E&E), USEPA and a comprehensive site investigation conducted by Harza Engineering Company in 2001.

Phase I sampling activities were conducted between August and September 1998 by E&E, USEPA, and IEPA. Sampling included determining the location of site features and potential sample locations using global positioning systems (GPS), screening metal concentrations in surface soils using x-ray fluorescence (XRF), and collecting samples of surface soils, subsurface soils, sediments, surface water, groundwater, and macroinvertebrates. Access to the Alburn Parcel was not available at that time; therefore, no samplings were conducted at this area (E&E, 1999).

The geographic locations of site features, including parking lots, roads and fence lines, and potential sample locations were demarcated using GPS and screened using XRF. Screening was conducted for arsenic, chromium, cobalt, copper, lead, manganese,

mercury, molybdenum, nickel, rubidium, strontium, and zinc. Sampling activities included collection of 84 surface soil samples, 5 subsurface soil samples, 3 groundwater samples, and 8 surface water, sediment, and macroinvertebrate samples.

Samples were analyzed for total metals, toxicity characteristic leaching procedure metals (soil only), volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides, PCBs, and pH.

Phase II activities included the installation of twelve monitoring wells by E&E in April 1999. The new wells were completed to depths of 14 to 16 ft bgs except for two locations, which were completed to 20 ft bgs. The 12 new wells and 6 existing wells were sampled in May 1999 using purge and bail methodology for total metals, VOCs, SVOCs, pesticides, PCBs, and nitrogen. Field parameters collected included groundwater temperature, dissolved oxygen, specific conductivity, oxidation-reduction potential, and pH.

Phase III sampling was performed between May and June 1999 and included the following: sampling at Alburn to address data gaps from Phase I; obtaining additional surface and subsurface soil data near areas of elevated concentrations identified during Phase I; collecting additional surface water and sediment samples at or near Alburn; and collecting nitrogen data from previous surface water locations. Soil samples included 39 surface samples, 15 subsurface samples between 2 and 3 ft bgs, and 15 subsurface samples between 4 and 6 ft bgs. Samples were analyzed for total metals, VOCs, SVOCs, pesticides, PCBs, and pH. Four surface water samples collected from ponded water in and near Alburn were analyzed for total metals, VOCs, SVOCs, pesticides, PCBs, and pH. Sixteen surface water samples were collected for nitrogen analysis (four in Alburn, eight in Indian Ridge Marsh, and four from on-site ponds). Seven sediment samples in and near Alburn were analyzed for total metals, VOCs, SVOCs, pesticides, and PCBs.

In 2000, comprehensive site investigation activities were conducted at Alburn, the Unnamed Parcel, and U.S. Drum and reported in *Comprehensive Site Investigation Report*. The investigation activities consisted of using a backhoe to sample a total of 134 test pits, including 44 test pits in Alburn, 39 test pits in the Unnamed Parcel, and 51 test pits in U.S. Drum. Two or more soil samples were collected from each of the 134 test pit locations in the three areas. Samples were analyzed for inorganics, VOCs, SVOCs, pesticides/herbicides, and PCBs. Dioxins were also analyzed in some locations.

2.4 Site Groundwater

E&E installed several monitoring wells at the Site (LC01 through LC07 and LC09 through LC13) in April 1999 to supplement an older monitoring network (P01 through P05) that previously had been installed at the Alburn parcel of the Site and monitoring well G21S that had been installed at the U.S. Drum parcel of the Site. Monitoring wells LC02 and LC11 were installed with screens completely within native soils. Monitoring wells LC01, LC03, LC06, LC10, LC13, and P02 were installed with their screens completely within fill material. The remaining wells (LC04, LC05, LC07, LC09, LC12, P01, P03, and P04) were screened across the fill/native soil interface. No boring logs are available for monitoring wells P05 and G21S. Three nested couplets were created as part of the 1999 groundwater investigation using newly installed and previously existing monitoring wells. These couplets are comprised of P05/LC07, LC09/LC10, and LC11/LC12. The approximate locations of these monitoring wells are shown on Figure 2-2. A summary of monitoring well locations, depths, and screened intervals can be found in Table 2-1.

Additional monitoring wells appear to be located in areas surrounding the Site (Illinois EPA 2002a) including well cluster G21S and G21D north of the U.S. Drum parcel, Monitoring Well G22D near P01, G26D north of the U.S. Drum parcel and G130B located north of the Alburn parcel. The locations of these wells are also shown on Figure 2-2. In addition, several monitoring wells are located upgradient of the Site on the Land and Lakes site (not shown on Figure 2-2).

2.4.1 Groundwater Monitoring Activities

Three Geoprobe® water samples were collected in 1998 by E&E. The locations of the Geoprobe® samples (GW1-GW3) are shown on Figure 2-2. A total of 18 monitoring wells (P01 through P05, LC01 through LC07, LC09 through LC13, and G21S) were subsequently sampled by E&E in 1999. The Illinois EPA performed an additional groundwater sampling event in 2002 sampling many of the same wells that had been sampled in 1999, as well as a number of off-site wells. Table 2-2 summarizes the laboratory analytical results for volatile organic compounds (VOCs) for the prior groundwater sampling events.

2.4.2 Groundwater-Surface Water Interaction

Roadcap et. al. (1999) has reported that the interaction between groundwater at the Site and the adjacent wetlands is complicated due to the extreme heterogeneity of the fill

material that is present. Roadcap et. al. (1999) reported that studies performed in the area surrounding Indian Ridge Marsh showed that macropore systems have developed within the fill that appear to have a hydraulic conductivity greater than that of the surrounding fill and underlying deposits. These preferential pathways were shown to manifest in Indian Ridge Marsh as springs regularly spaced 12 to 20 meters apart. Flow in the springs increased between six and 16 hours after a storm event.

Discharge into Indian Ridge Marsh from groundwater was observed during a period where water in the Marsh pools was frozen (Roadcap 1999). Areas along the bank that were free of ice or covered by thinner layers of ice were reported as areas where the discharge of warmer groundwater was occurring. The main area of groundwater inflow was along the middle third of the western property boundary of the north pool (between 118th and 120th Streets if they existed). Figure 2-1 provides the locations of the area streets if they existed.

Surface water sampling was conducted in Indian Ridge Marsh along the eastern site boundary to determine whether this area is impacted by groundwater discharge. A summary of the results of laboratory analysis for VOCs for surface water samples collected from Indian Ridge Marsh is provided in Table 2-3. The locations of the surface water samples (SW01-SW11 and SW18-SW19) are shown on Figure 2-2.

2.4 Overland Flow

Three culverts are reportedly located beneath the railroad tracks approximately one block north of 116th Street (Roadcap et. al. 1999). These culverts carry runoff from an on-site drainage area estimated to be roughly 13-acres in size. Flow from the culverts was measured to exceed five cubic feet per second (cfs) during large storm events.

The Illinois EPA (2001) reported overland flow from the U.S. Drum parcel occurred to the east towards a drainage ditch that runs adjacent to the railroad tracks. The water in the ditch was reported to flow through a pipe into the Indian Ridge Marsh. The location of the pipes was not identified in the report. In a separate document, the Illinois EPA (2001) stated that field observation of the Alburn parcel indicated storm water runoff would discharge from the Site's northeastern corner to a drainage ditch that runs along the southern side of 119th Street.

3.0 Site Characterization Tasks

The Site characterization tasks included in this RI/FS Work Plan were developed based on a review of the currently available data. Based on this review, the additional data and evaluation required to define the nature and extent of impacted media at the Lake Calumet Cluster Site have been identified. Additional site investigation is necessary to further characterize existing groundwater conditions at the Site. Several groundwater flow directions have been suggested at the Site. Radial groundwater flow was suggested by E&E in its 1999 report. In the 1999 report, E&E depicted groundwater flow towards the Indian Ridge Marsh (east) and the Big Marsh (north). Additional groundwater elevations contours were constructed in 2002 by the Illinois EPA using a greater number of wells (Illinois EPA 2002a). Groundwater flow direction was shown to be to the east and southeast within the Site boundaries. Accordingly, three potential groundwater flow directions have been indicated within the Site boundaries.

This section of the RI/FS Work Plan includes a description of the number, types, and locations of samples to be collected. The RI/FS Work Plan includes a data review and collection program to accomplish the following site investigation activities:

- Data Gap Identification;
- Monitoring well installation;
- Monitoring well elevation survey;
- Groundwater monitoring;
- Hydraulic testing; and
- Test trench groundwater sampling

The Site Characterization tasks described below will be performed in accordance with the FSP (see Appendix B), the QAPP (see Appendix C) and the HSP (see Appendix D). This section of the RI/FS Work Plan includes a description of the number, types, and locations of samples to be collected.

3.1 Data Gap Identification

As discussed in Section 2.3, Site groundwater data as presented in the E&E 1999, Harza 2001, and Illinois EPA 2001 Reports was reviewed during development of this RI/FS Work Plan to determine data gaps in the existing groundwater data set. ARCADIS identified gaps or areas for further study in the groundwater flow behavior

analysis and constituent behavior and biochemical condition analysis of on-Site groundwater. In addition to conducting the additional groundwater investigations, described in this RI/FS Work Plan new groundwater data from other sources, if available, will be reviewed and incorporated into the site characterization tasks as appropriate.

3.2 Monitoring Well Installation

Eight new groundwater monitoring wells and one piezometer will be installed to supplement the current monitoring well network at the Site. The objective of the additional monitoring wells is to refine groundwater flow direction information, evaluate natural attenuation rates within the surficial water bearing zone, and assess groundwater conditions along the south-southeast Site boundary. A minimum of three points along the groundwater flow path are required to complete the degradation rate analysis. Three proposed monitoring well locations were selected to ensure three points exist along each of the three potential flow paths. The existing and proposed wells will form three transects, each located along a potential groundwater flow direction. One new monitoring well also will be installed upgradient of the Site to assess upgradient groundwater quality and potential influence of off-Site groundwater on groundwater conditions. Four proposed monitoring wells locations were selected to assess groundwater along the south-southeastern Site boundary. A piezometer will be installed in the southwestern portion of the Site for groundwater elevation information. The proposed monitoring well locations, the locations of existing monitoring wells to be included in the RI, and potential groundwater flow directions are shown on Figure 2-3.

The first transect will follow the potential northeasterly flow direction and will be comprised of monitoring wells LC07, P02, and proposed well LC14 to be installed as the down gradient point of the northeastern transect. The second transect (to follow the potential easterly groundwater flow direction) will be comprised of monitoring well LC07, LC10, and proposed well LC15. Monitoring well LC12 may also be used within the second transect once a groundwater gradient and flow path direction have been verified in this portion of the Site. The third transect will evaluate the potential southeasterly component of groundwater flow. This transect will be comprised of LC07, proposed well LC16, and LC04.

One monitoring well (LC17) will be installed upgradiant of the Site west of the Paxton Lagoons. The objective of the off-Site monitoring well is to assess upgradiant groundwater quality and potential influence of off-Site groundwater on groundwater

conditions. This well will be screened in the surficial water bearing zone. Four monitoring wells (LC18 to LC21) will be installed along the south-southeastern Site boundary in order to assess groundwater conditions in the southern portion of the Site. One piezometer (PZ01) will be located in the southwestern portion of the Site for groundwater elevation data.

In addition to the installation of the proposed monitoring wells, an inventory of the existing monitoring well network will be conducted to verify the integrity of the existing monitoring wells and determine if any of the wells should be redeveloped before they are sampled. The existing well inventory will include monitoring wells P01, P02, P04, P05, LC07, LC10, LC12, and LC04. Replacement wells will be installed if any damaged wells that are identified are determined to be necessary to meet the objectives of the RI/FS Work Plan.

3.3 Monitoring Well Elevation Survey

A Site survey incorporating the wells shown on Figure 2-3, including top of casing elevation, ground surface elevation will be performed following completion of the monitoring well installation task.

3.4 Groundwater Monitoring

Groundwater samples for chemical analysis will be collect from twelve (12) on-Site monitoring wells and one off-Site monitoring well to determine constituent behavior and biogeochemical conditions within the proposed groundwater flow transects. Groundwater samples will be analyzed for low flow parameters, VOCs, light gases, and inorganic parameters. Low flow parameters will include dissolved oxygen, pH, conductivity, temperature, and oxidation-reduction potential. Light gases include methane, ethane, and ethene. Inorganic parameters will include nitrate, total and dissolved iron, sulfate, sulfide, ammonium, total suspended solids (TSS), and total Target Analyte List (TAL) metals. The Site groundwater monitoring will occur in a single groundwater monitoring event. Prior to groundwater sampling, a contemporaneous round of groundwater elevation measurements will be collected from all existing, new or replacement monitoring wells and the new piezometer at the Site.

3.5 Hydraulic Testing

An accurate estimate of the groundwater velocity is necessary to analyze Site data for natural attenuation processes and to design and implement enhancements to expedite

degradation rates, if necessary. In order to estimate the hydraulic conductivity of the fill, silty-sand and sandy surficial geologic material at the Site, hydraulic conductivity tests will be conducted. In-situ hydraulic conductivity (slug) tests will be conducted at new and existing wells to estimate the hydraulic conductivity of the geologic materials adjacent to the screened interval of the wells.

Slug tests measure the hydraulic response of the geologic materials adjacent to the screened interval of the well to a near-instantaneous withdrawal event. Slug-in/slug-out or repeat slug out (for water table wells) will be performed at each well. Each test will use a slug consisting of a five-foot long, ½-inch diameter solid plastic cylinder. A slug-in test will be performed by rapidly lowering the slug, causing a near-instantaneous rising of the water level. Water level and elapsed time will be recorded on a log-scale using a Hermit™ data logger and pressure transducer during the equilibration of the water level. A slug-out test will be performed by rapidly raising the slug out of the well, causing a lowering of the water table, and allowing the water level to equilibrate to static conditions. Water level and elapsed time will be recorded on a log-scale using a Hermit™ data logger and pressure transducer during the recovery of the water level to pretest levels.

3.6 Test Trench Groundwater Sampling

In order to assess groundwater quality at the interface between the Site and the Indian Ridge Marsh, one groundwater sample (LCT01) will be collected from an open test trench. The trench will be approximately ten feet long, two feet wide, and five feet deep. The trench will be dug along the northeast boundary of the Site at the approximate location shown on Figure 2-3. The water sample collected from the trench will be analyzed for VOCs, light gases, and inorganic parameters. Inorganic parameters include nitrate, total and dissolved iron, sulfate, sulfide, ammonium, TSS, and total TAL metals.

Tasks to be conducted after Site characterization has been completed include:

- Remedial Investigation Report (see Section 4.0);
- Baseline Human Health and Ecological Risk Assessments (see Sections 4.1 and 4.2); and
- Feasibility Study (see Section 6.0).

These tasks are discussed in greater detail in the following sections.

4.0 Remedial Investigation Report

At the conclusion of the RI activities at the Site, a comprehensive RI report will be prepared to present and evaluate the existing and supplemental site characterization data collected under this RI/FS Work Plan. The RI Report will be prepared in compliance with requirements and guidance for RI/FS studies and reports, including but not limited to U.S. Environmental Protection Agency (U.S. EPA) Superfund *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (USEPA 1988) (RI/FS Guidance), and other guidance that the U.S. EPA uses in conducting or submitting deliverables for a RI/FS, as appropriate. The RI Report will include a summary of available historical data, a discussion of the RI site characterization activities outlined in Section 3.0 of this RI/FS Work Plan, the results of the RI activities, a Human Health Risk Assessment (HHRA), and an Ecological Risk Assessment (ERA). A tentative outline for the RI Report is provided in the SOW (see Appendix A). Additional details regarding the HHRA and ERA components are provided below.

4.1 Human Health Risk Assessment

This HHRA will be conducted in accordance with U.S. EPA and Illinois EPA guidance including:

- Risk Assessment Guidance for Superfund (RAGS) – Parts A, D, and E (USEPA 1989, 1998a, 2004);
- Supplemental Guidance to RAGS: Calculating the Concentration Term (USEPA 1992a);
- The Lognormal Distribution in Environmental Applications (USEPA 1997a);
- Exposure Factors Handbook (USEPA 1997b); and
- Tiered Approach to Corrective Action Objectives (TACO), Ill. Adm. Code Title 35, Part 742.

Consistent with guidance developed by U.S. EPA (1989), the HHRA will include the following basic components: hazard identification, exposure assessment, toxicity assessment, and risk characterization. Hazard identification includes the analysis of relevant Site data and the identification of constituents of potential concern (COPCs). The exposure assessment identifies exposed populations and potential exposure pathways, estimates exposure point concentrations, and calculates doses for each pathway. The toxicity assessment provides a compilation of quantitative and

qualitative toxicity information about each COPC and identifies toxicity values descriptive of the dose-response relationships. Finally, the risk characterization estimates and summarized the cancer risks and noncancer hazards for each exposure pathway and population. In addition, the HHRA will describe the degree of certainty and conservatism associated with each component of the HHRA.

4.2 Ecological Risk Assessment

The purpose of the ERA will be to evaluate potential risks associated with exposure of aquatic biota and representative wildlife receptors to chemicals in surface soil, surface water, sediment, and biota on or adjacent to the Site. As such, it will provide a baseline evaluation of the nature and geographical extent of the possible ecological risks, based on current knowledge of environmental conditions, chemicals of interest, and ecological receptors in the study area.

The objectives of the ERA will be to:

- Identify chemicals in environmental media (surface soil, surface water, sediment, and biota tissue) that may pose a significant risk of adverse effects to ecological receptors (chemicals of potential ecological concern or COPECs);
- Identify potentially exposed receptors of interest (ROIs) and potentially complete exposure pathways to COPECs in environmental media.
- Assess and quantify the potential risks associated with each complete exposure pathway for representative ROIs; and
- Summarize the nature and spatial extent of possible risks to ROIs.

The ERA will follow relevant USEPA guidance, including:

- Framework for Ecological Risk Assessment (USEPA 1992b);
- Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments (USEPA 1997c); and
- Guidelines for Ecological Risk Assessment (USEPA 1998b).

Consistent with the conceptual framework for ERA developed by USEPA (1992c), the ERA will be organized into three major components: problem formulation, analysis (exposure characterization and effects characterization), and risk characterization:

- *Problem formulation* is a process to define the specific issues addressed in the ERA. It describes: a) ecological resources at the Site; b) representative ROIs, COPECs, and complete exposure pathways; c) a conceptual site model that establishes the exposure pathways that will be evaluated in the ERA and defines the relationships among endpoints; and d) assessment and measurement endpoints specifying the goals of the ERA.
- *Analysis* will include: a) exposure characterization, which quantifies the concentrations or doses of COPECs that ROIs might contact via each identified exposure pathway based on measured concentrations of COPECs; and b) effects characterization, which quantifies the concentrations or doses of COPECs that might be associated with adverse effects in ROIs.
- *Risk characterization* is the integration of the exposure and effects information to identify the nature and spatial extent of potential risks, if any. The quantitative results of the risk estimation process will be considered in light of site-specific considerations and uncertainties in the exposure and effects assessments.

Collectively, these components of the ERA are intended to provide a scientifically sound framework to support environmental management decisions. Using this framework, the ERA will evaluate the nature and spatial extent of possible ecological effects based on current knowledge of environmental conditions at the Site.

5.0 Treatability Studies

No treatability studies are proposed in this Work Plan, and as such there are currently no data requirements for treatability studies. As stated in Task 4 of the SOW, *"If determined to be necessary by U.S. EPA or the Respondents, treatability testing will be performed by the Respondents to evaluate a specific remedial approach of technology provided for in the FS".* If, using the above-described mechanism, it is determined that one or more treatability studies will be undertaken, a literature review will be conducted first to gather information on performance, relative costs, applicability, treatment efficiencies, operation and maintenance (O&M) requirements and implementability of any candidate technology.

If practical candidate technologies have not been demonstrated, or cannot be adequately evaluated for this Site on the basis of available information, a Treatability Study Work Plan would then be prepared for U.S. EPA review and approval. If necessary, candidate technologies for a treatability studies program will be identified in a Candidate Technologies and Testing Needs Technical Memorandum that will be

prepared following submittal of the draft RI Report. to U.S. EPA. The list of candidate technologies will cover the range of technologies required for alternatives analysis. The specific data requirements for the treatability testing program, if required would be refined during Site characterization and the development and screening of remedial alternatives.

6.0 Feasibility Study Report

Upon completion of the RI Report, a FS will be conducted in order to develop and screen an appropriate range of remedial alternatives which incorporate the findings of the RI Report including the HHRA and ERA. The FS Report will also provide information necessary for the U.S. EPA to prepare relevant sections of the Record of Decision (ROD) for the Site. The information required is outlined in Chapters 6 and 9 of U.S. EPA's *A Guide to Preparing Superfund Proposed Plans, Records of Decisions, and Other Remedy Selection Decision Documents* (USEPA 1999). A tentative outline for the FS Report is provided in the SOW (Appendix A).

7.0 Project Organization and Schedule

7.1 Project Organization

The section describes project organization, responsibilities of the project team, progress reports, and schedule.

The organizational structure of the project is shown on Figure 5-1 and is as follows:

U.S. EPA Project Coordinator: Kyle Rogers of the Superfund Division, Region 5 is the designated U.S.EPA Project Coordinator. The U.S.EPA Project Coordinator also has the authority of the Remedial Project Manager (RPM) and On-Scene Coordinator (OSC) as provided by the National Contingency Plan (NCP).

RI/FS Project Manager: ARCADIS

ARCADIS shall serve as the RI/FS Project Manager. As Project Manager, ARCADIS has the overall responsibility for implementing the RI/FS Work Plan.

7.2 Responsibilities of Project Team

The key ARCADIS project personnel and their responsibilities are as follows:

Project Manager: Jack Kratzmeyer

- Management of ARCADIS project team;
- Meetings with Site Group and U.S. EPA;
- Coordination of technical task leaders;
- Data evaluation;
- Preparation and review of Work Plan and related plans; and
- Technical representation of project activities.

Technical Task Managers

The ARCADIS technical task leaders are responsible for the task-specific aspects of the RI/FS Work Plan and related plans. The task leaders report to the project manager. The task leaders are as follows:

Health and Safety	Mija Coppola
Project Engineering	Darren Quillen
Hydrogeology	Todd O'Brien
Risk Assessment	Miranda Henning
Database	TBD

7.3 Progress Reports

In accordance with Task 6 of the SOW, monthly progress reports will be submitted to U.S. EPA by the 15th day of the following month during periods of active field activities. These reports will include the following information:

- A description of any significant developments during the preceding period;
- Results of sampling and tests and all other data received, or reference other submittals if the results and data were submitted under separate cover (the progress report will note that the data are unreviewed and unvalidated and therefore considered to be preliminary);
- A description and schedule for the work planned for the next reporting period; and

- A description of all problems encountered, any anticipated problems, any actual or anticipated delays, and solutions developed and implemented to address any actual or anticipated problems or delays.

7.4 Schedule

A tentative schedule for tasks associated with the RI/FS is outlined below

RI REPORT: The RI Report, including HHRA and ERA, is due 120 calendar days following the receipt of analytical data following completion of the last field sampling event under the RI/FS Work Plan.

FS REPORT: The FS Report, including Remedial Action Objectives and Comparative of Analysis Alternatives, is due within 90 days of U.S. EPA's approval of the RI Report.

MONTHLY PROGRESS REPORTS: On the 15th day of each month or the first business day after the 15th of the month, monthly progress reports shall be submitted to the U.S. EPA

8.0 References

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Harza. 2001, Final Comprehensive Site Investigation Report, Lake Calumet Cluster Site: Alburn, U.S. Drum and Unnamed Parcel Area, August

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TABLES

Table 2-1. Existing Monitoring Well Construction Information
Lake Calumet Cluster Site, Chicago, Illinois

MW ID	Install Date	Well Location	Depth of Completion (ft bgs)	Upper (ft bgs)	Lower (ft bgs)	Screened Unit Classification
LC01	22-Apr-99	N of Paxton I	16	5	15	Shallow Fill
LC02	23-Apr-99	N of US Drum	16	4	14	Shallow Sand/Silt Clay
LC03	23-Apr-99	N of US Drum	15	4.5	14.5	Shallow Fill
LC04	21-Apr-99	US Drum	16	5	15	Shallow Fill
LC-05	26-Apr-99	US Drum	16	5	15	Shallow Fill
LC06	26-Apr-99	US Drum	15	5	15	Shallow Fill
LC07	21-Apr-99	Alburn	14	4	14	Shallow Fill
LC09	20-Apr-99	Alburn	20	15	20	Shallow Fill
LC10	20-Apr-99	Alburn	15	5	15	Shallow Fill
LC11	19-Apr-99	US Drum	20	14	19	Shallow Sand/Silt Clay
LC12	20-Apr-99	US Drum	15	5	15	Shallow Sand/Silt Clay
LC13	21-Apr-99	Unnamed Parcel	16	5	15	Shallow Fill
P01	02-Oct-90	Alburn	20.5	10.4	19.8	Shallow Fill
P02	03-Oct-90	Alburn	20.5	10.5	20	Shallow Fill
P03	04-Oct-90	Alburn	24.5	14.9	23.9	Shallow Fill
P04	05-Oct-90	Alburn	20.5	10.0	19.6	Shallow Sand/Silt Clay
P05	---	Alburn	---	---	---	No Boring Log
G21S	---	US Drum	---	---	---	No Boring Log
G21D	---	US Drum	---	---	---	No Boring Log
G22D	---	Alburn	48	---	---	Lower Sand
G26D	---	N of US Drum	40	---	---	Lower Sand
G130B	---	N of Alburn	118	---	---	Bedrock

Notes:

--- No data available

Table 2-2. Groundwater Analytical Results - Volatile Organic Compounds
Lake Calumet Cluster Site, Chicago, Illinoois

Date	Well ID	Vinyl Chloride ug/L	Chloro ethane ug/L	Methylene Chloride ug/L	Acetone ug/L	1,1-Dichloro ethane ug/L	cis-1,2-Dichloro ethene	2-Butanone (MEK)	Tri chloro ethene ug/L	Benzene ug/L	4-Methyl-2-Pentanone (MIBK)	Tetra chloro ethene ug/L	Toluene ug/L	Chloro benzene ug/L	Ethyl benzene ug/L	Styrene ug/L	Xylenes ug/L
Alburn																	
1-Sep-98	GW-2*	NE	NE	NE	NE	NE	NE	NE	NE	8	NE	NE	NE	NE	NE	NE	NE
10-May-99	P-01	<10	<10	13 J	19 J	<10	<10	<10	<10	55 J	<10	<10	2 J	6 J	1 J	<10	12 J
10-May-99	P-02	<100	<100	170 J	<100	<100	<100	<100	<100	95 J	310	<100	1,600	170	550	<100	31,000
10-May-99	P-03	<10	<10	17 J	24	<10	<10	<10	<10	14	<10	<10	<10	3 J	<10	<10	<10
10-May-99	P-04	<10	<10	19 J	<10	<10	<10	<10	<10	68	<10	<10	<10	7 J	<10	<10	<10
10-May-99	P-05	<10	<10	<10	19 J	<10	<10	<10	<10	65 J	<10	<10	<10	<10	7 J	2 J	4 J
10-May-99	LC-07	<2,000	<2,000	<2,000	<2,000	<2,000	<2,000	<2,000	<2,000	2,400 J	<2,000	<2,000	38,000 J	<2,000	5,800 J	<2,000	18,000 J
30-Jul-04	LC-07	Not sampled - not accessible															
10-May-99	LC-09	<10	<10	<10	32	<10	<10	<10	<10	6 J	<10	7 J	<10	<10	81	<10	360
30-Jul-04	LC-09	<2	10	<5	<10	<2	<2	<5	<2	6.9	<2	<2	<2	6.6	2.5	<2	16
10-May-99	LC-10	<10	<10	<10	27 J	<10	<10	<10	<10	7 J	<10	<10	7 J	6 J	11 J	<10	63 J
30-Jul-04	LC-10	<2	10	<5	<10	<2	<2	<5	<2	7.6	<2	<2	<2	12	<2	<2	2
U.S. Drum																	
1-Sep-98	GW-1*	NE	NE	NE	NE	NE	NE	NE	NE	6	NE	NE	NE	NE	NE	NE	NE
1-Sep-98	GW-3*	NE	NE	NE	NE	NE	NE	NE	NE	6	NE	NE	NE	NE	NE	NE	NE
10-May-99	G21S	<10	<10	<10	<10	<10	<10	<10	<10	21	<10	<10	1 J	13	<10	<10	<10
10-May-99	LC-04	<10	<10	<10	<10	<10	<10	<10	<10	1 J	<10	<10	<10	62 J	<10	<10	1 J
30-Jul-04	LC-04	<2	<2	<5	<10	<2	<2	<5	<2	6.6	<2	<2	<2	110	<2	<2	<2
10-May-99	LC-05	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
30-Jul-04	LC-05	<2	<2	<5	<10	<2	<2	<5	<2	<2	<2	<2	<2	<2	<2	<2	<2
10-May-99	LC-06	<10	<10	<10	<10	<10	<10	<10	<10	26 J	<10	<10	<10	9 J	<10	<10	6 J
30-Jul-04	LC-06	<2	10	<5	<10	<2	<2	<2	<2	6.9	<2	<2	<2	6.6	2.5	<2	16
10-May-99	LC-11	<10	<10	<10	<10	<10	<10	<10	<10	27 J	<10	<10	<10	2 J	<10	<10	<10
30-Jul-04	LC-11	<2	<2	<5	<10	<2	<2	<5	<2	24	<2	<2	<2	2.8	<2	<2	<2
10-May-99	LC-12	<25	<25	<25	<25	<25	<25	<25	<25	72 J	<25	<25	3 J	<25	8 J	<25	5 J
30-Jul-04	LC-12	2	<2	24 J	<10	<2	<2	<5	<2	30	76	<2	8	4	7.4	<2	38

Table 2-2. Groundwater Analytical Results - Volatile Organic Compounds
Lake Calumet Cluster Site, Chicago, Illinoois

Date	Well ID	Vinyl Chloride ug/L	Chloro ethane ug/L	Methylene Chloride ug/L	Acetone ug/L	1,1-Dichloro ethane ug/L	cis-1,2-Dichloro ethene	2-Butanone (MEK)	Tri chloro ethene ug/L	Benzene ug/L	4-Methyl-2-Pentanone (MIBK)	Tetra chloro ethene ug/L	Toluene ug/L	Chloro benzene ug/L	Ethyl benzene ug/L	Styrene ug/L	Xylenes ug/L
10-May-99	LC-03	<10	20 J	<10	<10	<10	<10	<10	<10	9 J	<10	<10	<10	3 J	<10	<10	<10
31-Jul-02	LC-03	<2	23	<5	<10	<2	<2	<5	<2	4.4	<2	<2	<2	3.1	<2	<2	<2
31-Jul-02	LC-03	<2	22	<5	<10	<2	<2	<5	<2	4.4	<2	<2	<2	3	<2	<2	<2
31-Jul-02	G26D	<2	<2	<5	<10	<2	<2	<5	<2	<2	<2	<2	<2	<2	<2	<2	<2
Unnamed Parcel																	
10-May-99	LC-13	<10	8 J	<10	23 J	<10	<10	<10	<10	52 J	<10	<10	13 J	8 J	7 J	<10	72 J
30-Jul-04	LC-13	<2	---	<5	<10	<2	<2	<2	<2	54	<2	<2	<2	9	<2	<2	<2
North of Paxton I																	
10-May-99	LC-01	84 J	190	22,000	5,000	1,400	750	3,600	270	73 J	390 J	130	3,700	<100	240	<100	960
31-Jul-02	LC-01	32	290	310	9,200	50	4	7,500	2.5	72	1,300	<2	1,800	<2	350	<2	1,400
31-Jul-02	LC-01	31	410	490	9,300	54	4	7,300	29	73	1,800	<2	2,000	<2	460	<2	1,800
North of US Drum																	
10-May-99	LC-02	<10	<10	<10	<10	<10	3	<10	<10	9	<10	<10	<10	<10	<10	<10	2
31-Jul-04	LC-02	<2	<2	<5	<10	<2	<2	<5	<2	<2	<2	<2	<2	<2	<2	<2	<2

Notes:

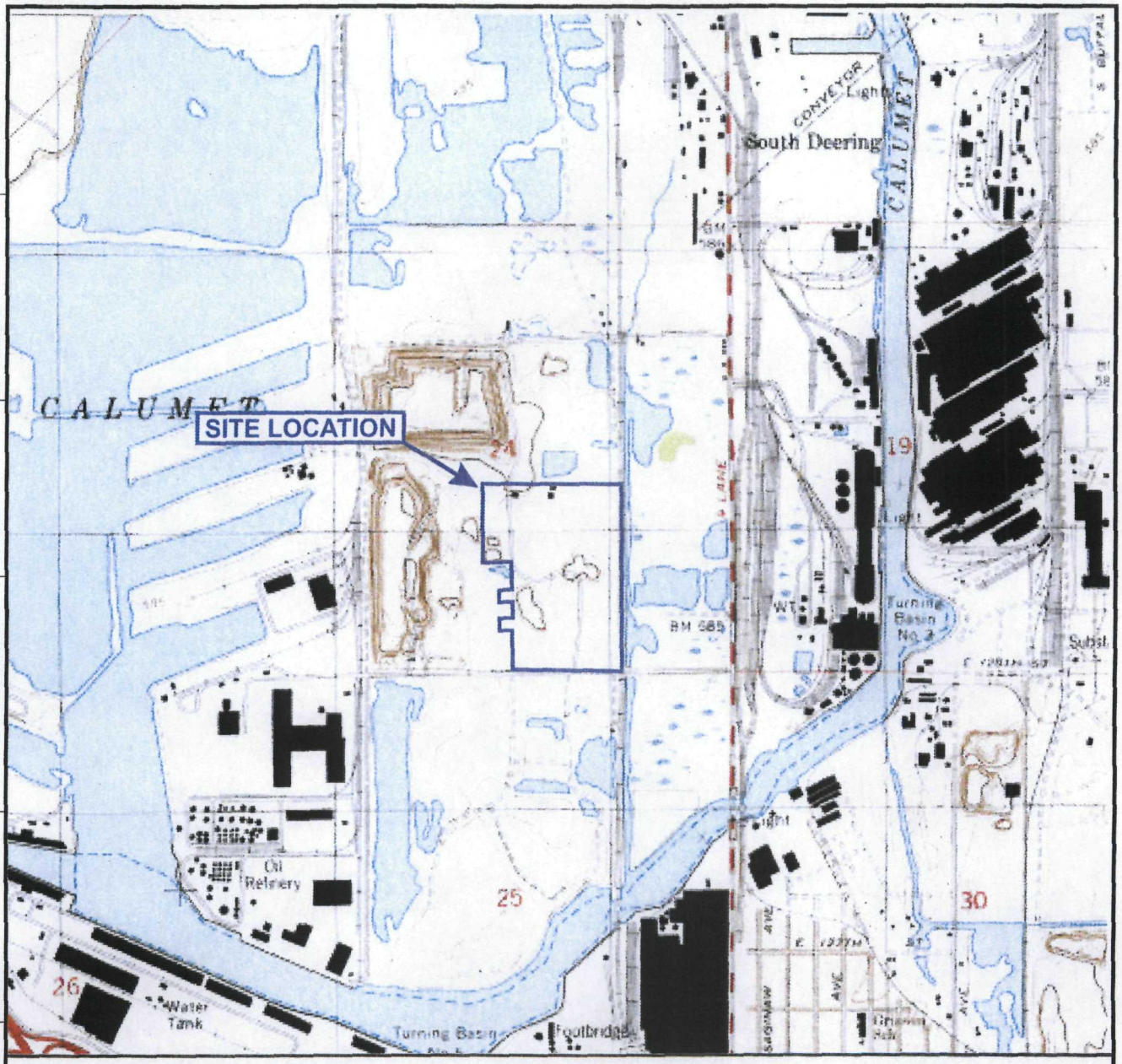
•	Geoprobe samples
Only compounds with detections listed	
ug/L	micrograms per liter
J	Value is an estimated quantity
B	Value is between the instrument detection limit and the contract required detction limit
---	Not available

Table 2-3. Summary of Off-site and Downgradient Surface Water Analytical Results
Volatile Organic Compounds
Lake Calumet Cluster Site

Date	Well ID	2-Butanone (MEK) ug/L	Acetone ug/L	Methylene Chloride ug/L	Toluene ug/L	Xylenes ug/L
Area of observed groundwater discharge east of LCCS Site						
1-Sep-98	SW08	<10	7 J	1 J	<10	<10
1-Sep-98	SW07	<10	<10	3 J	<10	<10
1-Sep-98	SW06	<10	<10	<10	2 J	1 J
1-Sep-98	SW05	<10	<10	<10	<10	<10
Remaining area located downgradient of LCCS estimated groundwater flow						
1-Sep-98	SW04	<10	<10	1 J	1 J	1 J
1-Sep-98	SW03	<10	<10	2 J	2 J	2 J
1-Sep-98	SW02	<10	<10	6 J	<10	<10
1-Sep-98	SW19	<10	<10	<10	<10	<10
1-Sep-98	SW01	<10	<10	<10	<10	<10
1-Sep-98	SW-18	<10	10 J	<10	<10	<10
Area located downgradient of Paxton I estimated groundwater flow						
1-Sep-98	SW09	2 J	14	3 J	<10	<10
1-Sep-98	SW10	<10	37	2 J	<10	<10
1-Sep-98	SW11	<10	<10	2 J	<10	<10

Notes:
Only compounds with detections listed
ug/L micrograms per liter
J Value is an estimated quantity

FIGURES



Source: USGS 7.5 Minute Topographic Map, 1991, Lake Calumet Quadrangle, Illinois- Cook County

N

0 1000 2000 4,000

APPROXIMATE SCALE IN FEET

QUADRANGLE LOCATION

ARCADIS

SITE LOCATION MAP

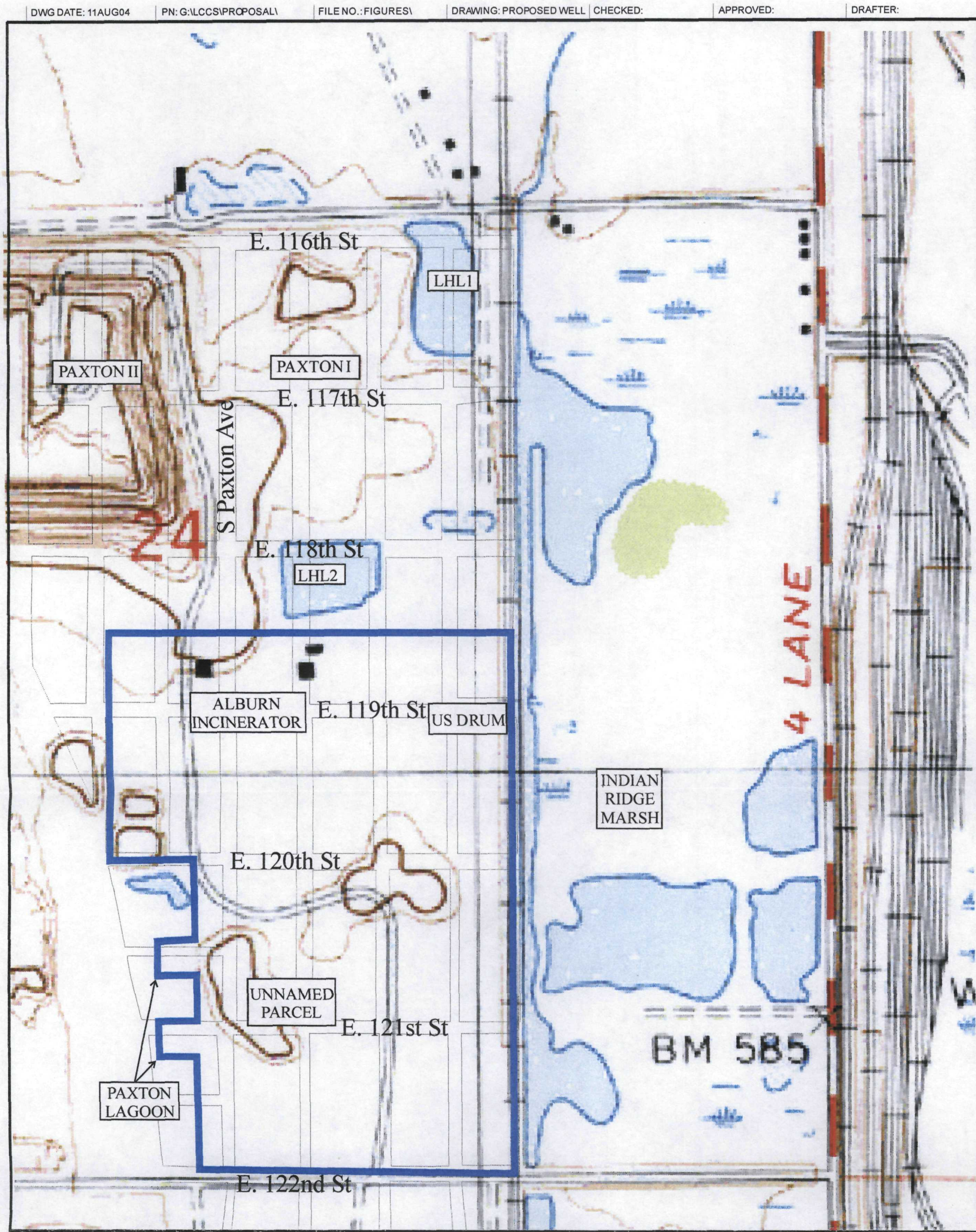
LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

FIGURE

1-1

DRAFTER:
APPROVED:
CHECKED:
DRAWING: Site Location...CDR
FILE NO.:
PN: G:\Office\Graphics\Arcadis
DWG DATE: 12APRIL01

DWG DATE: 11AUG04	PN: G:\LCCS\PROPOSAL\	FILE NO.: FIGURES\	DRAWING: PROPOSED WELL	CHECKED:	APPROVED:	DRAFTER:



Source: USGS 7.5 Minute Topographic Map, 1991, Lake Calumet Quadrangle, Illinois- Cook County

N

0 200 400 800

APPROXIMATE SCALE IN FEET

Legend

ApproximateSite Boundary

ARCADIS

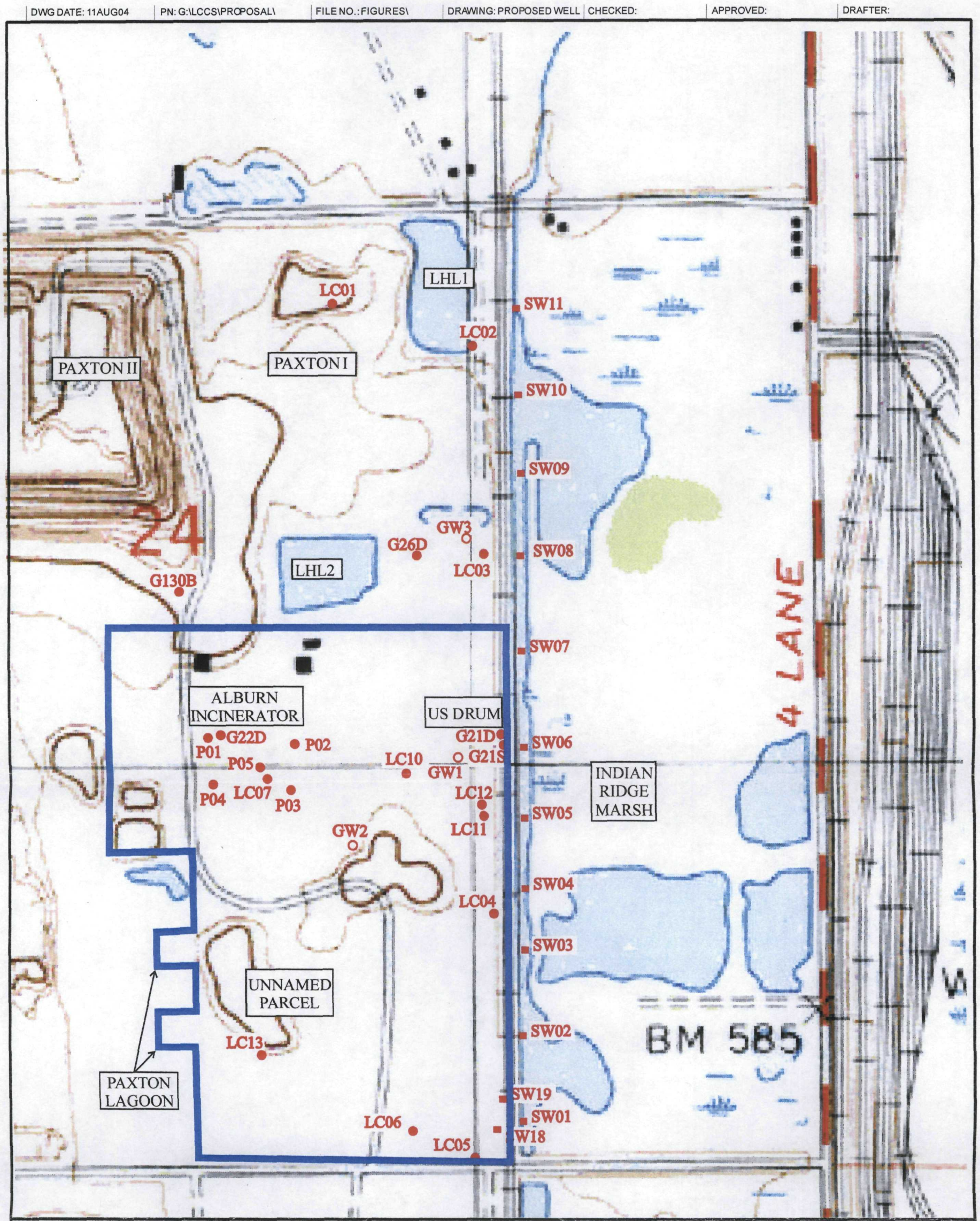
SITE PLAN

LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

FIGURE

2-1

DWG DATE: 11AUG04	PN: G:\LCCS\PROPOSAL\	FILE NO.: FIGURES\	DRAWING: PROPOSED WELL	CHECKED:	APPROVED:	DRAFTER:



Source: USGS 7.5 Minute Topographic Map, 1991, Lake Calumet Quadrangle, Illinois- Cook County

N

0 200 400 800

APPROXIMATE SCALE IN FEET

Legend

GW3 Geoprobe Location

LC06 Monitoring Well Location

Approximate Site Boundary

SW05 Surface Water Sample Location

ARCADIS

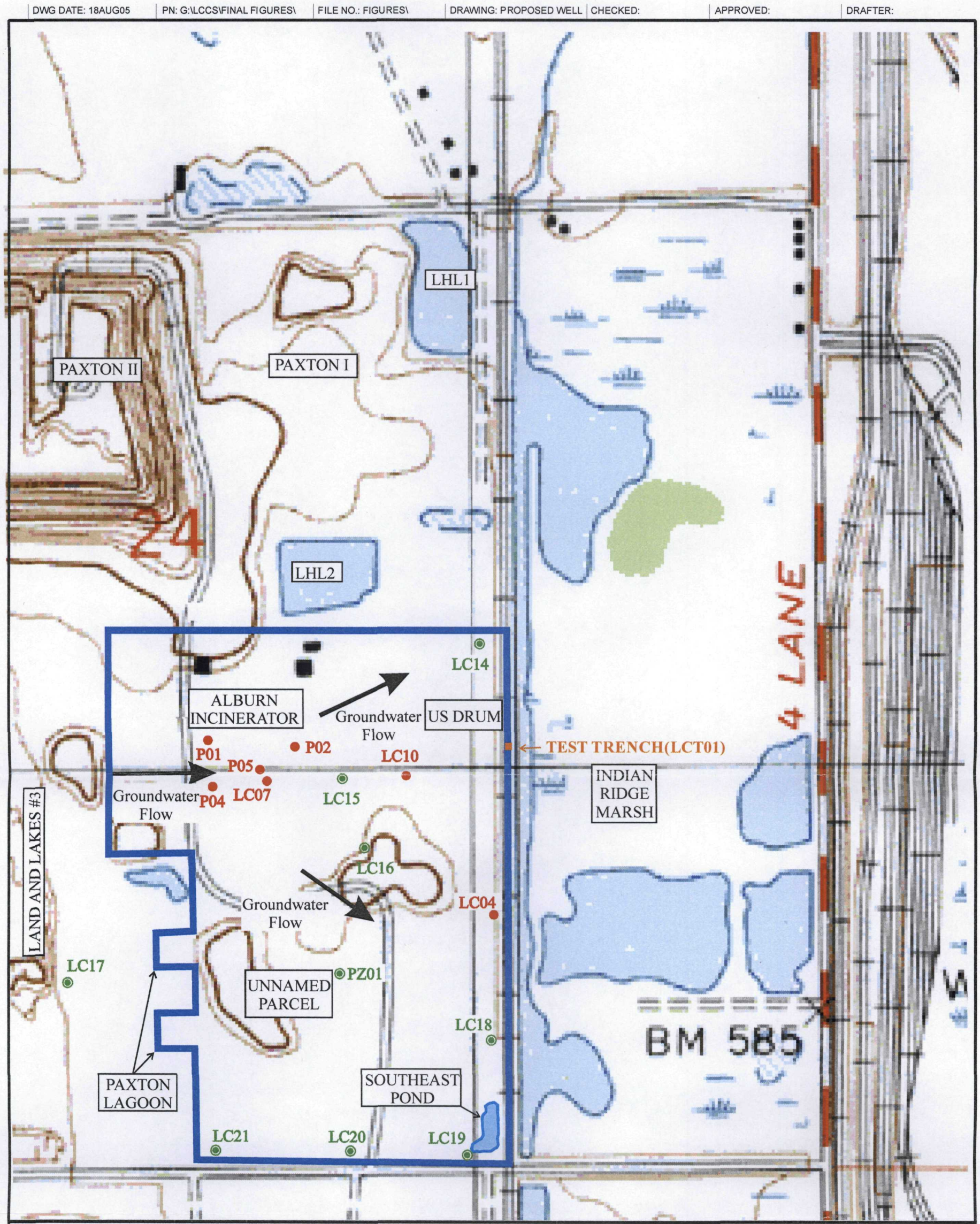
EXISTING MONITORING WELL LOCATIONS AND SURFACE WATER SAMPLE LOCATIONS

LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

FIGURE

2-2

DWG DATE: 18AUG05	PN: G:\LCCS\FINAL FIGURES\	FILE NO.: FIGURES\	DRAWING: PROPOSED WELL	CHECKED:	APPROVED:	DRAFTER:



Source: USGS 7.5 Minute Topographic Map, 1991, Lake Calumet Quadrangle, Illinois- Cook County

N

0 200 400 800

APPROXIMATE SCALE IN FEET

Legend

- LCT01 Test Trench Location
- LC04 Monitoring Well Location
- Approximate Site Boundary
- LC14 Proposed Monitoring Well Location

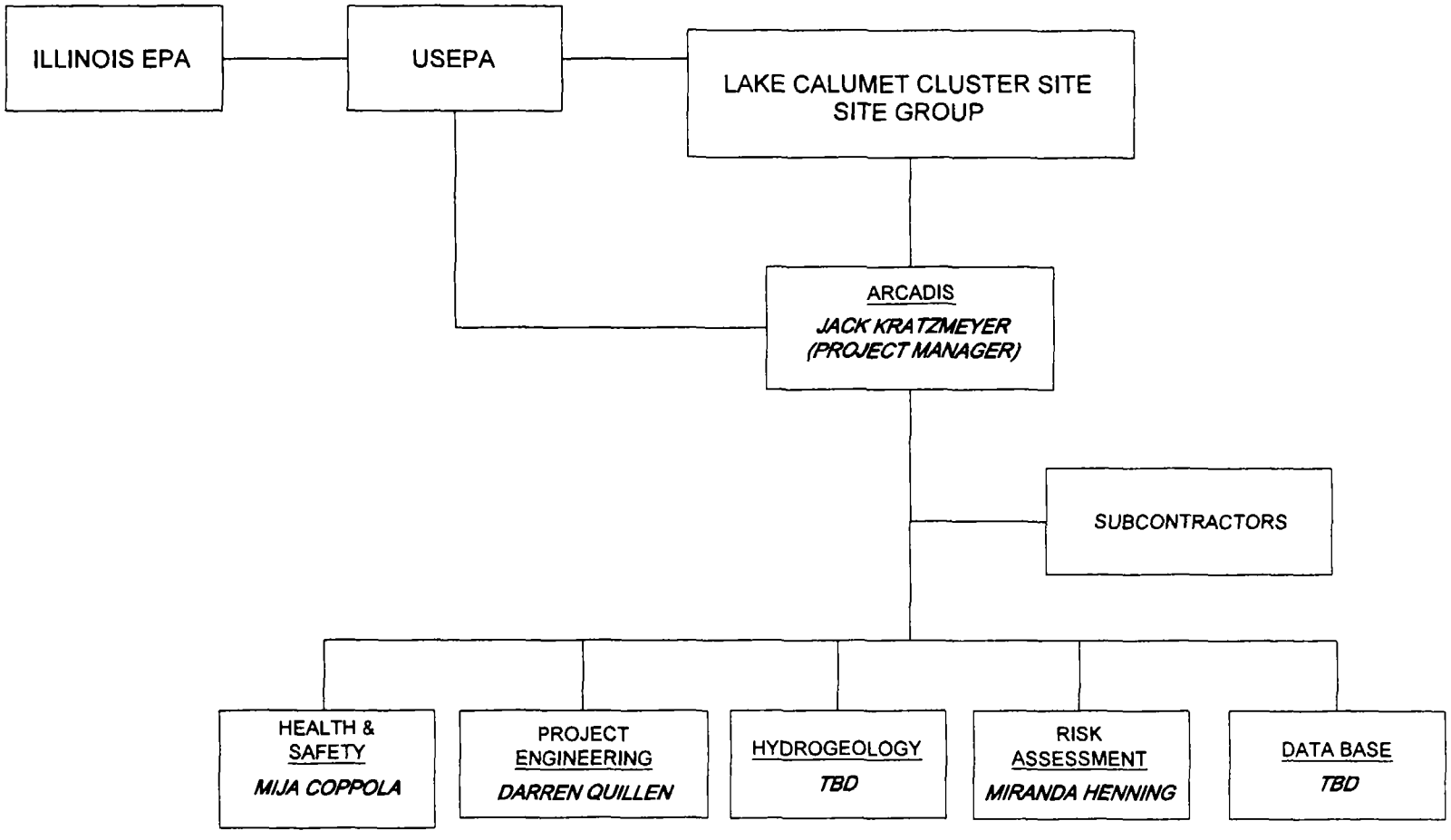
ARCADIS

REMEDIAL INVESTIGATION SAMPLE LOCATIONS

LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

FIGURE

2-3



ARCADIS

PROJECT ORGANIZATION
LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

DATE 4/29/05	PROJECT MANAGER J. KRATZMEYER	DRAWING NAME RIFS-SAP
DRAWN R. SMITH	LEAD DESIGN PROF	CHECKED A. SENN
PROJECT NUMBER CI001286.0001		FIGURE NUMBER 5-1

APPENDIX A

ARCADIS

Appendix A

U.S. EPA Statement of Work

STATEMENT OF WORK
FOR A REMEDIAL INVESTIGATION AND FEASIBILITY STUDY
AT THE LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

I. PURPOSE

This Statement of Work (SOW) sets forth the requirements for conducting a Remedial Investigation and Feasibility Study (RI/FS) at the Lake Calumet Cluster Site (Site) in southeastern Chicago, Illinois. The Lake Calumet Cluster Site, consists of the parcels commonly known as the Alburn/American Incineration, Inc., Site ("Alburn"); the U.S. Drum II Site ("U.S. Drum"), the Unnamed Parcel Site (Unnamed Parcel); and a portion of the Paxton Avenue Lagoons Site ("Paxton Lagoons") and covering approximately 88 acres bounded by the Land and Lakes Landfill to the west, 122nd Street to the south, the Norfolk and Western Railroad right-of-way and Indian Ridge Marsh to the east, and Paxton I and II Landfills (South of 118th Street) to the north, all in Chicago, Cook County, Illinois, and any nearby areas where hazardous substances, pollutants, or contaminants from the property or from former operations at the property have or may have come to be located. The RI Report shall fully evaluate the nature and extent of hazardous substances, pollutants or contaminants at and/or from the Site. The RI Report shall also assess the risk that these hazardous substances, pollutants, or contaminants present for human health and the environment. The RI Report shall provide sufficient data to develop and evaluate effective remedial alternatives. The FS Report shall evaluate alternatives for addressing the impact to human health and the environment from hazardous substances, pollutants or contaminants at the Site.

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The Respondents shall prepare and complete the RI and FS Reports in compliance with the Administrative Settlement Agreement and Order on Consent (Settlement Agreement), SOW, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), as amended, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 C.F.R. Part 300) as amended and the requirements and guidance for RI/FS studies and reports, including U.S. EPA Superfund *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA/540/G-89/004, October 1988) (RI/FS Guidance), and any other guidance that the United States Environmental Protection Agency (U.S. EPA) uses in conducting or submitting deliverables for a RI/FS. Exhibit B sets forth a list of such guidance used by U.S. EPA for an RI/FS.

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The Respondents shall furnish all personnel, materials, and services necessary for, or incidental to, performing the RI/FS at the Site, except as otherwise specified herein. As specified in CERCLA Section 104(a)(1), as amended by SARA, U.S. EPA will provide oversight of the Respondents' activities throughout the RI/FS.

II. DOCUMENT REVIEW

The Respondents shall submit five sets of all documents or deliverables required as part of this SOW to the U.S. EPA, with three additional sets of copies to the Illinois Environmental Protection Agency (IEPA), for review and approval by U.S. EPA. After review of any plan,

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report or other item which is required to be submitted for approval pursuant to this Settlement Agreement, U.S. EPA, after reasonable opportunity for review and comment by the State Agency, may: (a) approve, in whole or in part, the submission; (b) approve the submission upon specified conditions; (c) modify the submission to cure the deficiencies; (d) disapprove, in whole or in part, the submission, directing that Respondents modify the submission; or (e) any combination of the above. However, U.S. EPA will not modify a submission without first providing Respondents at least one notice of deficiency and opportunity to cure within 30 days. (See Section X of the Settlement Agreement for procedures concerning U.S. EPA Approval of Plans and Other Submissions.)

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III. SCOPE

Respondents shall complete the following tasks as part of this RI/FS:

Task 1: Project Scoping and RI/FS Planning Documents
Task 2: Community Relations Support and Technical Assistance Plan
Task 3: Site Characterization
Task 4: Remedial Investigation Report
Task 5: Treatability Studies
Task 6: Development and Screening of Alternatives
Task 7: Detailed Analysis of Alternatives (FS Report)
Task 8: Progress Reports

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TASK 1: PROJECT SCOPING AND RI/FS PLANNING DOCUMENTS

1.1 Site Background

The Respondents shall gather and analyze the existing Site background information and shall conduct a Site visit to assist in planning the scope of the RI/FS.

1.1.1 Collect and Analyze Existing Data

Before planning the RI/FS activities, the Respondents shall thoroughly compile and review existing Site data. Where previously compiled, U.S. EPA shall provide respondent with historical data in electronic format, according to U.S. EPA Region 5 specifications. Existing Site data includes presently available data relating to the varieties and quantities of hazardous substances, pollutants and contaminants constituents at the Site, past disposal practices, the results of previous sampling activities, and U.S. EPA's air photo analysis of the Site. Examples of existing information about the Site include: The Nature and Extent of Contamination at the Lake Calumet Cluster Site November 30, 1999; Comprehensive Site Investigation Report Lake Calumet Cluster Site: Alburn, U.S. Drum and Unnamed Parcel Areas; Remedial Options Report Southeast Chicago Cluster Site Chicago, Illinois September 27, 2002; Human Health Risk Assessment Report Lake Calumet Cluster Site: Alburn, U.S. Drum, and Unnamed Parcel Areas Final Report February 2002; Ecological Risk Assessment Lake Calumet Cluster Sites Chicago, Illinois November 2001.

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1.1.2 Conduct Site Visit

The Respondents shall visit the Site during the project scoping phase to develop a better understanding of the Site, and focus on the sources and the areas of impacted media, as well as potential exposure pathways and receptors at the Site. During the Site visit, the Respondents shall observe, to the extent possible, the Site's physiography, hydrology, geology, and demographics, as well as ecological resources and cultural features. The Respondents shall coordinate this visit with the U.S. EPA Remedial Project Manager (RPM).

1.2 RI/FS Planning Documents

1.2.1 General Requirements

The Respondents shall submit draft RI/FS Planning Documents (including the Work Plan, Field Sampling Plan, Quality Assurance Project Plan, and Health and Safety Plan) to U.S. EPA, with a copy to the IEPA, for review and approval by U.S. EPA.

The objective of the RI/FS Planning Documents is to develop an RI/FS strategy and general management plan that accomplishes the following:

- A remedial investigation that fully determines the nature and extent of the release or threatened release of hazardous substances, pollutants, or contaminants at and from the Site. In performing this investigation, the Respondents shall gather sufficient data, samples, and other information to fully characterize the nature and extent of the contamination at the Site, to support the human health and ecological risk assessments, and to provide sufficient data for the identification and evaluation of remedial alternatives for this Site.

- A feasibility study that identifies and evaluates alternatives for remedial action to protect human health and the environment by preventing, eliminating, controlling or mitigating the release or threatened release of hazardous substances, pollutants, or contaminants at and from the Site.

When scoping the specific aspects of the project, the Respondents shall meet with U.S. EPA to discuss all project planning decisions and special concerns associated with the Site.

The RI/FS Planning Documents shall include a detailed description of the tasks the Respondents shall perform, the information needed for each task, a detailed description of the information the Respondents shall produce during and at the conclusion of each task, and a description of the work products that the Respondents shall submit to U.S. EPA and IEPA. This includes the deliverables set forth in this SOW; a schedule for each of the required activities consistent with the RI/FS Guidance and other relevant guidance; monthly reports to U.S. EPA and IEPA; and meetings and presentations to U.S. EPA and IEPA at the conclusion of each major phase of the RI/FS. The Respondents shall refer to Appendix B of the RI/FS Guidance for a description of the required contents of the RI/FS Planning Documents.

The RI/FS Planning Documents shall identify the data needs for fully characterizing the nature and extent of the contamination at the site, evaluating risks and developing and evaluating remedial alternatives. The RI/FS Planning Documents shall reflect coordination with treatability study requirements, if any. The RI/FS Planning Documents shall also include a process for and

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Deleted: include the preliminary objectives for the remedial action at the Site; preliminary potential state and federal ARARs (chemical-specific, location-specific and action-specific); a description of the Site management strategy developed by the Respondents and U.S. EPA during scoping; a preliminary identification of remedial alternatives; and

manner of refining and/or identifying additional Federal and State ARARs, and for preparing the human health and ecological risk assessments and the feasibility study.

1.2.2 Specific Requirements

The Respondents shall prepare the RI/FS Planning Documents as described in "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA," October, 1988 and shall include:

1.2.2.1 Site Background

The Site Background section shall include a brief summary of the Site location, description, physiography, hydrology, geology, demographics, ecological, cultural and natural resource features, Site history, description of previous investigations and responses conducted at the Site by local, state, federal, or private parties, and Site data evaluations and project planning completed during the scoping process.

The Site background section shall discuss areas of waste handling and disposal activities, the locations of existing groundwater monitoring wells, if any, and previous surface water, sediment, soil, groundwater, and air sampling locations. The Site Background section shall include tables that summarize the available data.

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1.2.2.2. Work Plan and Field Sampling Plan

Respondents shall prepare the Work Plan and FSP portions of the RI/FS Planning Documents to ensure that sample collection and analytical activities are conducted in accordance with technically acceptable protocols and that the data meet the Site-specific Data Quality Objectives as established in the Quality Assurance Project Plan (QAPP) and FSP. All sampling and analyses performed shall conform to U.S. EPA direction, approval, and guidance regarding sampling, quality assurance/quality control (QA/QC), data validation, and chain of custody procedures. The Respondents shall ensure that the laboratory used to perform the analyses participates in a QA/QC program that complies with U.S. EPA guidance.

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Upon request by U.S. EPA, the Respondents shall have such a laboratory analyze samples submitted by U.S. EPA for quality assurance monitoring. The Respondents shall provide U.S. EPA with the QA/QC procedures followed by all sampling teams and laboratories performing data collection and/or analysis. The Respondents shall also ensure the provision of analytical tracking information consistent with OSWER Directive No. 9240.0-2B, *Extending the Tracking of Analytical Services to PRP-Lead Superfund Sites.*

Upon request by U.S. EPA, the Respondents shall allow U.S. EPA or its authorized representatives to take split and/or duplicate samples of any samples collected by the Respondents or their contractors or agents. The Respondents shall notify U.S. EPA not less than 7 days in advance of any sample collection activity. U.S. EPA shall have the right to take any additional samples that it deems necessary.

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1.2.2.3 Data Gap Description/Data Acquisition

As part of the FSP, the Respondents shall analyze the currently available data. The Respondents shall identify those areas of the Site that require data and evaluation in order to define the extent of hazardous substances, pollutants or contaminants. This section of the FSP shall include a description of the number, types, and locations of samples to be collected. The FSP shall include a data collection program to accomplish any of the following that are determined to be required at this Site:

- Site Reconnaissance:
  - Site surveys including property, boundary, utility rights-of-way, and topographic information
  - Land Survey
  - Topographic Mapping
  - Field Screening

- Geological Investigations (Soils and Sediments) to determine the extent of hazardous substances, pollutants, or contaminants in surface soils, subsurface soils and sediments at the Site:
  - Collect Surface Soil Samples
  - Collect Subsurface Soil Samples
  - Perform Soil Boring and Permeability Sampling
  - Collect Sediments Samples
  - Survey Soil Gases
  - Test Pit
  - Identify real-world horizontal and vertical coordinates for all samples and Site features in accordance with U.S. EPA Region 5 electronic data requirements

- Air Investigations to determine the extent of atmospheric hazardous substances, pollutants, or contaminants at and from the Site:
  - Collect Air Samples
  - Establish Air Monitoring Station

- Hydrogeological Investigations (Ground Water) to determine the horizontal and vertical distribution of hazardous substances, pollutants, or contaminants in the groundwater and the extent, fate, and transport of any groundwater plumes containing hazardous substances, pollutants, or contaminants:
  - Install Well Systems
  - Collect Samples from Upgradient, Downgradient, Private and Municipal wells
  - Collect Samples During Drilling (e.g., HydroPunch or Equivalent)
  - Perform Hydraulic Tests (such as Pump Tests, Slug Tests and Grain Size Analyses)

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- Measure Ground-Water Elevations and determine horizontal and vertical sample locations in accordance with U.S. EPA Region 5 electronic data requirements
- Modeling
- Determine the direction of regional and local groundwater flow
- Identify the local uses of groundwater including the number, location, depth and use of nearby private and municipal wells

Hydrogeological Investigations (Surface Water) to determine the nature and extent of contamination of surface water from the Site:
- Collect Samples
- Measure Surface-Water Elevation

Waste Investigations:
- Collect Samples (Gas, Liquid, Solid)
- Dispose of Investigation-Derived Waste (Gas, Liquid, Solid)

Geophysical Investigations to delineate waste depths, thicknesses, and volume; the elevations of the underlying natural soil layer; and the extent of cover over fill areas, as appropriate:
- Surface Geophysical Activity
- Magnetometer
- Electromagnetic
- Ground-Penetrating Radar
- Seismic Refraction
- Resistivity
- Site Meteorology
- Cone Penetrometer Survey
- Remote Sensor Survey
- Radiological Investigation
- Test Pits, trenches and soil borings

Ecological Investigations to assess the impact to aquatic and terrestrial ecosystems from the disposal, release, and migration of hazardous substances, pollutants, or contaminants:
- Wetland and Habitat Delineation
- Wildlife Observations
- Community Characterization
- Endangered Species Identification
- Biota Sampling
- Population Studies

Dispose of Investigation-Derived Waste. The Respondents shall characterize and dispose of investigation-derived wastes in accordance with local, state, and federal regulations as specified in the FSP (see the Fact Sheet, *Guide to Management of Investigation-Derived Wastes*, 9345.3-03FS (January 1992)).

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- Evaluate and Document the Need for Treatability Studies. If the Respondents or U.S. EPA identify remedial actions that involve treatment, the Respondents shall include treatability studies as outlined in Task 5 of this SOW unless the Respondents satisfactorily demonstrate to U.S. EPA that such studies are not needed. When treatability studies are needed, the Respondents shall plan initial treatability testing activities (such as research and study design) to occur concurrently with Site characterization activities.

1.2.2.4 Quality Assurance Project Plan (QAPP)

The Respondents shall prepare a QAPP that is Site-specific and covers sample analysis and data handling for samples collected during the RI, based on the Settlement Agreement and guidance provided by U.S. EPA. The Respondents shall prepare the QAPP in accordance with "EPA Requirements of Quality Assurance Project Plans (QA/R-5)" (EPA/240/B-01/003, March 2001) and "EPA Guidance for Quality Assurance Project Plans (QA/G-5)" (EPA/600/R-02/009, December 2002).

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In advance of sample collection, the Respondents shall demonstrate to U.S. EPA's satisfaction that each laboratory it may use is qualified to conduct the proposed work. This includes use of methods and analytical protocols for the chemicals of concern in the media sampled within detection and quantification limits consistent with both QA/QC procedures and data quality objectives (DQO) approved in the QAPP for the Site by U.S. EPA. The laboratory must have and follow an approved QA program. If a laboratory not in the Contract Laboratory Program is selected, methods consistent with CLP methods that would be used at this Site for the purposes proposed and QA/QC procedures approved by U.S. EPA shall be used. The Respondents shall only use laboratories which have a documented Quality Assurance Program which complies with ANSI/ASQC E-4 1994, "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs," (American National Standard, January 5, 1995) and "EPA Requirements for Quality Management Plans (QA/R-2)" (EPA/240/B-01-002, March 2001) or equivalent documentation as determined by U.S. EPA.

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The Respondents shall participate in a pre-QAPP meeting or conference call with U.S. EPA. The purpose of this meeting or conference call is to discuss QAPP requirements and obtain any clarification needed to prepare the QAPP.

1.2.2.5 Health and Safety Plan

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The Respondents shall prepare a Health and Safety Plan that conforms to its health and safety program and complies with the Occupational Safety and Health Administration (OSHA) regulations and protocols outlined in 29 C.F.R. Part 1910. The Health and Safety Plan shall be prepared in accordance with U.S. EPA's Standard Operating Safety Guide (PUB 9285.1-03, PB 92-963414, June 1992). The Health and Safety Plan shall include the 11 elements described in the RI/FS Guidance such as a health and safety risk analysis, a description of monitoring and personal protective equipment, medical monitoring and Site control. U.S. EPA does not "approve" the Respondents' Health and Safety Plan, but rather U.S. EPA reviews it to ensure that all the necessary elements are included, and that the plan provides for the protection of human health and the environment, and after that review provides comments as may be necessary and

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appropriate. The safety plan must, at a minimum, follow the U.S. EPA's guidance document *Standard Operating Safety Guides* (Publication 9285.1-03, PB92-963414, June 1992).

TASK 2: COMMUNITY INVOLVEMENT SUPPORT AND TECHNICAL ASSISTANCE PLAN

U.S. EPA has the responsibility of developing and implementing community involvement activities for the Site. The critical community involvement planning steps performed by U.S. EPA and IEPA include conducting community interviews and developing a Community Involvement Plan. Although implementing the Community Involvement Plan is the responsibility of U.S. EPA, the Respondents, if directed by U.S. EPA, shall assist by providing information regarding the Site's history; participating in public meetings; assisting in preparing fact sheets for distribution to the general public; or conducting other activities approved by U.S. EPA. All community involvement activities conducted by the Respondents shall be planned and developed in coordination with U.S. EPA.

TASK 3: SITE CHARACTERIZATION

3.1 Investigate and Define Site Physical and Biological Characteristics

The Respondents shall implement the Work Plan and Field Sampling Plan and collect data on the physical and biological characteristics of the Site and its surrounding areas including the physical physiography, geology, and hydrology, and specific physical characteristics. This information will be ascertained through a combination of physical measurements, observations, and sampling efforts and will be utilized to define potential transport pathways and human and ecological receptor populations. In defining the Site's physical characteristics, the Respondents will also obtain sufficient engineering data (such as pumping characteristics) for the projection of contaminant fate and transport, and development and screening of remedial action alternatives, including information to assess treatment technologies.

The Respondents shall provide the RPM or the entity designated by the RPM with a paper copy and an electronic copy (according to U.S. EPA Region 5 format specification) of laboratory data within the monthly progress reports and in no event later than 90 days after samples are shipped for analysis. In addition, the monthly progress reports will summarize field activities completed during that reporting period, (including drilling locations, depths and field notes if requested by RPM), problems encountered, solutions to problems, and upcoming field activities.

3.2 Define Sources of Contamination

The Respondents shall locate sources of contamination. For each source, Respondents shall determine the areal extent and depth of contamination by sampling, as necessary to supplement existing data. Respondents shall determine the physical characteristics and chemical constituents and their concentrations for all known and discovered sources of contamination. The Respondents shall conduct sufficient sampling to define the boundaries of the contaminant

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sources to the level established in the QAPP and DQOs. Defining the source of contamination will include analyzing the potential for contaminant release (e.g., long term leaching from soil), contaminant mobility and persistence, and characteristics important for evaluating remedial actions, including information to assess treatment technologies.

The Site is located in a heavily industrialized area of southeast Chicago. Land and Lakes Landfill is located to the west of the property, Paxton I Landfill is located northwest of the property, and Paxton II Landfill is located north of the property. If it is determined that these off-site areas are source(s) of contamination to the Cluster Site, the Respondents shall request that U.S. EPA take the necessary actions to investigate these off-site source areas.

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3.3 Describe the Nature and Extent/Fate and Transport of Contamination

The Respondents shall gather information to describe the nature and extent of contamination as a final step during the field investigation. To describe the nature and extent of contamination, the Respondents will utilize the information on site physical and biological characteristics and sources of contamination to give a preliminary estimate of the contaminants that may have migrated. The Respondents will then implement an iterative monitoring program and any study program identified in the work plan or sampling plan such that by using analytical techniques sufficient to detect and quantify the concentration of contaminants, the migration of contaminants through the various media at site can be determined. In addition, the Respondents shall gather data for calculations of contaminant fate and transport. This process is continued until the area and depth of contamination are known to the level of contamination established in the QAPP and DQOs.

3.3.1 Evaluate Site Characteristics

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The Respondents shall analyze and evaluate the data to describe: (1) site physical and biological characteristics; (2) contaminant source characteristics; (3) nature and extent of contamination; and (4) contaminant fate and transport. Results of the site physical characteristics, source characteristics, and extent of contamination analyses are utilized in the analysis of contaminant fate and transport. The Respondents shall evaluate the actual and potential magnitude of releases from the sources, and horizontal and vertical spread of contamination as well as mobility and persistence of contaminants. Where modeling is appropriate, such models shall be identified to U.S. EPA in a technical memorandum prior to their use. All data and programming, including any proprietary programs, shall be made available to U.S. EPA together with a sensitivity analysis. The RI data shall be presented electronically according to U.S. EPA Region 5 format requirements. Analysis of data collected for site characterization will meet the DQOs developed in the QAPP and stated in the FSP (or revised during the RI).

3.3.2 Baseline Human Health Risk Assessment

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As an attachment to the RI Report, the Respondents shall submit a Baseline Human Health Risk Assessment Report to U.S. EPA, with a copy to the IEPA, for review and approval by U.S. EPA. The Respondents shall conduct the baseline risk assessment to determine whether Site contaminants pose a current or potential risk to human health in the absence of any remedial action. The major components of the Baseline Risk Assessment include data evaluation/hazard

identification of constituents of concern (COCs), exposure assessment, toxicity assessment, and risk characterization.

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Respondents shall conduct a baseline human health risk assessment that focuses on actual and potential risks to persons coming into contact with on-site hazardous substances, pollutants or contaminants as well as risks to the nearby residential, recreational and industrial worker populations from exposure to hazardous substances, pollutants or contaminants in groundwater, soils, sediments, surface water, air, and ingestion of contaminated organisms in nearby, impacted ecosystems. The human health risk assessment shall define central tendency and reasonable maximum estimates of exposure for current land use conditions and reasonable future land use conditions. The human health risk assessment shall use data from the Site and nearby areas to identify the COCs, provide an estimate of how and to what extent human receptors might be exposed to these COCs, and provide an assessment of the health effects associated with these COCs. The human health risk assessment shall project the potential risk of health problems occurring if no cleanup action is taken at the Site and/or nearby areas, and establish target action levels for COCs (carcinogenic and non-carcinogenic).

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Respondents shall conduct the human health risk assessment in accordance with U.S. EPA guidance including, at a minimum: "Risk Assessment Guidance for Superfund (RAGS), Volume I - Human Health Evaluation Manual (Part A)," Interim Final (EPA-540-1-89-002)," OSWER Directive 9285.7-01A; December 1, 1989; and "Risk Assessment Guidance for Superfund (RAGS), Volume I - Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments)," Interim, (EPA 540-R-97-033), OSWER 9285.7-01D, January, 1998 or subsequently issued guidance.

Respondents shall also conduct the human health risk assessment in accordance with the following additional guidance found in the following U.S. EPA OSWER directives:

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1) "Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities," OSWER Directive 9200.4-27; August, 1998,

2) "Implementation of the Risk Assessment Guidance for Superfund (RAGS) Volume I - Human Health Evaluation Manual, (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments) (Interim)," OSWER Directive 9285.7-01D-1; December 17, 1997,

3) "Soil Screening Guidance: Technical Background Document," OSWER Directive 9355.4-17A; May 1, 1996 and "Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER Directive 9355.4; March 24, 2001,

4) "Soil Screening Guidance: User's Guide," Publication 9355.4-23; April, 1996,

5) "Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities," OSWER Directive 9355.4-12; July 14, 1994,

6) "Guidance Manual for the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children," Publication 9285.7-15-1; February, 1994, and

associated, clarifying Short Sheets on IEUBK Model inputs, including but not limited to OSWER 9285.7-32 through 34, as listed on the OSWER lead internet site at www.epa.gov/superfund/programs/lead/prods.htm,

7) Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children," Version 0.99D, NTIS PB94-501517, 1994 or "Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children," Windows© version, 2001,

8) "Risk Assessment Guidance for Superfund: Volume I - Human Health Evaluation Manual: (Part B, Development of Risk-based Preliminary Remediation Goals)," Interim, OSWER Directive 9285.7-01B; December, 1991,

9) "Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors," OSWER Directive 9285.6-03; March 25, 1991, and

10) "Exposure Factors Handbook," Volumes I, II, and III; August 1997 (EPA/600/P-95/002Fa,b,c).

Respondents shall also comply with the guidance on assessing human health risk associated with adult exposures to lead in soil as found in the following document: "Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil," December, 1996. This document may be downloaded from the Internet at the following address: www.epa.gov/superfund/programs/lead/prods.htm.

Respondents shall also comply with the "Superfund Lead-Contaminated Residential Sites Handbook," December 2002 by the U.S. EPA Lead Sites Workgroup.

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Additional applicable or relevant guidance may be used only if approved by U.S. EPA.

Respondents shall prepare the Human Health Risk Assessment Report according to the guidelines outlined below:

- Hazard Identification (sources). The Respondents shall review available information on the hazardous substances present at the site and identify the major contaminants of concern.

- Dose-Response Assessment. The Respondents shall select COCs based on their intrinsic toxicological properties.

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- Conceptual Exposure/Pathway Analysis. The Respondents shall identify and analyze critical exposure pathways (e.g., drinking water). The proximity of contaminants to exposure pathways and their potential to migrate into critical exposure pathways shall be assessed.

- Characterization of Site and Potential Receptors. The Respondents shall identify and characterize human populations in the exposure pathways.

- Exposure Assessment. The exposure assessment will identify the magnitude of actual or potential human exposures, the frequency and duration of these exposures, and the routes by which receptors are exposed. The exposure assessment shall include an evaluation of the likelihood of such exposures occurring and shall provide the basis for the development of acceptable exposure levels. In developing the exposure assessment, the Respondents shall develop reasonable maximum estimates of exposure for both current land use conditions and potential land use conditions at the site.

- Risk Characterization. During risk characterization, Respondents shall compare chemical-specific toxicity information, combined with quantitative and qualitative information from the exposure assessment, to measured levels of contaminant exposure levels and the levels predicted through environmental fate and transport modeling. These comparisons shall determine whether concentrations of contaminants at or near the site are affecting or could potentially affect human health.

- Identification of Limitations/Uncertainties. The Respondents shall identify critical assumptions (e.g., background concentrations and conditions) and uncertainties in the report.

- Site Conceptual Model. Based on contaminant identification, exposure assessment, toxicity assessment, and risk characterization, the Respondents shall develop a conceptual model of the site.

3.3.2 Baseline Ecological Risk Assessment

As an attachment to the RI Report, the Respondents shall submit a Baseline Ecological Risk Assessment Report to U.S. EPA, with a copy to IEPA, for review and approval by U.S. EPA. In the Ecological Risk Assessment Report, the Respondents shall evaluate and assess potential risks posed to ecological receptors by COCs. Respondents shall prepare the Ecological Risk Assessment Report in accordance with U.S. EPA guidance including, at a minimum: "Ecological Risk Assessment Guidance for Superfund, Process for Designing and Conducting Ecological Risk Assessments, (EPA-540-R-97-006, June 1997), OSWER Directive 9285.7-25 and shall follow the guidelines outlined below:

- Problem Formulation. The Respondents shall develop a conceptual site model that addresses the environmental setting and chemicals of potential concern at the Site, chemical fate and transport mechanisms, mechanisms of ecotoxicity associated with the COCs and relevant ecological receptors, exposure pathways by which a COC may travel from a source to an ecological receptor, and assessment and measurement endpoints selected for evaluation.

- Characterization of Exposure. The Respondents shall characterize potential exposure to relevant ecological receptors.

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- Characterization of Ecological Effects. The Respondents shall identify concentrations or doses of COCs that represent thresholds for adverse ecological effects.

- Risk Characterization. The Respondents shall integrate the findings of the preceding components of the ecological risk assessment, in order to determine whether: (a) ecological threats are negligible; (b) additional refinement of the ecological risk assessment is warranted in order to determine whether significant risks are plausible; or (c) there is a potential for adverse ecological effects.

- Uncertainty Analysis. The Respondents shall identify critical assumptions and uncertainties in the report.

3.4 Current and Future Land Uses and Reuse Assessment

As an Attachment to the RI Report, Respondents shall submit a Memorandum to U.S. EPA for review and approval that evaluates the current and reasonably anticipated future land uses at the Site. The Memorandum shall identify: 1) past uses at the Site including title and lien information; 2) current uses of the Site and neighboring areas; 3) the owner's plans for the Site following cleanup and any prospective purchasers; 4) applicable zoning laws and ordinance; 5) current zoning; 6) applicable local area land use plans, master plans and how they affect the site; 7) existing local restrictions on property; 8) property boundaries; 9) groundwater use determinations, wellhead protection areas, recharge areas and other areas identified in the state's Comprehensive Ground Water Protection Program; 10) Flood plains, wetland, or endangered or threatened species; and 11) utility rights of way.

If U.S. EPA, in its sole discretion, determines that a Reuse Assessment is necessary, Respondents will perform the Reuse Assessment in accordance with U.S. EPA guidance, including, but not limited to: "Reuse Assessments: A Tool To Implement The Superfund Land Use Directive", OSWER 9355.7-06P, June 4, 2001 upon request of U.S. EPA. The Reuse Assessment should provide sufficient information to develop realistic assumptions of the reasonably anticipated future uses for the Site.

TASK 4: REMEDIAL INVESTIGATION (RI) REPORT

Within 120 days following receipt of laboratory results following completion of the last field sampling event under the Final RI/FS Planning Documents (Task 1) (unless otherwise approved by U.S. EPA in the Final RI/FS Planning Documents), the Respondents shall submit to U.S. EPA, with a copy to IEPA, for review and approval by U.S. EPA, an RI Report addressing all of the Site. The RI Report shall be consistent with the Settlement Agreement, the RI/FS Work Plan, and this SOW. The RI Report shall accurately establish the site characteristics such as media contaminated, extent of contamination, and the physical boundaries of the contamination. Pursuant to this objective, the Respondents shall obtain only the essential amount of detailed data necessary to determine the key contaminant(s) movement and extent of contamination. The key contaminant(s) must be selected based on persistence and mobility in the environment and the degree of hazard. The key contaminant(s) identified in the RI shall be evaluated for receptor exposure and an estimate of the key contaminant level reaching human or environmental

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receptors must be made. The Respondents shall use existing standards and guidelines such as drinking-water standards, water-quality criteria, and other criteria accepted by the U.S. EPA as appropriate for the situation may be used to evaluate effects on human receptors that may be exposed to the key contaminant(s) above appropriate standards or guidelines. Respondents shall complete the RI Report in accordance with the following requirements:

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The Respondents shall submit an RI Report to U.S. EPA for review and approval pursuant to Section 2, which includes the following, as appropriate:

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- Executive Summary

- Site Background. The Respondents shall assemble and review available facts about the regional conditions and conditions specific to the Site under investigation.

- Investigation
  - Site Reconnaissance
  - Field Investigation & Technical Approach
  - Chemical Analysis & Analytical Methods
  - Field Methodologies
  - Biological
  - Surface Water
  - Sediment
  - Soil Boring
  - Soil Sampling
  - Monitoring Well Installation
  - Groundwater Sampling
  - Hydrogeological Assessment
  - Air Sampling
  - Waste Investigation
  - Geophysical Investigation

- Site Characteristics
  - Geology
  - Hydrogeology
  - Meteorology
  - Demographics and Land Use
  - Ecological Assessment

- Nature and Extent of Contamination
  - Contaminant Sources
  - Contaminant Distribution and Trends

- Fate and Transport
  - Contaminant Characteristics
  - Transport Processes
  - Contaminant Migration Trends

- Human Risk Assessment
  - Hazard Identification (sources)
  - Dose-Response Assessment
  - Prepare Conceptual Exposure/Pathway Analysis
  - Characterization of Site and Potential Receptors
  - Exposure Assessment
  - Risk Characterization
  - Identification of Limitations/Uncertainties
  - Site Conceptual Model

- Ecological Risk Assessment
  - Problem Formulation
  - Characterization of Exposure
  - Characterization of Ecological Effects
  - Risk Characterization
  - Uncertainty Analysis
- Summary and Conclusions

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TASK 5: TREATABILITY STUDIES

If U.S. EPA or the Respondents determine that treatability testing is necessary, the Respondents shall conduct treatability studies as described in this Task 5 of this SOW. In addition, if applicable, the Respondents shall use the testing results and operating conditions to evaluate a specific remedial approach or technology provided for in the FS. The Respondents shall perform the following activities.

5.1 Determine Candidate Technologies and the Need for Testing

The Respondents shall submit a Candidate Technologies and Testing Needs Technical Memorandum, to U.S. EPA with a copy to IEPA for review and approval by U.S. EPA, which identifies candidate technologies for a treatability studies program no later than at the time of submittal of the draft RI Report. The list of candidate technologies shall cover the range of technologies required for alternatives analysis. The Respondents shall determine and refine the specific data requirements for the testing program during Site characterization and the development and screening of remedial alternatives.

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5.1.1 Conduct Literature Survey and Determine the Need for Treatability Testing

Within the Candidate Technologies and Testing Needs Technical Memorandum, the Respondents shall conduct a literature survey to gather information on the performance, relative costs, applicability, removal efficiencies, operation and maintenance (O&M) requirements, and implementability of candidate technologies. Respondents shall conduct treatability studies except where Respondents can demonstrate to U.S. EPA's satisfaction that they are not needed.

5.2 Treatability Testing and Deliverables

5.2.1 Treatability Testing Work Plan and Sampling and Analysis Plan (SAP)

If U.S. EPA determines that treatability testing is necessary, U.S. EPA will decide on the type of treatability testing to use (e.g., bench versus pilot). Within 30 days of a request of U.S. EPA, the Respondents shall submit a Treatability Testing Work Plan and a SAP, or amendments to the original RI/FS Work Plan, FSP and QAPP to U.S. EPA with a copy to IEPA for review and approval by U.S. EPA, that describes the Site background, the remedial technology(ies) to be tested, test objectives, experimental procedures, treatability conditions to be tested, measurements of performance, analytical methods, data management and analysis, health and safety, and residual waste management. The Respondents shall document the DQOs for treatability testing as well. If pilot scale treatability testing is to be performed, the Treatability Study Work Plan shall describe pilot plant installation and start-up, pilot plant operation and maintenance procedures, operating conditions to be tested, a sampling plan to determine pilot plant performance, and a detailed health and safety plan. If testing is to be performed off-Site, the plans shall address all permitting requirements. The requirements of SAPs are outlined in Task 1.3.2 of this SOW.

5.2.2 Treatability Study Health and Safety Plan

If the original Health and Safety Plan is not adequate for defining the activities to be performed during the treatability tests, the Respondents shall submit a separate or amended Health and Safety Plan. Task 1.2.2 of this SOW provides additional information on the requirements of the Health and Safety Plan. U.S. EPA and IEPA review, but do not "approve" the Treatability Study Health and Safety Plan.

5.2.3 Treatability Study Evaluation Report

Following the completion of the treatability testing, the Respondents shall analyze and interpret the testing results in a technical report to U.S. EPA and IEPA. Respondents shall submit the treatability study report according to the schedule in the Treatability Study Work Plan. This report may be a part of the Site Characterization Technical Memorandum, the RI Report or submitted as a separate deliverable. The Treatability Study Evaluation Report shall evaluate each technology's effectiveness, implementability and cost, and actual results as compared with predicted results. The report shall also evaluate full scale application of the technology, including a sensitivity analysis identifying the key parameters affecting full-scale operation.

TASK 6: DEVELOPMENT AND SCREENING OF ALTERNATIVES

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The Respondents shall develop and screen an appropriate range of remedial alternatives that will be evaluated by the Respondents. This range of alternatives shall include, as appropriate, options in which treatment is used to reduce the toxicity, mobility, or volume of wastes, but which vary in the types of treatment, the amount treated, and the manner in which long-term residuals or untreated wastes are managed; options involving containment with little or no treatment; options involving both treatment and containment; and a no-action alternative. The Respondents shall

perform the following activities as a function of the development and screening of remedial alternatives.

6.1 Alternatives Development and Screening Deliverables

Unless U.S. EPA and the Respondents agree that the required information can be provided in the draft FS Report, the Respondents shall prepare and submit three technical memoranda for this task: a Remedial Action Objectives Technical Memorandum, an Alternative Arrays Technical Memorandum, and a Comparative Analysis of Alternatives Memorandum.

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6.1.1 Remedial Action Objectives Technical Memorandum

The Respondents shall submit a Remedial Action Objectives Technical Memorandum to U.S. EPA with a copy to IEPA for review and approval by U.S. EPA. The Respondents shall submit the Remedial Action Objectives Technical Memorandum at the same time as the Draft RI Report. Based on the baseline human health and ecological risk assessments, the Respondents shall document the Site-specific remedial action objectives in a Remedial Action Objectives Technical Memorandum. The remedial action objectives shall specify the contaminants and media of concern, potential exposure pathways and receptors; and contaminant levels or range of levels (at particular locations for each exposure route) that are protective of human health and the environment. Remedial action objectives shall be developed by considering the factors set forth in 40 C.F.R. § 300.430(e)(2)(i). The Respondents shall incorporate U.S. EPA's comments on the Remedial Action Objectives Technical Memorandum in the Alternatives Screening Technical Memorandum.

6.1.2 Alternatives Screening Technical Memorandum

The Respondents shall submit an Alternatives Screening Technical Memorandum to U.S. EPA with a copy to IEPA for review and approval by U.S. EPA. The Alternatives Screening Technical Memorandum shall summarize the work performed and the results of each of the above tasks, and shall include an alternatives array summary. If required by U.S. EPA, the Respondents shall modify the alternatives array to assure that the array identifies a complete and appropriate range of viable alternatives to be considered in the detailed analysis. The Alternatives Screening Technical Memorandum shall document the methods, the rationale and the results of the alternatives screening process. The Respondents shall incorporate U.S. EPA's comments on the Alternatives Screening Technical Memorandum in the Comparative Analysis of Alternatives Technical Memorandum. The Respondents shall submit the Alternatives Screening Technical Memorandum within 30 days after receipt of U.S. EPA's comments on the Remedial Action Objectives Technical Memorandum.

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6.1.2.1 Develop General Response Actions

In the Alternatives Technical Memorandum, the Respondents shall develop general response actions for each medium of interest including containment, treatment, excavation, pumping, or other actions, singly or in combination, to satisfy the U.S. EPA-approved remedial action objectives.

6.1.2.2 Identify Areas or Volumes of Media

In the Alternatives Technical Memorandum, the Respondents shall identify areas or volumes of media to which the general response actions may apply, taking into account requirements for protectiveness as identified in the remedial action objectives. The Respondents shall also take into account the chemical and physical characterization of the Site.

6.1.2.3 Identify, Screen, and Document Remedial Technologies

In the Alternatives Technical Memorandum, the Respondents shall identify and evaluate technologies applicable to each general response action to eliminate those that cannot be implemented at the Site. The Respondents shall refine applicable general response actions to specify remedial technology types. The Respondents shall identify technology process options for each of the technology types concurrently with the identification of such technology types or following the screening of considered technology types. The Respondents shall evaluate process options on the basis of effectiveness, implementability, and cost factors to select and retain one or, if necessary, more representative processes for each technology type. The Respondents shall summarize and include the technology types and process options in the Alternatives Screening Technical Memorandum. Whenever practicable, the alternatives shall also consider the CERCLA preference for treatment over conventional containment or land disposal approaches.

In the Alternatives Technical Memorandum, Respondents shall provide a preliminary list of alternatives to address contaminated soil, sediments, surface water, groundwater, and air contamination at the Site that shall consist of, but is not limited to, treatment technologies, removal and off-site treatment/disposal, removal and on-site disposal, and in-place containment for soils, sediments, and wastes. See 40 C.F.R. § 300.430(e)(1)-(7). The Respondents shall specify the reasons for eliminating any alternatives.

6.1.2.4 Assemble and Document Alternatives

The Respondents shall assemble the selected representative technologies into alternatives for each affected medium or operable unit. Together, all of the alternatives shall represent a range of treatment and containment combinations that shall address either the Site or the operable unit as a whole. The Respondents shall prepare a summary of the assembled alternatives and their related ARARs for the Alternatives Screening Technical Memorandum. The Respondents shall specify the reasons for eliminating alternatives during the preliminary screening process.

6.1.2.5 Refine Alternatives

The Respondents shall refine the remedial alternatives to identify the volumes of contaminated media addressed by the proposed processes and size critical unit operations as necessary. The Respondents shall collect sufficient information for an adequate comparison of alternatives. The Respondents shall also modify the remedial action objectives for each chemical in each medium as necessary to incorporate any new human health and ecological risk assessment information presented in the Respondents' baseline human health and ecological risk assessment reports. Additionally, the Respondents shall update ARARs as the remedial alternatives are refined.

6.1.3 Conduct and Document Screening Evaluation of Each Alternative

The Respondents may perform a final screening process based on short and long term aspects of effectiveness, implementability, and relative cost. Generally, this screening process is only necessary when there are many feasible alternatives available for a detailed analysis. If necessary, the Respondents shall conduct the screening of alternatives to assure that only the alternatives with the most favorable composite evaluation of all factors are retained for further analysis. As appropriate, the screening shall preserve the range of treatment and containment alternatives that was initially developed. The range of remaining alternatives shall include options that use treatment technologies and permanent solutions to the maximum extent practicable. The Respondents shall prepare an Alternatives Screening Technical Memorandum that summarizes the results and reasoning employed in screening; arrays the alternatives that remain after screening; and identifies the action-specific ARARs for the alternatives that remain after screening.

TASK 7: DETAILED ANALYSIS OF ALTERNATIVES (FS REPORT)

The Respondents shall conduct and present a detailed analysis of remedial alternatives to provide U.S. EPA with the information needed to select a Site remedy.

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7.1 Detailed Analysis of Alternatives

The Respondents shall conduct a detailed analysis of the remedial alternatives for the Site. The detailed analysis shall include an analysis of each remedial option against each of the nine evaluation criteria set forth in 40 C.F.R. § 300.430(e)(9)(iii) and a comparative analysis of all options using the same nine criteria as a basis for comparison.

7.1.1 Apply Nine Criteria and Document Analysis

The Respondents shall apply the nine evaluation criteria to the assembled remedial alternatives to ensure that the selected remedial alternative will protect human health and the environment and meet remedial action objectives; will comply with, or include a waiver of, ARARs; will be cost-effective; will utilize permanent solutions and alternative treatment technologies, or resource recovery technologies, to the maximum extent practicable; and will address the statutory preference for treatment as a principal element. The evaluation criteria include: (1) overall protection of human health and the environment and how the alternative meets each of the remedial action objectives; (2) compliance with ARARs; (3) long-term effectiveness and permanence; (4) reduction of toxicity, mobility, or volume; (5) short-term effectiveness; (6) implementability; (7) cost; (8) state (or support agency) acceptance; and (9) community acceptance. (Note: criteria 8 and 9 are considered after the RI/FS report has been released to the general public.) For each alternative the Respondents shall provide: (1) a description of the alternative that outlines the waste management strategy involved and identifies the key ARARs associated with each alternative, and (2) a discussion of the individual criterion assessment. If the Respondents do not have direct input on criteria (8) state (or support agency) acceptance and (9) community acceptance, U.S. EPA will address these criteria.

7.1.2 Compare Alternatives Against Each Other and Document the Comparison of Alternatives

The Respondents shall perform a comparative analysis between the remedial alternatives. That is, the Respondents shall compare each alternative against the other alternatives using the evaluation criteria as a basis of comparison. U.S. EPA will identify and select the preferred alternative. The Respondents shall prepare a Comparative Analysis of Alternatives Technical Memorandum which summarizes the results of the comparative analysis and fully and satisfactorily addresses and incorporates U.S. EPA's comments on the Alternatives Screening Technical Memorandum. The Respondents shall incorporate U.S. EPA's comments on the Comparative Analysis of Alternatives Technical Memorandum in the draft FS Report. The Respondents shall submit the Comparative Analysis of Alternatives Memorandum within 30 days after receipt of U.S. EPA's comments on the Alternatives Screening Technical Memorandum.

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7.1.3 Alternatives Analysis for Institutional Controls

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For any Alternatives that rely on Institutional Controls, the Respondents shall include in the Alternatives Screening Technical Memorandum, Comparative Analysis of Alternative Technical Memorandum and Feasibility Study an evaluation of the following: 1) *Overall Protection of Human Health and the Environment* including what specific institutional control components will ensure that the alternative will remain protective and how these specific controls will meet remedial action objectives; 2) *Compliance with ARARs;* 3) *Long Term Effectiveness* including the adequacy and reliability of institutional controls and how long the institutional control must remain in place; 4) *Short Term Effectiveness* including the amount of time it will take to impose the Institutional Control; 5) *Implementability* including research and documentation that the proper entities (e.g., potentially responsible parties, state, local government entities, local landowners conservation organizations) are willing to enter into any necessary agreement or restrictive covenant with the proper entities and/or that laws governing the restriction exist or allow implementation of the institutional control; 6) *Cost* including the cost to implement, maintain, monitor and enforce the institutional control;7) *State and Community acceptance* of the Institutional Control.

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7.2 Feasibility Study Report

Within 90 days after receipt of U.S. EPA's comments on the RI Report, Baseline Human Health Risk Assessment, and Ecological Risk Assessment, the Respondents shall prepare and submit a draft FS Report to U.S. EPA for its review pursuant to Section 2. The FS report shall summarize the development and screening of the remedial alternatives and present the detailed analysis of remedial alternatives. In addition, the FS Report shall also include the information U.S. EPA will need to prepare relevant sections of the Record of Decision (ROD) for the Site [see Chapters 6 and 9 of U.S. EPA's *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* (EPA 540-R-98-031, July 1999) for the information that is needed].

TASK 8: PROGRESS REPORTS

The Respondents shall submit monthly written progress reports to U.S. EPA and IEPA concerning actions undertaken pursuant to the Settlement Agreement and this SOW, beginning 30 days after the effective date of the Settlement Agreement, until the termination of the

Settlement Agreement, unless otherwise directed in writing by U.S. EPA's RPM. These reports shall include, but not be limited to, a description of all significant developments during the preceding period, including the specific work that was performed and any problems that were encountered; paper and electronic copies (formatted according to U.S. EPA specifications) of any analytical data reports that were received during the reporting period; (the progress report will note that the date are unreviewed and unvalidated and therefore considered by the Respondents to be preliminary); and the developments anticipated during the next reporting period, including a schedule of work to be performed, anticipated problems, and actual or planned resolutions of past or anticipated problems. The monthly progress reports will include a brief summary of any field activities conducted that month.

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EXHIBIT A
SCHEDULE FOR MAJOR DELIVERABLES

DELIVERABLE	DUE DATE
TASK 1.2.2 - RI/FS Planning Documents, including Work Plan/Field Sampling Plan, Quality Assurance Project Plan and Health and Safety Plan	RI/FS Planning documents due 60 days after the effective date of the Settlement Agreement. Final RI/FS Planning Documents due 30 days after U.S. EPA notification of deficiencies pursuant to Section 2 of the SOW and Section X of the Settlement Agreement.
Task 2 - Technical Assistance Plan (TAP)	TAP due 30 days after the effective date of the Settlement Agreement. Final TAP due 30 days after receipt of U.S. EPA's notification of deficiencies pursuant to Section 2 of the SOW and Section X of the Settlement Agreement.
Task 2 - Quarterly Progress Reports on Implementation of the TAP	10 days after the end of each calendar year quarter; first report due in the first full calendar year quarter after the effective date of the Settlement Agreement.
Task 3 - Site Characterization Technical Communications	To be included in the monthly Progress Reports.
Task 4 - RI Report	RI Report due 120 days following receipt of analytical data following completion of the last field sampling event under the Final Work Plan and Field Sampling Plan. Final RI Report due 30 days after receipt of U.S. EPA's notification of deficiencies pursuant to Section 2 of this SOW and Section X of the Settlement Agreement.
Task 5.1 - Candidate Technologies and Testing Needs Technical Memorandum	Within 60 days of request of U.S. EPA if determined to be necessary.
Task 5.2.1 - Draft and Final Treatability Testing Work Plan and SAP or Amendments to the Original RI/FS Work Plan, FSP and/or QAPP.	Within 60 days of request of U.S. EPA if determined to be necessary.

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DELIVERABLE	DUE DATE
Task 5.2.2 - Draft and Final Treatability Testing Health and Safety Plan or Amendment to the Original Health and Safety Plan	Within 30 days of request of U.S. EPA if determined to be necessary.
Task 5.2.3 - Draft and Final Treatability Study Evaluation Report	With the Site Characterization Technical Memorandum, the RI Report (Task 4), or as approved by U.S. EPA in the Work Plan/Field Sampling Plan.
Task 6 - Remedial Action Objectives Technical Memorandum	With the draft RI Report (Task 4) if requested by U.S. EPA.
Task 6 - Alternatives Screening Technical Memorandum	30 days after receipt of U.S. EPA's U.S. EPA's comments on the Remedial Action Objectives Technical Memorandum.
Task 6 - Comparative Analysis of Alternatives Technical Memorandum	30 days after receipt of U.S. EPA's comments on the Alternatives Screening Technical Memorandum.
Task 7 - FS Report	FS Report due 90 days after receipt of U.S. EPA's approval of RI Report, Baseline Human Health Risk Assessment, and Ecological Risk Assessment. Final FS Report due 30 days after receipt of U.S. EPA's notification of deficiency on the draft FS Report pursuant to Section 2 of the SOW and Section X of the Settlement Agreement.
Task 8: Monthly Progress Reports	On the 15th day of each month or the first business day after the 15th of the month commencing 30 days after the effective date of the Settlement Agreement.
Miscellaneous Documents	In accordance with the submittal date provided by the U.S. EPA RPM.

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EXHIBIT B
PARTIAL LIST OF GUIDANCE

The following list, although not comprehensive, comprises many of the regulations and guidance documents that apply to the RI/FS process. The majority of these guidance documents, and additional applicable guidance documents, may be downloaded from the following websites:

http://www.epa.gov/superfund/pubs.htm (General Superfund)
http://cluin.org (Site Characterization, Monitoring and Remediation)
http://www.epa.gov/ORD/NRMRL/Pubs (Site Characterization and Monitoring)
http://www.epa.gov/quality/qa_docs.html#guidance (Quality Assurance)
http://www.epa.gov/superfund/programs/risk/toolthh.htm (Risk Assessment - Human)
http://www.epa.gov/superfund/programs/risk/tooleco.htm (Ecological Risk Assessment)
http://www.epa.gov/superfund/programs/lead (Risk Assessment - Lead)
http://cfpub.epa.gov/ncea (Risk Assessment - Exposure Factors/Other)
http://www.epa.gov/nepis/srch.htm (General Publications Clearinghouse)
http://www.epa.gov/clariton/clhtml/pubtitle.html (General Publications Clearinghouse)

1. The (revised) National Contingency Plan

2. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, U.S. EPA, Office of Emergency and Remedial Response, OSWER Directive No. 9355.3-01, EPA/540/G-89/004, October 1988.

3. *Conducting Remedial Investigations/Feasibility Studies for CERCLA Municipal Landfill Sites*, U.S. EPA, Office of Emergency and Remedial Response, EPA/540/P-91/001, February 1991.

4. *Implementing Presumptive Remedies*, U.S. EPA, Office of Emergency and Remedial Response, EPA-540-R-97-029, October 1997.

5. *Presumptive Remedy for CERCLA Municipal Landfill Sites*, U.S. EPA, OSWER Directive No. 9355.0-49FS, EPA-540-F-93-035, September 1993.

6. *Presumptive Remedies: CERCLA Landfill Caps RI/FS Data Collection Guide*, U.S. EPA, OSWER 9355.3-18FS, EPA/540/F-95/009, August 1995.

7. *Presumptive Response Strategy and Ex-Situ Treatment Technologies for Contaminated Ground Water at CERCLA Sites*, OSWER 9283.1-12, EPA-540-R-96-023, October 1996.

8. *Field Analytical and Site Characterization Technologies Summary of Applications*, U.S. EPA, EPA-542-F-97-024, November 1997.

9. *CLU-IN Hazardous Waste Clean-Up Information World Wide Web Site*, U.S. EPA, EPA-542-F-99-002, February 1999.

10. *Field Sampling and Analysis Technology Matrix and Reference Guide*, U.S. EPA, EPA-542-F-98-013, July 1998.

11. *Subsurface Characterization and Monitoring Techniques: A Desk Reference Guide, Volumes 1 and 2*, U.S. EPA, EPA/625/R-93/003, May 1993.

12. *Use of Airborne, Surface, and Borehole Geophysical Techniques at Contaminated Sites: A Reference Guide*, U.S. EPA, EPA/625/R-92/007(a,b), September 1993.

13. *Innovations in Site Characterization: Geophysical Investigation at Hazardous Waste Sites*, U.S. EPA, EPA-542-R-00-003, August 2000.

14. *Innovative Remediation and Site Characterization Technology Resources*, U.S. EPA, OSWER, EPA-542-F-01-026b, January 2001.

15. *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells*, U.S. EPA, EPA/600/4-89/034, 1991.

16. *Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers*, U.S. EPA, EPA-542-S-02-001, May 2002.

17. *Ground Water Issue: Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, U.S. EPA, EPA/540/S-95/504, April 1996.

18. *Superfund Ground Water Issue: Ground Water Sampling for Metals Analysis*, U.S. EPA, EPA/540/4-89/001, March 1989.

19. *Resources for Strategic Site Investigation and Monitoring*, U.S. EPA, OSWER, EPA-542-F-010030b, September 2001.

20. *Region 5 Framework for Monitored Natural Attenuation Decisions for Groundwater*, U.S. EPA Region 5, September 2000.

21. *Ground Water Issue: Suggested Operating Procedures for Aquifer Pumping Tests*, U.S. EPA, OSWER, EPA/540/S-93/503, February 1993.

22. *Technical Protocol for Evaluating Natural Attenuation of Chlorinated Solvents in Ground Water*, U.S. EPA, EPA/600/R-98/128, September 1998.

23. *Use of Monitored Natural Attenuation at Superfund, RCRA Corrective Action and Underground Storage Tank Sites*, U.S. EPA, OSWER Directive 9200.4-17P, April 21, 1999.

24. *Ground Water Issue: Fundamentals of Ground-Water Modeling*, U.S. EPA, OSWER, EPA/540/S-92/005, April 1992.

25. *Assessment Framework for Ground-Water Model Applications*, U.S. EPA, OSWER Directive #9029.00, EPA-500-B-94-003, July 1994.

26. *Ground-Water Modeling Compendium - Second Edition: Model Fact Sheets, Descriptions, Applications and Cost Guidelines*, U.S. EPA, EPA-500-B-94-004, July 1994.

27. *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*, U.S. EPA, Office of Solid Waste and Emergency Response, OSWER Directive No. 9200.1-23P, EPA 540-R-98-031, July 1999.

28. *Region 5 Instructions on the Preparation of A Superfund Division Quality Assurance Project Plan Based on EPA QA/R-5, Revision 0*, U.S. EPA Region 5, June 2000.

29. *Guidance for the Data Quality Objectives Process (QA-G-4)*, U.S. EPA, EPA/600/R-96/055, August 2000.

30. *Guidance for the Data Quality Objectives Process for Hazardous Waste Sites (QA/G-4HW)*, U.S. EPA, EPA/600/R-00/007, January 2000.

31. *Guidance for the Preparation of Standard Operating Procedures (QA-G-6)*, U.S. EPA, EPA/240/B-01/004, March 2001.

32. *EPA Requirements for Quality Management Plans (QA/R-2)*, U.S. EPA, EPA/240/B-01/002, March 2001.

33. *EPA Requirements for QA Project Plans (QA/R-5)*, U.S. EPA, EPA/240/B-01/003, March 2001.

34. *Guidance for Quality Assurance Project Plans (QA/G-5)*, U.S. EPA, EPA/600/R-98/018, February 1998.

35. *Users Guide to the EPA Contract Laboratory Program*, U.S. EPA, Sample Management Office, OSWER Directive No. 9240.0-01D, January 1991.

36. *Technical Guidance Document: Quality Assurance and Quality Control for Waste Containment Facilities*, U.S. EPA, EPA/600/R-93/182, 1993.

37. *Risk Assessment Guidance for Superfund - Volume I Human Health Evaluation Manual (Part A)*, U.S. EPA, EPA/540/1-89/002, December 1989.

38. *Risk Assessment Guidance for Superfund - Volume I Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals)*, U.S. EPA, EPA/540/R-92/003, OSWER Publication 9285.7-01B, December 1991.

39. *Risk Assessment Guidance for Superfund - Volume I Human Health Evaluation Manual (Part C - Risk Evaluation of Remedial Alternatives)*, U.S. EPA, Office of Emergency and Remedial Response, Publication 9285.7-01C, October, 1991.

40. *Risk Assessment Guidance for Superfund - Volume I Human Health Evaluation Manual (Part D - Standardized Planning, Reporting, and Review of Superfund Risk Assessments)*, U.S. EPA, Office of Emergency and Remedial Response, Publication 9285.7-47, December 2001.

41. *Risk Assessment Guidance for Superfund: Volume III - Part A, Process for Conducting Probabilistic Risk Assessment*, U.S. EPA, OSWER Publication 9285.7-45, EPA-540-R-02-002, December 2001.

42. *Policy for Use of Probabilistic in Risk Assessment at the U.S. Environmental Protection Agency*, U.S. EPA, Office of Research and Development, 1997.

43. *Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors*, U.S. EPA, OSWER Directive 9285.6-03, March 25, 1991.

44. *Exposure Factors Handbook*, Volumes I, II, and III, U.S. EPA, EPA/600/P-95/002Fa,b,c, August 1997.

45. *Supplemental Guidance to RAGS: Calculating the Concentration Term*, U.S. EPA, OSWER Publication 9285.7-08I, May 1992.

46. *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, U.S. EPA, OSWER Directive 9355.4-12, EPA/540/F-94/043, July 14, 1994.

47. *Clarification to the 1994 Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, U.S. EPA, OSWER Directive 9200.4-27, EPA/540/F-98/030, August 1998.

48. *Guidance Manual for the Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children*, U.S. EPA, OSWER Publication 9285.7-15-1, February 1994; and associated, clarifying Short Sheets on IEUBK Model inputs, including but not limited to OSWER 9285.7-32 through 34, as listed on the OSWER lead internet site at www.epa.gov/superfund/programs/lead/prods.htm.

49. *Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children*, Version 0.99D, NTIS PB94-501517, 1994 or *Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead in Children*, Windows© version, 2001,

50. *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, U.S. EPA, OSWER Directive 9355.0-30, April 22, 1991.

51. *Performance of Risk Assessments in Remedial Investigation /Feasibility Studies (RI/FSs) Conducted by Potentially Responsible Parties (PRPs)*, OSWER Directive No. 9835.15, August 28, 1990.

52. *Supplemental Guidance on Performing Risk Assessments in Remedial Investigation Feasibility Studies (RI/FSs) Conducted by Potentially Responsible Parties (PRPs)*, OSWER Directive No. 9835.15(a), July 2, 1991.

53. *Role of Background in the CERCLA Cleanup Program*, U.S. EPA, OSWER 9285.6-07P, April 26, 2002.

54. *Soil Screening Guidance: User's Guide*, U.S. EPA, OSWER Publication 9355.4-23, July 1996.

55. *Soil Screening Guidance: Technical Background Document*, U.S. EPA, EPA/540/R95/128, May 1996.

56. *Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites* (Peer Review Draft), U.S. EPA, OSWER Publication 9355.4-24, March 2001.

57. *Ecological Risk Assessment Guidance for Superfund: Process for Designing & Conducting Ecological Risk Assessments*, U.S. EPA, OSWER Directive 9285.7-25, EPA-540-R-97-006, February 1997.

58. *Guidelines for Ecological Risk Assessment*, U.S. EPA, EPA/630/R-95/002F, April 1998.

59. *The Role of Screening-Level Risk Assessments and Refining Contaminants of Concern in Baseline Ecological Risk Assessments*, U.S. EPA, OSWER Publication 9345.0-14, EPA/540/F-01/014, June 2001.

60. *Ecotox Thresholds*, U.S. EPA, OSWER Publication 9345.0-12FSI, EPA/540/F-95/038, January 1996.

61. *Issuance of Final Guidance: Ecological Risk Assessment and Risk Management Principles for Superfund Sites*, U.S. EPA, OSWER Directive 9285.7-28P, October 7, 1999.

62. *Guidance for Data Usability in Risk Assessment (Quick Reference Fact Sheet)*, OSWER 9285.7-05FS, September, 1990.

63. *Guidance for Data Usability in Risk Assessment (Part A)*, U.S. EPA, Office of Emergency and Remedial Response, Publication 9285.7-09A, April 1992.

64. *Guide for Conducting Treatability Studies Under CERCLA*, U.S. EPA, EPA/540/R-92/071a, October 1992.

65. *CERCLA Compliance with Other Laws Manual, Two Volumes*, U.S. EPA, Office of Emergency and Remedial Response, OSWER Directive No. 9234.1-01 and -02, EPA/540/G-89/009, August 1988.

66. *Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites*, U.S. EPA, Office of Emergency and Remedial Response, (Interim Final), OSWER Directive No. 9283.1-2, EPA/540/G-88/003, December 1988.

67. *Considerations in Ground-Water Remediation at Superfund Sites and RCRA Facilities - Update*, U.S. EPA, OSWER Directive 9283.1-06, May 27, 1992.

68. *Methods for Monitoring Pump-and-Treat Performance*, U.S. EPA, EPA/600/R-94/123, June 1994.

69. *Pump-and-Treat Ground-Water Remediation A Guide for Decision Makers and Practitioners*, U.S. EPA, EPA/625/R-95/005, July 1996.

70. *Ground-Water Treatment Technology Resource Guide*, U.S. EPA, OSWER, EPA-542-B-94/009, September 1994.

71. *Land Use in the CERCLA Remedy Selection Process*, U.S. EPA, OSWER Directive No. 9355.7-04, May 25, 1995.

72. *Reuse Assessments: A Tool To Implement The Superfund Land Use Directive*, U.S. EPA, OSWER 9355.7-06P, June 4, 2001.

73. *Reuse of CERCLA Landfill and Containment Sites*, U.S. EPA, OSWER 9375.3-05P, EPA-540-F-99-015, September 1999.

74. Reusing Superfund Sites: Commercial Use Where Waste is Left on Site, U.S. EPA, OSWER 9230.0-100, February 2002.

75. Covers for Uncontrolled Hazardous Waste Sites, U.S. EPA, EPA/540/2-85/002, 1985.

76. *Technical Guidance Document: Final Covers on Hazardous Waste Landfills and Surface Impoundments*, U.S. EPA, OSWER, EPA/530-SW-89-047, July 1989.

77. *Engineering Bulletin: Landfill Covers*, U.S. EPA, EPA/540/S-93/500, 1993.

78. *Principles for Managing Contaminated Sediment Risks at Hazardous Waste Sites*, U.S. EPA OSWER Directive 9285.6-08, February 12, 2002.

79. *Institutional Controls: A Site Manager's Guide to Identifying, Evaluating and Selecting Institutional Controls at Superfund and RCRA Corrective Action Cleanups*, U.S. EPA, OSWER 9355.0-74FS-P, EPA/540-F-00-005, September 29, 2000.

80. *Health and Safety Requirements of Employees Employed in Field Activities*, U.S. EPA, Office of Emergency and Remedial Response, EPA Order No. 1440.2, July 12, 1981.

81. *OSHA Regulations in 29 CFR 1910.120*, Federal Register 45654, December 19, 1986.

82. *Standard Operating Safety Guides*, PB92-963414, June 1992.

83. *Community involvement in Superfund: A Handbook*, U.S. EPA, Office of Emergency and Remedial Response, OSWER Directive No. 9230.0#3B June 1988; and OSWER Directive No. 9230.0-3C, January 1992.

APPENDIX B

ARCADIS

Infrastructure, environment, buildings

APPENDIX B
SAMPLING AND ANALYSIS PLAN

Lake Calumet Cluster Site
Chicago, Illinois

ORIGINAL: May 2005
REVISION NO. 1: August 2005

Part of a bigger picture

ARCADIS

Jack Kratzmeyer
ARCADIS Project Manager / Principal Engineer

Ali C. Senn
ARCADIS RI Task Manager

Appendix B
Sampling and Analysis Plan

Remedial Investigation / Feasibility Study

Lake Calumet Cluster Site
Chicago, Illinois

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Date:
August 26, 2005

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Acronym List

AOC	Administrative Order by Consent
ASTM	American Society of Testing Materials
DO	Dissolved Oxygen
DOT	Department of Transportation
DTW	Depth to Water
FID	Flame Ionization Detector
FS	Feasibility Study
FSS	Field Support Section
HASP	Health and Safety Plan
Illinois EPA	Illinois Environmental Protection Agency
IDW	Investigation Derived Waste
Mg/L	Milligrams Per Liter
mS/cm	MilliSiemen Per Centimeter
MS/MSD	Matrix Spike/Matrix Spike Duplicate
mV	Millivolts
NCP	National Contingency Plan
NTU	Nephelometric Turbidity Units
ORP	Oxidation Reduction Potential
PID	Photoionization Detector
PPE	Personal Protective Equipment
PVC	Polyvinyl Chloride
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
QC	Quality Control
Redox	Oxidation-reduction
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SAP	Sampling and Analysis Plan
Site	Lake Calumet Cluster Site, Chicago, Illinois
Site Group	Lake Calumet Cluster Site Group
SOP	Standard Operating Procedure
SOW	Statement of Work

TAL	Target Analyte List
U.S. EPA	United States Environmental Protection Agency
USCS	Unified Soil Classification System
USGS	United States Geological Survey
VOCs	Volatile Organic Compounds

1. Introduction

The purpose of this Sampling and Analysis Plan (SAP) is to present the field procedures that will be used during the remedial investigation/feasibility (RI/FS) study at the Lake Calumet Cluster Site located in Chicago, Illinois (the Site). This SAP covers the following RI field activities:

- Install of four monitoring wells to verify hydraulic gradient and flow direction.
- Conduct an elevation survey, including top of casing elevation and ground surface elevation of monitoring wells.
- Sample the four new monitoring wells and six existing monitoring wells.
- Conduct hydraulic conductivity testing (slug testing) of the fill, silty-sand and sandy surficial geologic material at the Site.
- Collect one groundwater sample from a test trench placed at the interface of the Site and the Indian Ridge Marsh.

The rational for collecting samples in select areas is presented in Table B-1. Table B-2 summarizes the field and analytical parameters for each sample matrix.

The SAP is derived from field sampling protocols that are based on technically sound, standard practices such as those published in "Handbook for Sampling and Preservation of Water and Wastewater," U.S. EPA, 1982, "RCRA Ground-Water Monitoring Technical Enforcement Guidance Document," U.S. EPA, and Standard Operating Procedures (SOPs) developed by ARCADIS G&M (ARCADIS). The SAP protocols were developed to ensure that the RI field procedures are of uniform and high quality. The proper use of the SOPs developed by ARCADIS is outlined in T100 "SOP Control and Use" (Attachment B-1).

1.1 Sampling Team Responsibilities

The project team members were selected because of their experience in the following areas:

- Technical expertise in preparing National Contingency Plan (NCP)-compliant feasibility studies, including development and screening of alternatives, cost estimating, and evaluating remedial technologies.
- Familiarity and previous experience at the Site.

- Technical expertise in groundwater remedial technologies.

This project will be managed in accordance with the organization chart presented in Figure B-1. This hierarchy will be used to ensure that all team members are familiar with their expected roles in completing a specific assignment. The management responsibilities are described below:

Project Manager – Jack Kratzmeyer

- Management of ARCADIS project team;
- Meetings with Respondants and U.S. EPA;
- Coordination of technical task leaders;
- Data evaluation;
- Preparation and review of Work Plan and related plans; and
- Technical representation of project activities.

Technical Task Managers

The ARCADIS technical task leaders are responsible for the task-specific aspects of the RI/FS Work Plan and related plans. The task leaders report to the project manager. The task leaders are as follows:

Health and Safety	Mija Coppola
Project Engineering	Darren Quillen
Hydrogeology	TBD
Risk Assessment	Miranda Henning
Database	TBD

1.2 Site and Project Description

The reader is referred to Section 2.0 (Background) of the Remedial Investigation/ Feasibility Study Work Plan (RI/FS Work Plan) for a description of the Site and a summary of the pertinent site background and operating history. This plan specifically addresses the field sampling procedures that will be followed during RI field investigations at the Site.

2. Sampling Program, Procedures, and Equipment

2.1 Installation of Monitoring Wells

The new wells associated with the RI will be installed using hollow stem auger drilling methods (ASTM Method D1452, Attachment A-2) and standard split-barrel sampling techniques. Prior to initiating drilling and between each borehole, the auger flights, drill rig, and all downhole equipment will be decontaminated with a pressurized steam cleaner.

2.1.1 Well Construction

A total of four (4) monitoring wells are expected to be installed as part of the RI. This total includes three on-Site monitoring wells and one off-Site monitoring well.

The existing and new well locations are shown on Figures B-2 and B-3. The well installations will be performed using a truck-mounted drill rig and hollow-stem augers. The monitoring wells will be installed by a qualified drilling subcontractor, under the supervision of an ARCADIS geologist. Continuous soil samples will be collected from the unsaturated zone in each of the soil borings. The soil samples will be screened in the field for visual signs of contamination. During drilling operations, the lithology of the soil samples will be classified in accordance with the Unified Soil Classification System (ASTM D2487). Refer to ARCADIS SOP T116 "Borehole Soil Logging" (Attachment B-1).

The SOP for well installation operations is provided in Attachment B-1, "T105-Monitoring Well Installation Unconsolidated Formation". All downhole equipment will be steam cleaned between each location and sampling equipment will be decontaminated with a non-sudsing detergent and rinsed with distilled water between each sample interval. Each well will be developed by overpumping and surging (surge block or air lift), to remove a minimum of ten well volumes or until water clarity is achieved. All soil cuttings, development fluid, and decontamination water will be drummed for subsequent characterization and disposal, as appropriate.

In addition to developing the new monitoring wells, ARCADIS will conduct a survey of the existing monitoring wells to verify their integrity and determine if any of the wells should be redeveloped. If it is determined the wells require redevelopment, they will be redeveloped by overpumping and surging (surge block or air lift), to remove a minimum of ten well volumes or until water clarity is achieved.

2.2 Site Topographic Survey

The Site topographic survey will address RI monitoring well locations. The monitoring well locations will be surveyed relative site datum to be assigned during field activities. Elevations will be surveyed to +/- 0.01 foot using an automatic level.

2.3 Groundwater Level

Groundwater levels will be collected at accessible existing and the three new on-Site monitoring wells and one new off-Site monitoring well. The groundwater level will be measured to the nearest 0.01 foot using a pre-cleaned Solinst Model 101 electric water level indicator or equivalent. Field calibration, preventative maintenance, and SOPs are contained in Section 5.0. The total depth of the monitoring well from the reference point (i.e., top of casing) will be measured to ±0.01 foot using a pre-cleaned weighted measuring tape.

2.4 Groundwater Monitoring

The groundwater monitoring well network of eight (8) wells will be sampled in one round. A list sample points is provided on Table B-1. The groundwater samples will be submitted to STL Savannah of Savannah, Georgia (project laboratory) for analyses of the parameters listed in Table B-3. The groundwater samples collected for analysis will be collected using low-flow sampling methods.

The protocol described herein applies minimal drawdown techniques to obtain samples that are representative of groundwater moving through the subsurface under natural conditions. Groundwater samples will be collected and analyzed for the parameters listed in Table B-4.

All downhole equipment, such as the water level indicator, dissolved oxygen probe, and pumps, will be decontaminated as discussed in Section 6.0. Purge water and decontamination water will be managed as discussed in Section 7.0.

The minimal drawdown purging and sampling protocol will be as follows:

1. The groundwater level will be measured to the nearest 0.01 foot using a pre-cleaned Solinst Model 101 electric water level indicator or equivalent. Field calibration, preventative maintenance, and SOPs are contained in Section 5.0.

2. The total depth of the monitoring well from the reference point (i.e., top of casing) will be measured to ±0.01 foot using a pre-cleaned weighted measuring tape. The measured well depth will be compared to the constructed well depth to evaluate the presence of any sediment accumulated at the well bottom. The measurement device will be lowered slowly to the well bottom to minimize mixing of the stagnant well casing water and to minimize agitation of solids into suspension. The depth of any well bottom sediment will be considered when positioning the pump intake to avoid mobilizing the sediment while purging.

3. Purging will be conducted using a Micropurge pump, a pre-cleaned stainless-steel bladder pump with a Teflon® bladder, or equivalent. The pump discharge line and air supply line for the bladder pump operation will be polyethylene and dedicated to the well. The bladder pump will be secured to nylon rope (dedicated to the well) and positioned in the well prior to commencement of purging and sampling activities. The bladder pump will be positioned such that the pump intake corresponds to the middle of the screen. The SOP T133 for the Micropurge pump is included in Attachment B-1.

4. Purging of the monitoring well will be conducted using a pumping rate, designed to minimize drawdown, no greater than 500 milliliters per minute (mL/min). Initial purging will begin using a pumping rate at the lower end of this range. The groundwater level will be measured while purging to ensure that less than 0.3 foot of drawdown occurs. The pumping rate may be gradually changed depending upon the amount of drawdown and the behavior of the stabilization parameters (see item 5 below). Pumping rate adjustments generally will be made within 15 minutes from the start of purging and then should remain constant for the duration of purging. While purging, the pumping rate and groundwater level will be measured and recorded every 10 minutes (or as appropriate). If it is apparent that stabilization of the purged groundwater (see item 5 below) will not be achieved rapidly, these measurements may be made at longer time intervals to allow field staff to perform other sampling activities.

5. Stabilization of the purged groundwater is necessary prior to sampling to ensure that the samples obtained are representative of groundwater in the subsurface only and not influenced by stagnant groundwater stored in the well casing. The field parameters pH, temperature, conductivity, oxidation-reduction (redox) reaction potential (ORP), and dissolved oxygen (DO) will be monitored while purging to evaluate the stabilization of the purged groundwater. The field parameters will be measured and recorded every 10 minutes (or as appropriate)

and recorded on the Groundwater Sampling Form, an example of which is in Attachment B-2. Stabilization will be considered to be achieved when three consecutive recorded readings for each parameter are within the following limits:

pH	±0.1 pH units of the average value of the three readings;
Temperature	±3 percent of the average value of the three readings;
Conductivity	±0.005 milliSiemen per centimeter (mS/cm) of the average value of the three readings for conductivity <1 mS/cm and ±0.01 mS/cm of the average value of the three readings for conductivity >1 mS/cm;
ORP	±10 millivolts (mV) of the average value of the three readings; and
DO	±10 percent of the average value of the three readings.

pH, temperature, conductivity, ORP, and DO will be monitored using a YSI Model 6820 instrument or equivalent instruments. Field calibration, preventative maintenance, and SOPs are contained in Section 5.0. At the start of purging, the purge water will be visually inspected for water clarity prior to connecting the flow-through-cell. If the purge water appears turbid, purging will be continued until the purge water becomes visibly less turbid before connecting the flow-through-cell. While purging, the meter readings will be monitored for evidence of meter malfunction. The following are common indicators of meter malfunctions:

- DO above solubility [e.g., oxygen solubility is approximately 11 milligrams per liter (mg/L) at 10° Celsius] may indicate a DO meter malfunction;
- Negative ORP and DO greater than 1 to 2 mg/L may indicate either an ORP or a DO meter malfunction (i.e., should have positive ORP and DO greater than 1 to 2 mg/L under oxidizing conditions); and
- Positive ORP and DO less than 1 mg/L may indicate either an ORP or a DO meter malfunction (i.e., should have negative ORP and DO less than 1 mg/L under reducing conditions).

Meter calibration fluids will be available for meter re-calibration in the field, if necessary.

In general, stabilization of the individual field parameters is expected to occur in the order listed above. Should stabilization not be achieved for all field parameters, purging will be continued until a maximum of 10 well screen volumes have been purged from the well. After purging 10 well screen volumes, purging will be continued if the purge water remains visibly turbid and appears to be clearing, or if stabilization parameters are varying slightly outside of the stabilization criteria listed above and appear to be approaching stabilization. In the event the monitoring well does not stabilize after the removal of 10 well screen volumes, the monitoring well will be redeveloped using the procedures described in Section 2.1.1.

In the event that the groundwater recharge to the monitoring well is insufficient to conduct the minimal drawdown protocol, the well will be pumped dry and allowed to sufficiently recharge prior to sampling. Wells, which are purged dry, will not be subject to the above purging criteria.

2.4.1 Groundwater Sample Collection Methodologies

Groundwater samples will be collected using the following procedures during low-flow sampling:

1. A new pair of disposable latex gloves will be used for each sample collected.

2. If a flow-through-cell is used, it will be disconnected prior to obtaining the sample. The discharge line from the pump will be positioned at the base of the sample bottle. All required preservatives will be added to the samples in the manner consistent with the appropriate methodology by either placing the preservative in the sample containers prior to sampling or adding at the sample location immediately after collection. The sample bottle will be filled from the bottom to the top and will be allowed to overflow before sealing (over flow is not recommended if the sample bottles have been prepared with preservatives prior to sample collection). Samples will be collected in the following order:

   a) VOCs;

   b) Light Gases;

c) unfiltered inorganics; and

d) filtered inorganics.

Each VOC and light gases sample vial will be inspected for the presence of bubbles. If bubbles are observed, the sampler will attempt to add sample volume to the vial to remove the bubbles. If bubbles continue to form, indicating effervescence, the sample will be discarded and recollected. The project laboratory will be notified that the samples are unpreserved and the analyses will be completed within the appropriate holding time.

Parameters that require filtering will be collected following the attachment of a disposable 0.45 μm in-line filter to the discharge tubing.

3. All equipment used during sampling, which may have come in contact with potentially contaminated waters, will be decontaminated. Latex gloves used during the collection of the samples will be disposed of. The pump discharge line and air supply line will either be dedicated and left hanging in the well or disposed of after the well has been sampled.

4. QC samples will be collected for chemical analysis as discussed in Section 3.0. The sample containers will be placed in the sample cooler with packing material and bagged ice and will be held at or below 4° Celsius prior to and during shipment to the laboratory. The samples will be shipped by overnight delivery to the project laboratory. Sample custody and document control procedures outlined in Section 4.0 will be followed.

2.5 Hydraulic Conductivity Test

To estimate the hydraulic conductivity of the fill, silty-sand and sandy surficial geologic material, in-situ hydraulic conductivity tests (slug tests) will be conducted at the Site. The testing will be conducted in accordance with the ARCADIS SOP T122, "Slug Testing Using a Hermit Data Logger" (refer to Attachment A-1). Data reduction for the hydraulic conductivity test results is also covered in the SOP.

2.6 Trench Test

In order to assess groundwater quality at the interface between the Site and the Indian Ridge Marsh, one groundwater sample will be collected from an open test trench. The

trench will be created with a small track hoe and will measure approximately ten feet long by two feet wide and five feet deep. The actually size of the test trench may vary depending on field conditions and equipment. A groundwater sample will be collected from the open trench. Samples will be analyzed for VOCs, light gases, and inorganics, as presented on Table B-4.

3. Field Quality Control Sampling

3.1 General

The RI sampling and analysis program including associated QC sampling is summarized in Table B-2.

The following types of field QC samples will be collected for laboratory chemical analysis during the collection of select aqueous samples:

- Equipment blank samples;
- Trip blank samples;
- Field duplicate samples; and,
- Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples.

Each type of field QC sample for laboratory chemical analysis is discussed below.

3.2 Equipment Blank Samples

Equipment blank samples will be collected for any aqueous sampling activity that requires equipment decontamination. One equipment blank will be collected for each twenty or fewer aqueous investigative samples submitted.

The equipment blank will be obtained by passing analyte-free laboratory-supplied, deionized water through a cleaned sampling apparatus (i.e., bladder pump or sampler) and collecting it in a clean container. Specifically, the equipment blank for the bladder pump will be collected by attaching a short length of discharge tubing to the pump, turning the pump upside down and pouring laboratory-supplied deionized water through the pump and into the appropriate sample containers.

3.3 Trip Blank Samples

Trip blank samples will be used to determine if the sample shipping or storage procedures have influenced the analytical results. Trip blanks will be prepared by the project laboratory using deionized water and preservative and sent to the Site in the shipping container(s) designated for the project. These samples will be kept with the investigative samples, then submitted to the laboratory for analysis with the investigative samples. Trip blank samples will not be opened.

Trip blanks will be analyzed for VOCs only. One trip blank will be submitted for each cooler containing sample media for analysis of aqueous VOCs.

3.4 Field Duplicate Samples

During the RI, field duplicate samples will be collected and submitted to the project laboratory. VOC fractions for aqueous samples will be filled continuously until an individual vial is completely filled before filling a vial for a duplicate sample. One field duplicate will be collected for each ten or fewer investigative samples submitted.

3.5 Matrix Spike/Matrix Spike Duplicate Samples

MS/MSD sample volumes are additional sample aliquots provided to the project laboratory to evaluate the accuracy and precision of the sample preparation and analysis technique.

Two times the normal sample aliquot is required for VOCs and light gases to conduct MS/MSD procedures. No additional sample volume is required for inorganics parameters. Sample collection is identical to the technique described for collection of field duplicates. Sample labeling identifies the respective sample location and each additional container, which is labeled as the "MS/MSD" volume. One MS/MSD sample will be collected for each twenty or fewer aqueous or sediment investigative samples submitted.

4. Sample Custody and Document Control

ARCADIS follows the U.S. EPA Region 5 sample custody protocols described in "NEIC Policies and Procedures", EPA-330/9-78-001-R, revised August 1991. This custody is segregated into three parts: sample collection; laboratory analysis; and final

evidence files. Final evidence files, including all originals of laboratory reports, are maintained under document control in a secure area.

A sample or evidence file is in a person's custody if:

- The item is in actual possession of a person; or
- The item is in the view of the person after being in actual possession of the person; or
- The item was in actual physical possession of the person and is secured in an appropriate container and arrangements are made to transport it to the laboratory via a bonded courier; or
- The item is in a designated and identified secure area.

4.1 Sample Labeling

Each sample container will be labeled with a unique sample number that will facilitate tracking and cross-referencing of sample information and will be recorded in the field logbook. The unique sample number will be recorded with the sample location in the field logbook at the time of sample collection. The field logbook will form part of the permanent field record. The sample numbering system to be used is described as follows (the information entered on the sample labels will be printed by the field sampler):

Example: LOC-XX-MMDDYY

Where:

LOC	-	designates sample location (i.e., LC10, P02, etc.);
XX	-	designates types of sample (GW-groundwater); and
MMDDYY	-	designates date of collection presented as month, day, year.

QC samples also will be numbered with a unique sample number. The sample location of each QC sample will be recorded in the field log book only. The sample numbering system to be used for such samples is described as follows (the information entered on the sample labels will be printed by the field sampler):

Example:

TB - MMDDYY-N

Where:

TB	-	designates type of field QC sample (Dup – field duplicate, EB – equipment blank, TB – trip blank, and MS/MSD – matrix spike/matrix spike duplicate);
MMDDYY	-	designates date of collection presented as month, day, year; and
N	-	designates sequential number for each sample.

An example of the sample label is provided in Attachment B-2.

4.2 Field Chain-Of-Custody Procedures

The sample packaging and shipment procedures summarized below will insure that the samples will arrive at the project laboratory with the chain-of-custody intact. The Field Quality Assurance (QA) Officer will be responsible for oversight of field documentation procedures.

4.2.1 Field Procedures

1. The field sampler is personally responsible for the care and custody of the samples until they are transferred to another individual or properly dispatched to the laboratory. As few people as possible should handle the samples.

2. All containers will be labeled with unique sample numbers.

3. Sample labels will be completed for each sample using waterproof ink.

4.2.2 Field Logbooks/Documentation

Field logbooks will provide the means of recording data collecting activities performed. As such, entries will be described in as much detail as possible so that persons going to the Site could reconstruct a particular situation without reliance on memory.

Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel and will be stored by the ARCADIS Chicago, Illinois office when not in use. Each logbook will be identified by a project-specific number, which includes the project number.

The title page of each logbook will contain the following:

- Person to whom or task for which the logbook is assigned;
- Project number;
- Project name;
- The starting date for entries into the logbook; and
- The ending date for entries into the logbook.

Entries into the logbook will contain a variety of information. At the beginning of each day's logbook entry, the date, start time, weather, names of all sampling team members present, and the signature of the person making the entry will be entered. The names of individuals visiting the Site or field sampling team and the purpose of their visit will also be recorded in the field logbook.

All field measurements taken and samples collected will be recorded. All logbook entries will be recorded in ink, signed and dated. If an incorrect logbook entry is made, the incorrect information will be crossed out with a single strike mark, which is initialed and dated by the person making the erroneous entry. The correct information will be entered into the logbook adjacent to the original entry.

Whenever a sample is collected or a measurement is made, a detailed description of the location will be recorded in the logbook. Photographs taken at a location, if any, will also be noted in the logbook. All equipment used to obtain field measurements will be recorded in the field logbook. The sample numbering system (as described in Section 4.1) will be recorded in the field logbook correlating the unique sample number to the sample location and sample depth (if necessary). In addition, the calibration data for all field measurement equipment will be recorded in the field logbook.

Samples will be collected following the sampling procedures documented in this SAP. The equipment used to collect samples, time of sample collection, sample description, and volume and number of containers will be recorded in the field logbook.

4.2.3 Transfer of Custody and Shipment Procedures

The sample packaging and shipping procedures summarized below will ensure that the samples arrive at the laboratory with the chain-of-custody intact.

1. The field sampler is personally responsible for the care and custody of the samples until they are transferred to another person or the laboratory. As few people as possible will handle the samples.

2. All sample containers will be identified using sample labels, which include the date of collection, unique sample number, and analyses to be performed.

3. Sample labels will be completed for each sample using waterproof ink.

4. Samples will be placed in coolers containing ice immediately after collection.

5. Samples will be accompanied by a properly completed chain-of-custody form. An example chain-of-custody form is in Attachment B-2. The sample identification numbers will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving the samples will sign and record the date and time on the form. The chain-of-custody form documents sample custody transfers from the sampler to another person, to the laboratory, or to/from a secure storage area.

6. All sample shipments will be accompanied by the chain-of-custody form identifying its contents. The chain-of-custody form is a three-part carbonless-copy form. The form is completed by the sampling team and, after signing and relinquishing custody to the shipper, retains the bottom copy. The laboratory retains the yellow copy and the fully executed top copy is returned as part of the data deliverables package.

7. Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed chain-of-custody form enclosed in and secured to the inside top of each shipping cooler. Shipping coolers will be secured with custody tape for shipment to the laboratory. The custody tape is then covered with clear plastic tape to prevent accidental damage to the custody tape. An example chain-of-custody seal is in Attachment B-2.

8. If the samples are sent by common carrier, a bill of lading will be used and copies will be retained as permanent documentation. Commercial carriers are not required to sign the chain-of-custody form as long as the form is sealed inside the sample cooler and the custody tape remains intact.

9. If samples are not shipped to the laboratory the same day the samples are collected in the field, additional ice will be placed in the coolers, the coolers will be sealed and kept in a designated secure area until they are shipped to the laboratory as described above.

4.3 Laboratory Chain-Of-Custody Procedures

Laboratory sample custody begins when the samples are received at the laboratory. The laboratory's sample custodian will assign a unique laboratory sample identification number to each incoming sample. The field sample identification numbers, laboratory sample identification numbers, date and time of sample collection, date and time of sample receipt, and requested analyses will be entered into the sample receiving log. The laboratory's sample log-in, custody, and document control procedures are detailed in the appropriate SOPs in the Quality Assurance Project Plan (QAPP).

4.4 Laboratory Storage of Samples

Following log-in, all samples will be stored within an access-controlled location and will be maintained properly preserved (as defined in Table B-3) until completion of all laboratory analyses. Unused sample aliquots and sample extracts/digestates/distillates will be maintained properly preserved for a minimum of 30 days following receipt of the final report by ARCADIS. The laboratory will be responsible for the disposal of unused sample aliquots, samples, containers, and sample extracts/digestates/distillates in accordance with all applicable local, state, and federal regulations.

The laboratory will be responsible for maintaining analytical log books and laboratory data. Raw laboratory data files will be inventoried and maintained by the laboratory for a minimum period of six years, after which time ARCADIS will advise the laboratory regarding additional storage.

4.5 Final Evidence Files Custody Procedures

Evidential files for the entire project will be maintained by ARCADIS and will consist of the following:

1. Project plan;
2. Project log books;
3. Field data records;
4. Sample identification documents;
5. Chain-of-custody records;
6. Correspondence;
7. References, literature;
8. Final laboratory reports;
9. Miscellaneous - photos, maps, drawings, etc.; and
10. Final report.

The final evidence file materials will be the responsibility of the evidentiary file custodian (ARCADIS Project Manager) with respect to maintenance and document removal. Section XIV of the AOC specifies that all records or documents be maintained for a minimum of ten years following completion of the actions required by the AOC. U.S. EPA is to be notified at least 90 days before the documents are scheduled to be destroyed. All records for the RI/FS will be maintained consistent with the requirements of the AOC.

5. Field Calibration, Preventative Maintenance, and Standard Operating Procedures

Field calibration, preventative maintenance, and SOPs for field equipment are described in the following sections. Equipment calibration, maintenance, and inspections will be noted in the field log book.

5.1 Photoionization Detector

The photoionization detector(s) (PID(s)) will be maintained and used according to the manufacturer's specifications. The operating manual is kept in the instrument case. Field calibration, including date, time, standard used, results, and corrective actions taken will be recorded in the field logbook. The PID will be calibrated and the moisture filter will be replaced at least once daily, prior to use. Recalibration will be undertaken at more frequent intervals if there is any indication of faulty performance. Additional calibration checks will be completed at any time "drift" occurs. Calibration check results must be ±10 percent of the true value. If the result is outside of

±10 percent, the meter will be recalibrated. Field calibration will be carried out according to the manufacturer's procedure. All initial and continuing PID calibrations performed in the field will be carried out using two reference standards.

5.2 Water Quality Measurements

Temperature, pH, conductivity, dissolved oxygen, and ORP will be measured using a YSI Model 6820 instrument, or equivalent. The instrument will be calibrated daily, or as necessary, if malfunction is suspected. Initial calibration will be performed in accordance with manufacturer's requirements. The SOP is in Attachment B-1.

5.3 Water Level Indicator

Water level measurements will be collected using a Solinst Model 101 water level indicator, or equivalent. The instruments do not require calibration. The only maintenance required is battery replacement.

6. Equipment Cleaning Protocols

6.1 Sampling Equipment Decontamination Procedures

Sampling equipment will be decontaminated before and after use in accordance with the appropriate guidance. The water level indicator will be cleaned prior to use and between each sampling point by the following procedure:

- Spray potable or distilled water on the outside surfaces; and
- Wipe outside surface with paper towel.

The submersible pump used for well development, if used for groundwater purging, will be decontaminated prior to use and between each location according to the following procedures:

- Spray the discharge tubing, reel, and pump with potable water to rinse off particulates;
- Pump soapy (phosphate-free soap) water solution through the pump and tubing for a minimum of 2 minutes;
- Circulate potable water through the pump and discharge tubing until all traces of soap are gone; and

- Pump distilled water through the pump and tubing for a minimum of 5 minutes.

If new tubing is used for each well, the tubing will not be decontaminated.

Following the collection of each groundwater sample for analysis, the micropurge pump will be decontaminated in the following manner:

- Pre-Rinse – Place non-disposable pump parts in a basin (e.g., barrel or new garbage can) with potable water.
- Wash – Wash non-disposable pump parts in the basin with potable water and Alconox.
- Rinse – Rinse non-disposable pump parts in the basin with potable water.
- The bladder pump will be wrapped in inert material (i.e., polyethylene sheeting or aluminum foil) for storage or transport.

The bladder and tubing will be disposed of after sampling of each well is completed.

6.2 Drilling Equipment

The drill rig, auger flights, split-spoon samplers, and drill rods will be steam-cleaned before startup of field operations and after each boring using a high-pressure, high-temperature, hot water cleaner. The potable water used will come from an offsite source free of contamination (a fire hydrant may be used).

Sampling equipment will be washed before each sample is collected using a brush and non-phosphate laboratory-grade detergent, such as Alconox®, rinsed with potable water, and rinsed again with distilled water.

7. Management of Investigation-Derived Waste (IDW)

The IDW materials that are expected to be produced during the RI activities include drill cuttings, development and purge water from monitoring wells, decontamination water, used personal protective equipment (PPE), and used disposable sampling equipment. Each of these waste streams will be managed in accordance with Federal, state and local requirements and are further discussed below.

All drill cuttings and soil waste will be containerized in new or reconditioned Department of Transportation (DOT)-approved drums and analyzed by the laboratory

prior to proper disposal. Soil from the test trench will be put back into the trench. Development, purge, sampling-waste and decontamination waters and other liquid waste will be containerized and analyzed by the laboratory prior to proper disposal.

Used PPE and used disposable sampling equipment will be placed in garbage bags and will be disposed of at a sanitary landfill.

All records pertaining to waste accumulation, transport and disposal will be managed and maintained in compliance with Federal, State and local regulations.

TABLES

Table B-1. Rationale for Sampling Locations
Lake Calumet Cluster Site, Chicago, Illinois

Category	ID Numbers	Rationale
First Transect	LC07, P02, and LC14	Groundwater samples to assess potential northeasterly groundwater flow direction
Second Transect	LC07, LC10, and LC15	Groundwater samples to assess potential westerly groundwater flow direction
Third Transect	LC07, LC16, and LC04	Groundwater samples to assess potential southeasterly groundwater flow direction
South-Southeastern Site Boundary	LC18, LC19, LC20, and LC21	Groundwater samples to assess groundwater along south-southeastern boundary
Off-Site	LC17	Groundwater sample to upgradiant groundwater quality
Test Trench	LCT01	Groundwater sample from test trench to assess groundwater at interface of Site and Marsh

Notes
Samples will be collected during one sampling event

Table B-2. Summary of Sampling and Analysis Program
Lake Calumet Cluster Site, Chicago, Illinois

Matrix	Field Parameters	Laboratory Parameter	Number of Samples	Number of Equip. Blanks	Number of Trip Blanks	Number of Duplicates	Number of MS/MSD	Matrix Total Samples
Groundwater Sampling [a]								
Water (onsite) [b]	Temperature, pH, conductivity, DO, ORP	VOCs, light gases [c], inorganic parameters [d]	11	1	1 [e]	1	1	15
Water (offsite)	Temperature, pH, conductivity, DO, ORP	VOCs, light gases [c], inorganic parameters [d]	1			1		2

Notes:
(a) The on-Site and off-Site groundwater samples will collected during one event
(b) Includes open test trench sample
(c) Light gases include methane, ethene, ethane
(d) Inorganic parameters include nitrate, total and dissolved iron, sulfate, sulfide, ammonium, TSS, and total TAL metals
(e) One trip blank will be submitted for each cooler submitted. The number of trip blanks listed is estimated based on sampling experience.

Field Blanks are one per sampling event or every twenty or fewer samples collected.
Trip Blanks are one per sampling event or each cooler containing sample media for analysis of aqueous VOCs.
MS/MSD are one per sampling event or every twenty or fewer samples collected.
Duplicates are one per sampling event or every ten or fewer samples collected.

Light gases	Methane, ethene, ethane
Inorganic parameters	*Nitrate, total and dissolved iron, sulfate, sulfide, ammonium, TSS, and total TAL metals*
MS/MSD	Matrix Spike/Matrix Spike Duplicate
TAL	Target Analyte List
TCL	Target Compound List
TSS	Total Suspended Solids
VOC	Volatile Organic Compound

Table B-3. Sample Containers, Preservatives, and Holding Time Requirements
Lake Calumet Cluster Site, Chicago, Illinois

	Container	Preservative	Maximum Holding Time
Groundwater Analysis			
Volatiles	3 x 40 mL Glass	0.3-mL, 1:1 hydrochloric acid, cool to 4°C	14 Days
Light Gases			
Methane	3 x 40 mL Glass	Cool to 4°C	14 Days
Ethene	3 x 40 mL Glass	Cool to 4°C	15 Days
Ethane	3 x 40 mL Glass	Cool to 4°C	16 Days
Inorganic Parameters			
Nitrate	120 mL Plastic	Cool to 4°C	2 Days
Total Iron	500 mL Plastic	2mL 1:1 nitric acid, cool to 4°C	6 Months
Dissolved Iron (field filtered)	500 mL Plastic	2mL 1:1 nitric acid, cool to 4°C	6 Months
Sulfate	120 mL Plastic	Cool to 4°C	28 Days
Sulfide	500 mL Plastic	2mL 2N zinc acetate, cool to 4°C	7 Days
Ammonium	125 mL Plastic	Sulfric acid, cool to 4°C	28 Days
Total Dissolved Solids	500 mL Plastic	Cool to 4°C	7 Days
Total TAL Metals	500 mL Plastic	2-mL, 1:1 nitric acid, cool to 4°C	6 Months

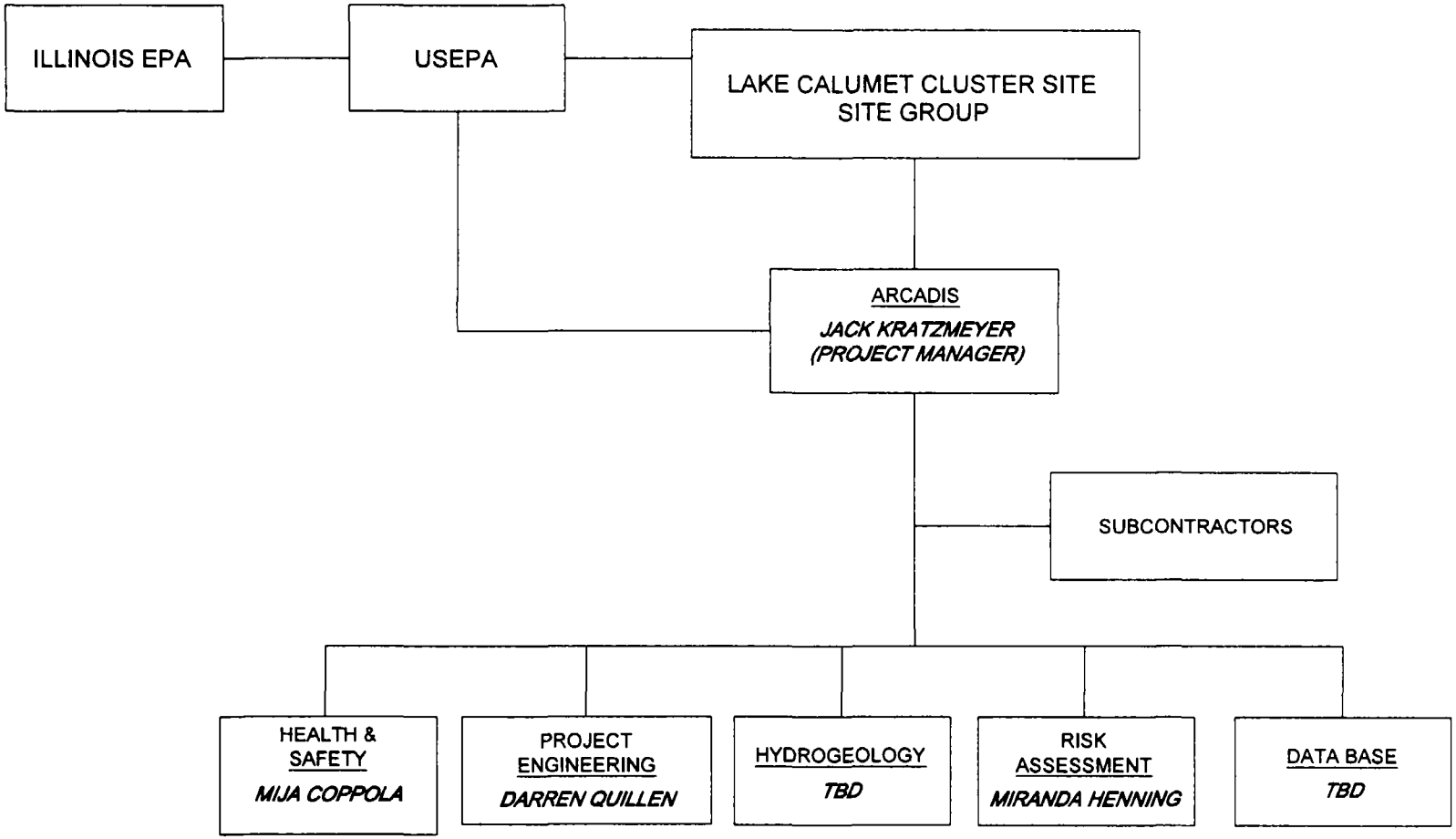
Notes:
(1) Vials must be weighed by the project laboratory prior to sampling.

Table B-4. Groundwater Sampling of Monitoring Wells
Lake Calumet Cluster Site, Chicago, Illinois

Well Number	Volatiles	Light Gases	Inorganic Parameters
On-Site			
P02	X	X	X
LC04	X	X	X
LC07	X	X	X
LC10	X	X	X
LC14	X	X	X
LC15	X	X	X
LC16	X	X	X
LC18	X	X	X
LC19	X	X	X
LC20	X	X	X
LC21	X	X	X
LCT01[(a)]	X	X	X
Off-Site			
LC17	X	X	X

Notes:
(a) LCT01 will collected from an open test trench
Inorganic param Nitrate, total and dissolved iron, sulfate, sulfide, ammonium, TSS, and total TAL metals
PCB Polychlorinated Biphenols
VOC Target Compound List Volatile Organic Compounds
SVOC Target Compound List Semivolatile Organic Compounds, including 1,4-dioxane
Metals Target Analyte List Metals

FIGURES



ARCADIS

PROJECT ORGANIZATION
LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

DATE 4/29/05	PROJECT MANAGER J. KRATZMEYER	DRAWING NAME RIFS-SAP
DRAWN R. SMITH	LEAD DESIGN PROF	CHECKED A. SENN
PROJECT NUMBER CI001286.0001		FIGURE NUMBER B-1

ATTACHMENTS

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Attachment B-1

ARCADIS Standard Operating Procedures

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ARCADIS

-- Chicago

Infrastructure, buildings, environment, communications

SOP CONTROL AND USE
STANDARD OPERATING PROCEDURE

No. T100
By: M. Hamper
Approved by: G. Vanderlaan
Date: 2/24/97
Revision Number: 2
Date: 3/6/02

1. Applicability

1.1 This ARCADIS Standard Operating Procedure (SOP) covers the control and use of ARCADIS Chicago Office Standard Operating Procedures. The purpose of this procedure is to facilitate the use of the most current version of the ARCADIS SOPs.

2. Procedure

2.1 SOPs will be marked "Uncontrolled Copy" or "Controlled Copy." Controlled copies are issued to individuals or the Chicago Office Library. Uncontrolled copies may be submitted with client deliverables.

2.2 A record will be maintained of the names of the individuals (and the library) who have been issued Controlled Copies of the SOPs. Recipients of Controlled Copies will automatically receive updated versions of SOPs and new SOPs as they are issued. Recipients of Uncontrolled Copies will not automatically receive updated versions of SOPs or new SOPs as they are issued.

2.3 The most current version of SOPs will be used unless otherwise directed by the Project Manager.

2.4 Only Uncontrolled SOPs may be submitted with project work plans. When Uncontrolled SOPs are included with project work plans, this SOP should also be included. Inclusion of this SOP in the project work plans will allow the use of the most current ARCADIS SOP at the time the work is performed.

2.5 A copy of the most recent SOPs will be maintained in the Chicago Office library. ARCADIS staff may check out this copy by leaving a sign-out card with the name of person who has checked out the SOPs and the date the SOPs were checked-out.

2.6 Recipients of Controlled SOPs must return the SOPs upon termination of employment with ARCADIS or relocation within ARCADIS.

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ARCADIS GERAGHTY & MILLER

- Chicago

BOREHOLE SOIL LOGGING
STANDARD OPERATING PROCEDURE

No. T116
By: M. Hamper
Approved by: G. Vanderlaan
Date: 2/24/97
Revision Number: 1
Date: 4/12/99

1. Applicability

1.1 This Geraghty & Miller Standard Operating Procedure (SOP) indicates the observations that should be made and recorded when performing a soil boring for environmental projects.

1.2 This SOP does not address health and safety, sample collection, or laboratory analysis. Refer to other Geraghty & Miller SOPs, the project work plans including the quality assurance project plan, sampling plan, and health and safety plan, as appropriate.

2. Equipment/Supplies

2.1 Sample/Core Log Form
2.2 Black or blue ink pen (black preferred).
2.3 Measuring tape (graduated in tenths or hundreths)
2.4 Field headspace Measurements SOP (T109)
2.5 Field Log Book SOP (T102)
2.6 Field Soil Classification SOP (T115)

3. Procedure

3.1 Complete the header information section of the Sample/Core Log Form (Form) including the boring number, the logger's name, the project name, the site location, the project number, and date started. Record information as required by the Field Log Book SOP (T102)

3.2 Note the drilling company, lead driller's name, and the drilling method on the Form. Drilling methods typically include HSA, air rotary, mud rotary, solid stem augers, and direct push. Note the inside (ID) and outside diameter (OD) of the HSA, the rotary bit size, OD of the solid stem auger, or the type of direct push equipment being used.

3.3 As samples are collected, record the sample type on the Form. Sample types typically include 2-ft split-spoon (SS), auger cuttings (AU), shelby tube (ST), 5-ft Central Mine Equipment (CME) tube (CME), and 4-ft direct push tube (DP).

3.4 Record the length of recovered sample, if applicable. The length should be recorded to the nearest 0.1 ft.

3.5 Note the moisture condition of the sample as dry, moist, or wet.

3.6 Record the blow counts in the sample/core description section of the Form, if applicable. Determine the N value and record the N value on the Form.

3.7 Record in the sample/core description section of the Form the depth at which water is first observed in the borehole in the sample.

3.8 Record the depth interval where the sample(s) was collected. Note if a sample was selected for laboratory analysis.

3.9 If field headspace PID measurements (SOP T108) are made, record the PID values on the Form. If another type of PID measurement of the soil sample is made, record the PID value in the sample/core description section of the Form and indicate what type of PID measurement was made.

3.10 Record in the sample/core description section of the Form, the sample description and classification made following the Field Soil Classification SOP (T115).

3.11 Record in the sample/core description section of the Form, the water level at the completion of the boring.

3.12 Record the depth of the end of the boring in the sample/core description section of the Form.

3.13 Record on the Form in the sample/core description section if the hole was abandoned and sealed, or if a well was installed. Record how the borehole was abandoned.

3.14 Record the date the boring was completed.

3.15 Write legibly in ink. Write the soil description in the required format (SOP T115) so that the log does not have to be revised prior to being put into the computerized log system.

3.16 After the log is peer reviewed in the office, and the corrections are made, record the editor's name on the Form.

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-Chicago

MONITORING WELL INSTALLATION
UNCONSOLIDATED FORMATIONS
STANDARD OPERATING PROCEDURE

No. T105
By: M. Hamper
Approved by: Greg Vanderalaan
Date: 1/29/97
Revision Number: 1
Date: 4/12/99

1. Applicability

1.1 This Geraghty & Miller Standard Operating Procedure (SOP) covers the installation of monitoring wells installed in unconsolidated formations for environmental investigations.

1.3 This SOP does not address health and safety, emergency procedures, or all the requirements that may be needed for a specific project. Refer to other Geraghty & Miller SOPs, the project work plans including the quality assurance project plan, sampling plan, and health and safety plan, as appropriate.

2. Equipment

2.1 Field Log Book
2.2 Ball point (medium point) pen with black or blue ink (black preferred)
2.3 Electronic Interface Probe
2.4 Decontamination Equipment
2.5 List of wells and well characteristics(well total depth, historical water levels)
2.6 Map of well locations
2.7 Extra batteries for extended field work
2.8 Paint pen

3. Procedure

3.1 Utilities. Obtain a commercial utiltity clearance within the required time frame. This is typically 2 to 3 working days prior to drilling. The utility clearance is only good for a finite period, typically two weeks. After this time frame has passed, the utilities must be re-cleared. This is especially important for second or multiple mobilizations. The commercial utility clearance does not include the client's utilities and may not include the municipality's. These must be cleared separately. Re-clear these utilities for second or multiple mobilizations as well. Record the request for clearance in a telephone record, or letter as appropriate. Record confirmation number from commercial utility in the field book.

3.2 Site Layout. On a scaled site map, draw the estimated location of the utilities as marked by the commercial service municipality and the client.

Also indicate the location of above ground lines and wires. Mark map "NOT SURVEYED" (or equivalent) to indicate that the utilities are only located approximately.

Identify potential conflicts between proposed well locations and the utilities. The utilities sketch map will be used to locate alternate well locations. At the completion of the field work, the utilties sketch map must be placed in the project file.

3.3 Well Design Review. Discuss the drilling method and well construction with the lead driller and resolve any misunderstandings. Verify that the driller is prepared to drill the borehole and construct the well as specified. Resolve problems prior to proceeding and contact the project manager, if needed.

3.4 Drill Borehole. Drill the borehole using the specified method. Log samples as required by the work plans. Look for unexpected conditions such as significant PID measurements indicative of a contaminant zone, which if drilling was continued as planned, could cause cross-contamination. Report unexpected conditions to the project manager and obtain further instructions. When the desired depth is reached, verify the measurement yourself.

3.5 Piping and Screen Preparation. Using a tape measure, measure the total length of the screen as well as the length of the slotted area. Verify that the bottom of the screen is securely capped. Note the additional length due to the bottom cap. Measure the length of the riser pipe. Decontaminate each pipe and screen sections prior to assembling the pieces. If "O"-rings or teflon tape is required for the type of pipe used, verify that each joint has the tape or O-ring and that the pieces are hand-tightened. The decontaminated materials should only be handled using clean hands, gloves, or tools. Record the measurements in the field log book. Record in the field log book that well pipes and screens were decontaminated.

3.6 Piping and Screen Placement. Prior to placing the pipe in the borehole, pour filter media in the borehole to create a bedding, if required by the specifications. The piping and screen is lowered into the well by hand for shallow wells or using a coupling attach to the top of the string attached to a winch. The string is lowered into the well using the winch. Additional sections of the pipe are added to the top of the string and the string is again lowered into position with the winch and the process repeated until the correct amount of well pipe is installed. Verify that the well couplings are completed as specified (see #5). Centralizers must be used if there is difficulty in keeping the well pipe centered in the borehole. Measure the total depth of the well to verify that the well is located at the desired depth. Record the measurement in the field log book.

3.7 Filter Media and Volume. Examine packaging to verify that the filter media meets the specifications. Calculate the amount of ilter media needed to fill the annular to the specified depth.

3.8 Filter Media Placement. Withdraw the casing or augers about two to five feet, then pour filter media into the borehole around the well pipe. Repeat the process of pouring a portion of filter media and retracting casing and augers, taking care not to get sand between the well screen and the temporary casing. Place the required number of filter layers, measuring the depth to the top of each and recording it in the field log book or well log.

3.9 Bentonite Seal Placement. Place the specified bentonite seal. If pellets, chips, or other particular bentonite is used, be alert for bridging at depth. Measure the depth to the top of the seal. When a particulate bentonite seal is installed above the water table, the bentonite must be hydrated by pouring water into the annular space as the bentonite is placed in lifts.

3.10 Annular Space Seal Placement. Pre-mix sufficient grant to fill the annular space to the water table. The grout must be mixed to the manufacturer's specifications or to the work plan specification. The grout is pumped into the annulus until the water table is reached. Above the water table, the annular space is typically filled with bentonite chips or granular bentonite to minimize settling of the seal. Leave space to install protective casing, if required.

3.11 Protective Casing. The protection casing may be a flush mount well box or stitch-up type. Install the casing consistent with the specification. Mark the well casing with the well identification number and the measuring point location using a paint pen.

3.12 Complete the Illinois well construction form and submit to the appropriate department. Keep a copy in the project file.

3.13 Make all field log book entries in ink using a ball point pen (medium). If weather conditions prevent the use of the pen, indicate so in the log and use an alternate writing instrument.

3.14 Print or write legibly.

3.15 Problems noted in the log book must be brought to the attention of the project manager in a timely fashion. Problems may be reported in person, on the telephone, or in a written daily log form. If daily logs are prepared and you will not be able to personally give the daily log to the project manager, send the daily log via FAX or overnight courier to the project manager.

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SINGLE WELL HYDRAULIC CONDUCTIVITY TEST
STANDARD OPERATING PROCEDURE

No. T122
By: Jim Hertel
Approved by: G.Vanderlaan
Date: 10/6/97
Revision Number: 2
By: J. Hertel
Approved by: P. Hutton
Date: 1/31/02

1. Applicability

1.1 This ARCADIS Standard Operating Procedure (SOP) covers the performance of a hydraulic conductivity test in a single well using a slug (slug test). The response of the water column in the well to the instantaneous introduction ("slug-in") and/or removal of the slug ("slug-out") is recorded by hand or using an automatic data logger. The data is later analyzed to estimate the hydraulic conductivity (K) of the materials in the vicinity of the screened portion of the well.

1.2 This SOP does not address health and safety, decontamination, data logger operation, or analysis of the collected data. Refer to other ARCADIS SOPs, published literature, and the project work plans including the quality assurance project plan, sampling plan, and health and safety plan, as appropriate.

1.3 During the performance of more than one slug test at a particular site, the proximity to the other test locations must be considered, especially if the tests are conducted concurrently at nearby locations. Weather conditions (or changes) that may potentially affect the results of short or long term tests should also be considered.

1.4 If using an automatic data logger, highly contaminated groundwater may damage the transducer and cable. Do not conduct a test with an automatic data logger in highly contaminated groundwater without direction from the project manager.

2. Equipment/Supplies

Slug
Electronic Water Level Indicator

Decontamination Equipment
Monitoring Well Keys
Flushmount monitoring well accessing tools
Field Book Entries SOP T102
Groundwater Level Measurements SOP T103
Equipment Decontamination SOP T108
Bailer Decontamination SOP T112
Stopwatch or data logger.
Transducer and cable, if using data logger.
Well construction logs/soil boring logs
Available analytical data
New Polypropylene rope (0.25 inch diameter)
Duct tape
Laptop computer or printer is recommended, if using data logger
Mobile or cellular phone

3. Procedure

1. Prior to mobilizing to the site, review the groundwater data, monitoring well construction diagrams, and the soil boring logs. Review this information and discuss with the project manager.

2. Review of this information will determine the order that the slug tests will be performed (least-impacted well to most-impacted well), the methodology (slug-in, slug-out, or both), slug length, and need for an automatic data logger. In addition, if using a data logger, the information will help determine the depth at which the transducer should be placed.

3. If the geology suggests a high-K media, a smaller slug should be used to reduce dampening effects. Also, an automatic data logger is recommended in a high-K media due to the quick aquifer response and the short test duration.

4. If recording depth measurements manually, the recording intervals should be determined prior to beginning test. As many measurements as possible should be recorded during the initial moments of the test. For example, depth measurements should be recorded at 5-second intervals through the first minute of the test, at 15-second intervals through the first 5 minutes, so on. After the first 30 minutes of the test, measurements should be recorded hourly at a minimum. Discuss this with the project manager.

5. Decontaminate each piece of equipment that will be placed into the well, including the slug, the transducer, the cable, and the electronic water level indicator. Follow the applicable procedures in SOP T108 and SOP T112.

As appropriate, determine if more that one slug, transducer, or cable will be needed to minimize the potential for cross contamination.

6. Open the well and measure depth to water and depth to the bottom of the well (SOP T103) and record the measurements in the field log book (SOP T102). Compare the measurements to the well construction log. Determine if the amount of silt in the well (if any) could impact the test. Evaluate the available water column and determine if sufficient water exists in well to conduct a test. Water column should be near middle of screen and the water column height should be greater than the length of the slug.

7. If using a data logger, determine the maximum depth to which the slug can be lowered into the well before it interferes with the transducer. Make sure slug will remain completely submerged during entire test (slug-in). Inform the project manager of any problems.

8. If using data logger, initiate data logger & transducer set-up in accordance with ARCADIS SOP or manufacturer's instructions.

9. If measurements are being recorded manually, skip to step 11. If using data logger, lower the transducer to approximately six-inches to one-foot above the bottom of the well (above the silted in portion, if any). Secure transducer cable to well casing with duct tape to reduce the potential for cable movement.

10. Take and record another water level measurement with the electronic water level indicator. Compare the result to the initial measurement. If there is no difference (> 0.01 ft), proceed with the test. If there is a difference, wait a few minutes and re-measure the depth to water. If there is no change from the previous measurement, proceed. If there is a change, repeat the wait and re-measure cycle until the water level stabilizes. If the water level does not stabilize, contact the project manager.

11. Verify that data logger is ready to begin test.

12. Verify that the knot attaching the rope to the slug is secure. Lower slug to just above the top of the water column in the well.

13. If using a bailer to remove a "slug" of water and complete only the slug-out portion of the test, insert bailer into water. Complete Step 10 until the water level stabilizes. If the water level does not stabilize, contact the project manager.

14. If completing only the slug-out portion of test, skip to Step 19.

15. Simultaneously start data logger (or stopwatch) and lower slug quickly and smoothly into water to the predetermined depth. Lower slug deep enough to remain completely submerged during the entire test. Avoid contact with the transducer cable while inserting slug into water. Record the time test started in the field book.

16. Secure rope to prevent slug from moving during test.

17. If recording data by hand, collect and record water levels with the electronic water level indicator at the predetermined intervals.

18. Continue recording data until water level has returned to the level recorded at the beginning of test. If the water level does not return to the pre-test level in 4 hours, discontinue test unless otherwise directed by the project manager. Once the water level has returned to the pre-test level, the slug-out test can be performed. If test is discontinued, stop data logger, take and record a water level measurement, and carefully remove the slug, transducer and cable. Record the time the test was stopped in the field book.

19. To continue the "slug-out" portion of the test, collect and record one more measurement at the next time interval prior to removing the slug.

20. Prepare to perform the slug-out portion of test by pressing the appropriate buttons on the data logger or stopwatch.

21. Simultaneously start data logger (or stopwatch) and remove slug quickly and smoothly from of the well. Avoid contact with the transducer cable during slug removal. Place the slug on plastic sheeting. Record the time the slug was removed in the field book.

22. Continue recording data until the water level returns to static or until time limit (4 hours) of test is reached unless otherwise directed by the project manager. Stop data logger. Take another water level measurement and then remove the transducer and cable from the well.

23. Measure the depth to water with the electronic water level interface probe and record in the field book.

24. Clean each piece of equipment that comes in contact with water from the well or other potential sources of contamination following SOP T108 and SOP T112.

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SAMPLE PRO PORTABLE MICROPURGE PUMP
STANDARD OPERATING PROCEDURE

No. T133
By: Ben Olszewski
Approved by: Phil Hutton
Date: 08/06/02
Revised: 11/21/02

1. Applicability

1.1 This ARCADIS Standard Operating Procedure (SOP) covers the operation of the Sample Pro MicroPurge Pump, the MicroPurge Basics MP10 Contoller, and the Well Wizard 12-volt Air Compressor. The Part numbers below are for the QED Environmental Systems Company 1-800-624-2026. The pump should not be used in wells with free product, or known high levels of contamination without special precautions taken.

1.2 This SOP does not address health and safety, equipment decontamination, chain-of-custody, or laboratory analysis. Refer to other ARCADIS SOPs, the project work plans including the quality assurance project plan, sampling plan, and health and safety plan, as appropriate.

2. Equipment/Supplies

2.1 Sample Pro MicroPurge Pump

2.2 MicroPurge Basics MP10 Contoller

2.3 Well Wizard 12-volt Air Compressor

2.4 Bonded ¼" O.D. disposable tubing (DT-TP4B) (water & air tubing bonded together)

2.5 Polyehylene Bladders (38360)

2.6 O rings (38362)

2.7 Stainless Steel intake screens (38361)

2.8 Teflon Check Balls (38408)

2.9 SS Grab Plates ¼" X ¼" (38364)

2.10 Car battery (to run air compressor)

2.11 Distilled water.

2.12 String or rope

2.13 Purge water container (bucket).

2.14 Well Keys

2.15 Well vault opening tools

2.16 Well construction logs

2.17 Field Log Book Entries SOP (T102)

2.18 Groundwater Level Measurements SOP (T103)

2.19 Flathead screwdriver

2.20 Extra well locks

2.21 Bolt cutter

2.22 Paper towel

2.23 Plastic garbage bags

2.24 Tubing cutter or Utility knife

2.25 Graduated cylinder

2.26 Watch with second hand or digital readout

3. Procedure

3.1 ***Determine pump set depth.*** The pump set depth may be established in the project work plans, or by the project manager. Absent a specific project requirement, set the pump intake at the midpoint of the available screen length for low-flow sampling (see SOP T101).

3.2 ***Determine current well characteristics.*** Proceed from the least contaminated to the most contaminated well to minimize the potential for cross-contamintation. Open the well and note any observations such as noises, odors, or escaping gases.

Using an electronic water level indicator, determine the depth to water and the depth to the bottom of the well using SOP T103. Record all informationin the field book or field log forms.

3.3 ***Determine if the well has silt accumulation.*** Compare the measured total depth to the total well depth on the well construction log. If a significant amount of silt has accumulated in the well, the well may require redevelopment prior to sampling. Check with the project manager for the specific requirements, and redevelop the well as directed. Record the evaluation on the field log forms or field book.

3.4 ***Check bladder.*** Open the pump body and make sure an unused clean bladder is attached to the pump. Replace the bladder if needed. Only use the white plastic grab ring if you are pumping at a depth of more than 50 feet below ground surface.

3.5 ***Prepare the down well tubing.*** Based upon the pump intake set depth, cut the desired length of new bonded ¼" tubing with a clean tubing cutter or utility knife. Separate the two strands of the bonded tubing for at least one foot at the end of the cut tubing. Push each strand of the bonded tubing into the top of the Sample Pro Pump. The tubing should be pushed into the top of the pump into either the hole marked with an "A" for air or a "W" for water. Use the clear strand of tubing for the water line and the gray strand of tubing for the airline (clear for water so you can see the water location in tubing when starting to pump). Push each strand into the pump until you can feel the tubing slide past the o ring in the pump.

3.6 ***Attach safety line to pump.*** Attach safety string or rope to top of pump as to not loose pump down hole. The pump user guide claims that the tubing grab plates are strong enough to keep tubing from pulling out of pump in the well. This is not true. Use a safety line to support the pump while lowering and removing the pump from the well.

3.7 ***Set pump at desired depth.*** Carefully lower the pump into the well using the support line. Avoid allowing the pump to agitate the water in the well. Once pump is at the desired location in the well, tie the support line to the protective well casing or other fixed object.

3.8 ***Prepare discharge tubing and air line.*** Separate the last two to three feet of bonded tubing into its individual strands. Attach the air line (gray) to the quick connect fitting associated with the **AIR OUT** location on the MP-10 controller. Connect the water line (clear) to a flow through cell using C-Flex tubing (if desired) or place discharge end of tubing in purge bucket.

3.9 ***Prepare air source.*** Connect the Well Wizard air compressor to a car battery. Use the red high pressure air line to connect the Well Wizard air compressor to

the **AIR IN** quick connect fitting on the MP-10 Controller. Turn on the Well Wizard air compressor. (Expel condensate regularly from Well Wizard air compressor during pumping by pressing moisture vent button).

3.10 ***Setting Throttle.*** The display panel on the MP-10 Controller will automatically turn on and off when the lid is opened and closed. Use the throttle control to set the associated gauge to the pump depth in the well. **ALWAYS SET THE PUMP DEPTH TO BE 10 TO 20 FEET DEEPER THAN THE PUMP ACTUALLY IS IN THE WELL TO ALLOW ENOUGH PRESSURE TO PUMP WATER FROM TOP OF WELL TO THE END OF THE DISCHARGE TUBING.**

3.11 ***Setting desired pump cycle.*** For wells that are less than 50 feet in total depth use the default setting of CPM4 to begin pumping. CPM stands for cycles per minute. CPM4 will refill and discharge water in and out of the pump 4 times each minute. *For deeper pumping depths use less cycles per minute.* To change the CPM setting use the CPM/Value button on the MP-10 Controller. Once a desired flow rate is selected press the Start/Stop button to begin pumping. *The individual refill and discharge times can be altered within each CPM Value during pumping by pressing the Flow/Value up or down buttons.*

3.12 ***Operate the pump.*** Operate the pump at the desired flow rate, purge the required volumes, take and record the required measurements, and collect samples as required.

3.13 ***Completion of sampling.*** At the completion of the sampling at the well, turn off the pump using the Start/Stop button on the MP-10 Controller. Turn off the Well Wizard air compressor and expel any moisture. Disconnect the air line from the compressor to the MP-10 Controller. Slowly remove the pump from the well by using the support line. Once the pump is out of the well, cut the tubing to allow the easy removal of the grab plate and top plate from the tubing. Decon all parts of the pump and discard the used bladder, tubing, and support line. Replace the bladder with a new bladder and return each piece of equipment to its transport case.

4. Reference

4.1 Sample Pro Portable MicroPurge Pump "User's Guide"
4.2 MicroPurge Basics MP-10 Controller "User's Guide"

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Attachment B-2

Field Forms

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Sample/Core Log

Boring/Well _____ Project/No. _____ Page ____ of ____

Site Location _____ Drilling Started _____ Drilling Completed _____

Total Depth Drilled _____ Feet Hole Diameter _____ inches Type of Sample/ Coring Device _____

Length and Diameter of Coring Device _____ Sampling Interval _____ feet

Land-Surface Elev. _____ feet ☐ Surveyed ☐ Estimated Datum _____

Drilling Fluid Used _____ Drilling Method _____

Drilling Contractor _____ Driller _____ Helper _____

Prepared By _____ Hammer Weight _____ Hammer Drop _____ ins.

Sample/Core Depth (feet below land surface) From	To	Core Recovery (feet)	PID (ppm)	Sample/Core Description

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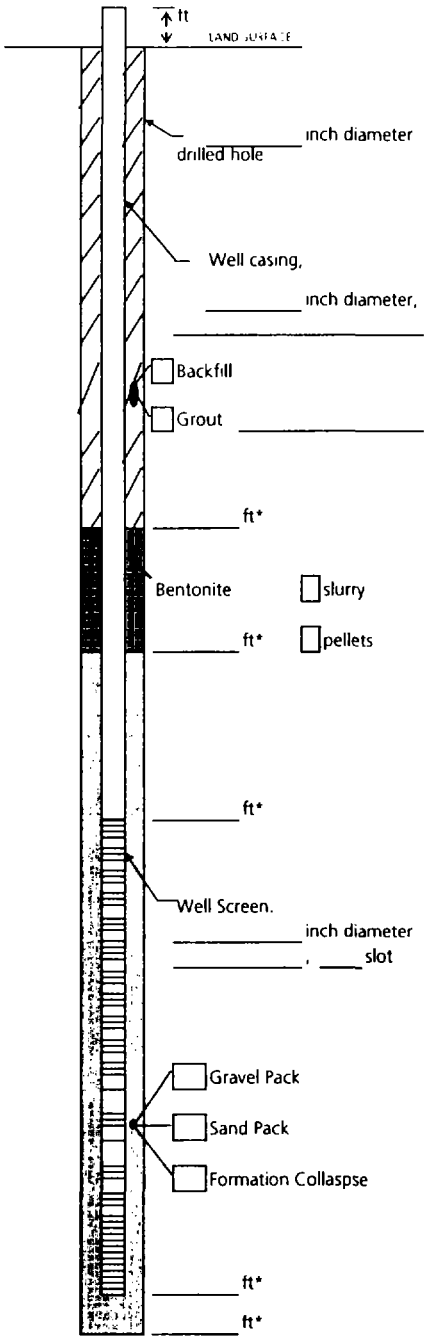
Well Construction Log

(Unconsolidated)



Measuring Point is
Top of Well Casing
Unless Otherwise Noted.

* Depth Below Land Surface

Project _____ Well _____

Town/City _____

County _____ State _____

Permit No. _____

Land-Surface Elevation and Datum:

_____ feet ☐ Surveyed ☐ Estimated

Installation Date(s) _____

Drilling Method _____

Drilling Contractor _____

Drilling Fluid _____

Development Technique(s) and Date(s)

Fluid Loss During Drilling _____ gallons

Water Removed During Development _____ gallons

Static Depth to Water _____ feet below M.P.

Pumping Depth to Water _____ feet below M.P.

Pumping Duration _____ hours

Yield _____ gpm Date _____

Specific Capacity _____ gpm/ft

Well Purpose _____

Remarks _____

Prepared by _____

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Groundwater Sampling Form

Page ____ of ____

Project/No. _____ Well _____ Date _____

Screen Setting _____ Measuring Point Description _____ Casing Diameter (inches) _____

Static Water Level _____ Measured Width _____ Well Materials ____ PVC ____ ST. Steel

Total depth _____ Pump On: _____ Pump Intake: _____

Purge Method Pump Off. _____ **Volumes Purged** _____

Centrifugal _____ **Sample Time:** _____

Submersible _____

Other _____ Bailer Type: _____ Sampled By: _____

Time	Minutes Elapsed	Rate (gpm) (ML)	DTW	Gallons Purged	pH	Cond. umhos ms/cm	TURB (NTUs)	Redox (mV)	Diss. O2 (mg/L)	TEMP. (C) (F)	REMARKS 3)

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Laboratory Task Order No./P.O. No._____

CHAIN-OF-CUSTODY RECORD

Page ____ of ____

Project Number/Name _____

Project Location _____

Laboratory _____

Project Manager _____

Sampler(s)/Affiliation _____

Sample ID/Location	Matrix	Date/Time Sampled	Lab ID	ANALYSIS / METHOD / SIZE						Remarks	Total

Sample Matrix: L = Liquid; S = Solid; A = Air

Total No. of Bottles/ Containers

Relinquished by: _____	Organization: _____	Date ___/___/___	Time _____	Seal Intact?
Received by: _____	Organization: _____	Date ___/___/___	Time _____	Yes No N/A
Relinquished by: _____	Organization: _____	Date ___/___/___	Time _____	Seal Intact?
Received by: _____	Organization: _____	Date ___/___/___	Time _____	Yes No N/A

Special Instructions/Remarks: _____

Delivery Method: ☐ In Person ☐ Common Carrier _____ ☐ Lab Courier ☐ Other _____

User Name : fkate Path\Name : C:\Drafting\CLIENT\CURRENT\CALUMETCLUSTER\SAP_ATTACHMENT.dwg Acad Version : 816.0 Date\Time : Fri, 29 Apr 2005 - 1:30pm

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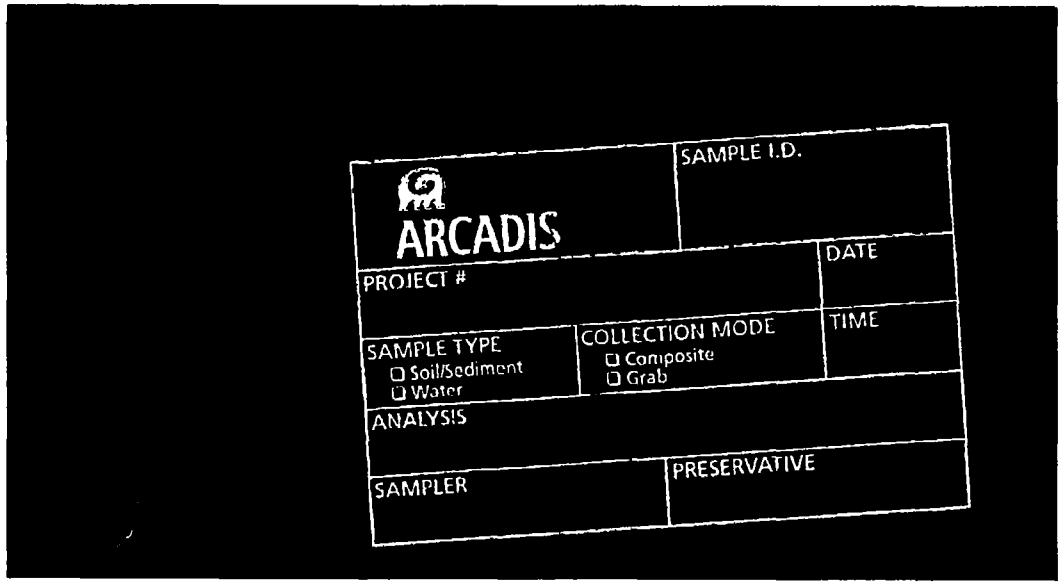
LAKE CALUMET CLUSTER SITE

CHAIN-OF-CUSTODY SEAL

CHICAGO, ILLINOIS

File Name: SAP_ATTACHMENT.DWG	Drawn BY: FS	Checked BY: A. BIRN	Project Manager: J. BRATZMEYER
		Department Manager: L. GUBIN	Unique Number:
Drawing Date: 4/29/05	File Location: G:\CALUMETCLUSTER	Project Number: CI001286.0001	Figure: B-2



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LAKE CALUMET CLUSTER SITE

SAMPLE LABEL

CHICAGO, ILLINOIS

File Name	Drawn BY	Checked BY	Project Manager
SAP_ATTACHMENT.DWG	FS	A. SENN	J. KRATZMEYER
		Department Manager	Unique Number
		S. GLENN	
Drawing Date	File Location	Project Number	Figure
4/29/05	G:\CALUMETCLUSTER	CI001286.0001	B-2

APPENDIX C

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Appendix C
Quality Assurance Project Plan

Remedial Investigation / Feasibility Study
Work Plan

Lake Calumet Cluster Site
Chicago, Illinois

Prepared for:
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Revision:
Rev. 01

Date:
August 16, 2005

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Appendix C
Quality Assurance Project Plan

Remedial Investigation / Feasibility Study
Work Plan

Lake Calumet Cluster Site
Chicago, Illinois

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Sid Glenn ARCADIS Quality Assurance Manager	1
Angela Weimerskirk STL Savannah Laboratories Project Manager	1

ARCADIS

Acronym List

ACLs	Alternate Concentration Limits
AOC	Administrative Order by Consent
ARCADIS	ARCADIS G&M, Inc.
bls	Below Land Surface
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLP SOW	Contract Laboratory Program Statement of Work
DO	Dissolved Oxygen
DQOs	Data Quality Objectives
ERA	Ecological Risk Assessment
EDD	Electronic Data Deliverable
FSS	Field Support Section
FS	Feasibility Study
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSP	Health and Safety Plan
HHRA	Human Health Risk Assessment
ICP	Inductively Coupled Plasma
Illinois EPA	Illinois Environmental Protection Agency
LCS	Laboratory Control Sample
LIMS	Laboratory Information Management System
MS/Dup	Matrix Spike/Laboratory Duplicate
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NELAP	National Environmental Laboratory Accreditation Program
NIST	National Institute of Standards and Technology
ORP	Oxidation Reduction Potential
PARCCS	Precision, Accuracy, Representativeness, Comparability, Completeness, Sensitivity
PE	Performance Evaluation
PID	Photoionization Detector
PPE	Personal Protective Equipment
%R	Percent Recovery
%RSD	Percent Relative Standard Deviation
QA	Quality Assurance
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan

ARCADIS

QC	Quality Control
RI	Remedial Investigation
ROD	Record of Decision
RI/FS	Remedial Investigation/Feasibility Study
RPD	Relative Percent Difference
RPM	Remedial Project Manager
RSD	Relative Standard Deviation
SAP	Sampling and Analysis Plan
SDG	Sample Delivery Group
Site	Lake Calumet Cluster Site
Site Group	Lake Calumet Cluster Site Group
SOP	Standard Operating Procedure
SOW	Statement of Work
SRM	Standard Reference Material
STL Savannah	Severn Trent Laboratory in Savannah, Georgia
SW-846	"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA SW-846, 3rd Edition with Updates I through III
TAL	Target Analyte List
U.S. EPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds

Introduction

This Remedial Investigation /Feasibility Study (RI/FS) Quality Assurance Project Plan (QAPP) for the Lake Calumet Cluster Site (the Site) in Chicago, Illinois has been prepared by ARCADIS G&M, Inc. (ARCADIS) on behalf of the Lake Calumet Cluster Site Group (Site Group). The RI/FS Sampling and Analysis Plan (SAP) describes the work that will be performed by the Site Group towards completion of their RI/FS obligations under the terms and conditions of the Administrative Order by Consent (AOC) and the Statement of Work (SOW) for Remedial Investigation/Feasibility Study at the Lake Calumet Cluster Site.

United States Environmental Protection Agency (U.S. EPA) policy requires that all work performed by or on behalf of the U.S. EPA involving the collection of environmental data be implemented in accordance with a U.S. EPA-approved QAPP. The QAPP is a planning document that provides a "blueprint" for obtaining the type and quantity of data needed to support environmental decision-making. The QAPP integrates all technical and quality aspects of a project and documents all quality assurance (QA), quality control (QC), and technical activities and procedures associated with planning, implementing, and assessing environmental data collection operations.

This QAPP was prepared in accordance with the U.S. EPA QAPP guidance documents "EPA Requirements for Quality Assurance Project Plans," EPA QA/R-5, March 2001, "EPA Guidance for Quality Assurance Project Plans," EPA QA/G-5, February 1998, and "Region 5 Instructions on the Preparation of a Superfund Division Quality Assurance Project Plan, Revision 0," June 2000. In accordance with these documents, this QAPP contains the four basic groups of elements that must be included in a QAPP. These four groups and associated elements include:

- Group A - Project Management. The elements in this group include all aspects of project management, project objectives, and project history.
- Group B - Data Generation and Acquisition. The elements in this group include descriptions of the design and implementation of all measurement systems that will be used during the project.
- Group C - Assessment/Oversight. The elements in this group encompass the procedures used to ensure proper implementation of the QAPP.
- Group D - Data Validation and Usability. The elements in this group cover the QA activities that occur after the data collection phase of the project is completed.

The elements that comprise project management, data generation and acquisition, assessment/oversight, and data validation and usability for the RI/FS to be conducted at the Site in Chicago, Illinois are documented in this QAPP. This QAPP is presented as Appendix C of the "RI/FS Work Plan, Lake Calumet Cluster Site, Chicago, Illinois" (RI/FS Work Plan).

A. Project Management

The responsibilities of management, QA personnel, field personnel, and laboratory personnel are provided in the following subsections. Additionally, any special training/certification requirements for the project are identified, and an organization chart that identifies the lines of communication among the participants in the RI/FS is presented herein.

A.1 Approvals

All QAPPs must be approved by the U.S. EPA prior to implementation of activities. Approval of this QAPP is demonstrated on the title and approval signature page at the beginning of this document.

A.2 Contents

The content of this QAPP has been prepared in accordance with "Region 5 Instructions on the Preparation of a Superfund Division Quality Assurance Project Plan, Revision 0," June 2000. Additionally, the document has been prepared per the U.S. EPA's Document Control Format.

A.3 Distribution

The list of individuals and their organizations that will receive copies of the approved QAPP and any subsequent revisions is presented in the AOC and Table of Contents section of this document.

A.4 Project Organization

At the direction of the Remedial Project Manager, the U.S. EPA has overall responsibility for all phases of the RI/FS. ARCADIS will perform the field investigation and prepare the RI and FS Reports. The various quality assurance and management responsibilities of key project personnel are defined below. Please refer to the Project Organization Chart in Figure C-1 of this QAPP for an overview of key responsibilities.

A.4.1 Management Responsibilities

U.S. EPA PROJECT COORDINATOR

Kyle Rogers of the Superfund Division, Region 5 is the designated U.S.EPA Project Coordinator. The U.S.EPA Project Coordinator also has the authority of the Remedial Project Manager (RPM) and On-Scene Coordinator (OSC) as provided by the National Contingency Plan (NCP).

RESPONDENTS RI/FS PROJECT MANAGER – ARCADIS

The Respondents have retained ARCADIS as their RI/FS Project Manager. Jack Kratzmeyer will serve as the ARCADIS Project Manager, and will have overall responsibility for technical and quality-related matters associated with completion of the RI/FS. Final decisions on recommendations, personnel assignments, and the submission of final reports are made by the Project Manager. Although the actual preparation of written documents may be performed by other members of the project team, all of these documents will be subjected to ARCADIS's Quality Assurance/Quality Control (QA/QC) program and will be reviewed and signed by the Project Manager.

STL SAVANNAH LABORATORY PROJECT MANAGER: The laboratory selected for this project is Severn Trent Laboratory in Savannah, Georgia (STL Savannah). The analytical laboratory's Project Manager, Angie Weimerskirk, is responsible for ensuring that the project objectives are achieved by the laboratory. The laboratory project manager will ensure all resources of the laboratory are available on an as-required basis; review final analytical reports; and approve final reports prior to submission to ARCADIS.

A.4.2 Quality Assurance Responsibilities

U.S. EPA QUALITY ASSURANCE REVIEWER: The U.S. EPA Region 5 Field Support Section (FSS) Quality Assurance Reviewer has yet to be determined (TBD) and is responsible for reviewing and providing final approval of the QAPP.

ARCADIS QUALITY ASSURANCE MANAGER: Sid Glenn will have overall responsibility for quality assurance for ARCADIS. The QA manager will review field QA/QC; review laboratory QA/QC; coordinate and review data validation and assessment;

advise on laboratory corrective action procedures; prepare and review QA reports; provide QA/QC representation of project activities; and approve the QAPP.

ARCADIS FIELD QUALITY ASSURANCE MANAGER: Todd O'Brien will have responsibility for quality management in the field. Responsibilities will include management of field activities and field QA/QC; field data assessment; internal field technical system audits; technical representation of field activities; preparation of standard operating procedures (SOPs) for field activities; and implementation and documentation of field corrective actions, if necessary.

STL SAVANNAH LABORATORY QUALITY ASSURANCE OFFICER: Andrea Teal, STL Savannah's quality assurance officer, will coordinate and overview laboratory systems audits; review QA/QC documentation; conduct detailed data review; implement and document laboratory corrective actions, if required; provide technical representation of laboratory QA procedures; oversee preparation of laboratory SOPs; and approve the QAPP.

A.4.3 Field Responsibilities

ARCADIS REMEDIATION TASK MANAGER: Ali Senn will have the overall responsibility for ensuring that the remediation goals meet U.S. EPA and Illinois EPA objectives.

ARCADIS FIELD STUDY COORDINATORS: Ali Senn will have the responsibility of leading and coordinating all of the activities undertaken during the remedial investigation field activities. In addition, she will be responsible for coordination of field staff and daily supervision and documentation of all safety, decontamination, and environmental monitoring activities. Field study coordinators are responsible for assuring that all field personnel comply with the Site Health and Safety Plan (HSP). The ARCADIS Field Coordinators report to the ARCADIS Project Manager and Task Manager.

A.4.4 Laboratory Responsibilities

STL Savannah, located in Savannah, Georgia, will perform all chemical analyses of samples collected during the RI/FS activities. Groundwater samples will be analyzed for various VOCs, light gases, and inorganics. Specific information regarding the sampling and analysis program are provided in Sampling and Analysis Plan (SAP), Appendix B of this RI/FS Work Plan.

The specific responsibilities of laboratory personnel involved in the project follow:

OPERATIONS MANAGER, STL SAVANNAH: The operations manager will coordinate laboratory analyses; supervise in-house chain-of-custody; schedule sample analyses; oversee data review; and oversee preparation of analytical reports.

SAMPLE CUSTODIAN, STL SAVANNAH: The sample custodian will receive and inspect the incoming sample containers; record the condition of the incoming sample containers; sign appropriate documents; verify correctness of chain-of-custody documentation; notify the laboratory project manager of any non-conformances identified during sample receipt and inspection; assign a unique identification number to each sample, and enter the client identification number and sample identification numbers into the sample receiving log; initiate transfer of the samples to appropriate laboratory sections; and control and monitor access/storage of samples and extracts.

A.4.5 Special Training Requirements / Certification

ARCADIS' field sampling team members are required to have received the 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) safety training and annual 8-hour refresher courses required by 29 CFR Parts 1910 and 1926. On-Site subcontractor personnel involved in invasive activities (e.g., drilling) are required to have received the same training. The subcontractor is responsible for compliance of their personnel with the applicable regulations.

The laboratory performing sample analysis for the RI/FS is required to be accredited by the National Environmental Laboratory Accreditation Program (NELAP) to demonstrate compliance with U.S. EPA's requirement that the laboratory have a documented quality system that complies with ANSI/ASQC E4-94 ("Specifications and Guidelines for Quality System for Environmental Data Collection and Environmental Technology Programs," January 1995), and EPA QA/R-2 ("EPA Requirements for Quality Management Plans," March 2001). STL Savannah is accredited by NELAP for the analyses identified in this QAPP.

A.4.6 Project Organization Chart

Figure C-1 presents the organizational chart for the RI/FS data collection activities.

A.5 Problem Definition and Background

The purpose of the RI/FS and background information for the Site are presented in the following sections.

A.5.1 Problem Definition

As stated in the SOW attached to the AOC, the purpose of the RI/FS is to investigate the nature and extent of affected media at the Site, assess the risk of impacts on human health and the environment, and develop and evaluate potential remedial alternatives. The strategy for the RI/FS and general management of the Site are to:

- Conduct a remedial investigation to determine fully the nature and extent of the release or threatened release of hazardous substances, pollutants, or contaminants of concern from the Site, at levels that adversely affect human health and the environment;
- Gather sufficient data, samples, and other information in order to perform human health and ecological risk assessments for the Site; and
- Perform a feasibility study to identify and evaluate a streamlined list of alternatives for the appropriate extent of remedial action to protect human health and the environment by preventing, eliminating, controlling or mitigating the release or threatened release of hazardous substances, pollutants, or contaminants of concern from the Site.

A.5.2 Background Information

The Site is located in southeastern Chicago, Illinois, southeast of Lake Calumet and approximately two (2) miles northeast of Hegewisch, Illinois (Figure 1-1). The Site approximately 90-acre Site consists of the parcels commonly referred to as the Alburn Incinerator site, the U.S. Drum site, the Unnamed Parcel, and a portion of the Paxton Lagoons. The Paxton Lagoons parcel is the only parcel visually distinct from the others and was previously closed by the Illinois Environmental Protection Agency (Illinois EPA) by draining the lagoons, thermal treatment of selected soils, and construction of an engineered clay cap over the closed lagoons.

The property is bounded to the west by Land and Lakes #3 Landfill, Paxton II Landfill to the northwest, Paxton I Landfill to the north, the Norfolk Southern Railroad right-of-

way and Indian Ridge Marsh to the east, and 122nd Street to the south. The boundary with Paxton I Landfill to the north is not clearly defined with a fence line, differential land uses, or topographic inclination.

Additional information regarding the regional and Site setting, including geology, hydrogeology, and climate, are provided in Section 2 of the Work Plan.

A.6 Project Description and Schedule

This QAPP has been prepared to satisfy the requirements for the RI/FS, and addresses sampling procedures, sample custody, analytical procedures, data reduction, data validation, reporting, and personnel requirements to ensure that the data obtained are of sufficient quality and quantity to adequately characterize the Site and conduct a human health risk assessment (HHRA) and ecological risk assessment (ERA). Based on the details presented in the RI/FS Work Plan, the Site has already been largely characterized by prior subsurface investigations; however, data gaps exist which will require additional information in order to complete the Feasibility Study. This section describes the Site investigation activities that will be conducted during the Remedial Investigation at the Site. The specific RI work tasks include:

- Install of eight monitoring wells and one piezometer to verify hydraulic gradient and flow direction.
- Survey elevations of the top of casing (TOC) and ground surface of the existing Site monitoring wells, new monitoring wells, and new piezometer.
- Sample the eight new monitoring wells and four existing monitoring wells.
- Conduct hydraulic conductivity testing (slug testing) of the fill, silty-sand and sandy surficial geologic material at the Site.
- Collect one groundwater sample from a test trench placed at the interface of the Site and the Indian Ridge Marsh.

RI/FS activities will be conducted consistent with the U.S. EPA Office of Emergency and Remedial Response Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (U.S. EPA, 1988). Investigative activities will be conducted in accordance with the Site-specific SAP (Appendix B to the RI/FS Work Plan) and HSP (Appendix D to the RI/FS Work Plan).

A detailed description of each of the RI Site characterization tasks is provided in Section 3 of the RI/FS Work Plan. Table C-1 presents a summary of the sampling and analysis effort for the groundwater characterization tasks.

A.6.1 Groundwater

A.6.1.1 Groundwater Investigation Program

Eleven (11) on-Site monitoring wells and one off-Site monitoring well will be sampled to determine constituent behavior and biogeochemical conditions within the proposed groundwater flow transects. Groundwater samples will be analyzed for low flow parameters, VOCs, light gases, and inorganic parameters. Low flow parameters include dissolved oxygen, pH, conductivity, temperature, and redox. Light gases include methane, ethane, and ethene. Inorganic parameters will include nitrate, total and dissolved iron, sulfate, sulfide, ammonium, total suspended solids (TSS), and total Target Analyte List (TAL) metals. The Site groundwater monitoring will occur in a single groundwater monitoring event. Prior to groundwater sampling, a contemporaneous round of groundwater elevation measurements will be collected from the accessible Site monitoring wells.

A.6.1.2 Groundwater Data Verification and Validation

ARCADIS will internally verify the groundwater sample data by reviewing field documentation and chain-of-custody records. Data from direct-reading instruments used to measure pH, conductivity, oxidation-reduction potential (ORP), and dissolved oxygen (DO) will be internally verified by reviewing calibration and operating records. It should be noted that field temperature measuring equipment are not calibrated in the field and the only data verification that can be performed is reviewing the records from routine factory calibration. The project laboratory will internally verify the VOCs, light gases and inorganic parameters data by reviewing sample receipt, sample preparation, sample analysis (including internal QC checks), and data reduction and reporting documentation. The field-measured pH, conductivity, ORP, and DO data and laboratory-generated VOCs, light gases and inorganic parameters data will be validated by ARCADIS by evaluating the Precision, Accuracy, Representativeness, Comparability, Completeness, and Sensitivity (PARCCS) of the data from field QC samples and internal laboratory QC checks relative to the requirements in this QAPP.

A.6.2 Project Schedule

The project schedule is presented in Section 5.3 of the RI/FS Work Plan.

A.7 Quality Objectives and Criteria for Measurement Data

The data quality objectives and measurement performance criteria for the RI activities are presented in the following subsections.

A.7.1 Data Quality Objectives

Data quality objectives (DQOs) are qualitative and quantitative statements derived from the outputs of each step of the DQO process. The DQO process is a series of planning steps based on the scientific method that is designed to ensure that the type, quantity, and quality of environmental data used in decision-making are appropriate for the intended application.

There are seven steps in the DQO process that include:

1. Stating the problem;
2. Identifying the decision;
3. Identifying inputs to the decision;
4. Defining the boundaries of the study;
5. Developing a decision rule;
6. Specifying limits on decision errors; and
7. Optimizing the design for obtaining data.

The details of the DQO process for the groundwater characterization tasks are provided below.

Step 1. Stating the Problem

The problem, as identified in Section A.5 of this QAPP, is to investigate the nature and extent of affected groundwater at the Site, complete the human health and ecological risk assessments, and develop and evaluate potential remedial alternatives.

Step 2. Identifying the Decision

The primary decision for the groundwater investigation is to determine the distribution of hazardous substances, pollutants, or contaminants as well as the extent, fate, and transport of any groundwater plumes. Another decision for the groundwater investigation is to determine groundwater flow direction and hydraulic conductivity.

Step 3. Identifying Inputs

In addition to the data collected during implementation of the RI, the inputs to the decision process for the groundwater investigation are data from previous investigations and yet to be determined cleanup objectives.

Step 4. Defining Study Boundaries

The spatial boundaries for the groundwater investigation consist of Site monitoring wells.

Step 5. Develop Decision Rule

If the concentrations of VOCs, light gases and inorganic parameters detected in groundwater samples collected during the RI are less than their respective cleanup objectives, then the vertical and horizontal extent of impacted groundwater have been defined. If the concentrations of VOCs, light gases and inorganic parameters detected in groundwater samples collected during the RI are greater than or equal to their respective cleanup objectives, then the vertical and horizontal extent of impacted groundwater have not been defined.

Step 6. Specify Limits on Decision Errors

The limits on decision errors expressed as percent error should be no greater than 25 percent. The aggregate sampling and analysis error may be greater, but error resulting from sampling procedures or the nature of the sample matrix is not quantifiable.

Step 7. Optimize the Design

The design of the sampling and analysis program (SAP) was developed in accordance with the SOW for the Site. The SAP has been designed to ensure that the problem identified in Section A.5 of this QAPP can be solved in a resource-efficient and timely manner. The details of the investigations are presented in Section 3 of the RI/FS Work Plan.

A.7.2 Measurement Performance Criteria

The measurement performance criteria for precision, accuracy, representativeness, completeness, and comparability are provided in the following subsections.

A.7.2.1 Precision

Precision is a measure of the degree to which two or more measurements of the same characteristic (i.e., analyte, parameter) under the same or similar conditions are in agreement.

Field Precision Criteria

Precision of the field sample collection procedures will be assessed by the data from analysis of field duplicate samples. Relative percent differences (RPDs) will be calculated for detected analytes from investigative and field duplicate samples. Field duplicate samples will be collected at a minimum frequency of 1 per 10 investigative samples. RPDs of 35 percent water sample field duplicates will be used as advisory limits for analytes detected in both the investigative and field duplicate samples at concentrations greater than or equal to five times its quantitation limit. Professional judgment will be used to qualify associated investigative sample data.

Field precision for measurements obtained during groundwater monitoring will be assessed through duplicate/replicate measurement of the same sample at a frequency of 1 per 10 or fewer groundwater sampling locations. The precision acceptance criteria for field measurements obtained during the field activities are presented in the SOPs in the SAP.

Laboratory Precision Criteria

Laboratory precision will be assessed through the calculation of RPDs for replicate/duplicate sample analyses. In general, these will be matrix spike/matrix spike duplicate (MS/MSD) samples for organic analyses and matrix spike/laboratory

duplicate (MS/Dup) samples for inorganic analyses. Field samples will be collected as at a minimum frequency of 1 per 20 aqueous investigation samples. The equation to be used to determine precision is presented in Section D.3.1 of this QAPP. Precision control limits for the analyses are presented in Table C-3.

A.7.2.2 Accuracy

Accuracy is the extent of agreement between an observed value (i.e., sample result) and the accepted or true value for the parameter being measured.

Field Accuracy Criteria

The criteria for accuracy of the field sample collection procedures will be to verify that samples are not affected by sources external to the sample, such as sample contamination by ambient conditions or inadequate equipment decontamination procedures. Field sampling accuracy will be assessed by the data from equipment and trip blank samples.

Equipment blank samples will be collected at a frequency of 1 per 20 or fewer sampling equipment decontamination procedures. Equipment blank samples will be collected by routing laboratory-provided deionized water through decontaminated sampling equipment. Equipment blank samples will be analyzed to check procedural contamination and/or ambient conditions and/or sample container contamination at the Site that may cause sample contamination. Equipment blank samples will be collected for aqueous samples only, and will not be collected for samples collected using pre-cleaned or pre-cleaned, disposable sampling equipment.

Trip blank samples, consisting of organic-free water poured into sample vials at the laboratory, will be provided by the project laboratory for the groundwater sampling events. Trip blank samples will be handled in a manner consistent with actual field samples, but will not be opened, and will be shipped back to the laboratory with the samples. Trip blank samples will provide a measure of potential cross-contamination of samples by VOCs during shipment and handling. One trip blank sample will be included in each shipping cooler containing aqueous samples for VOC analysis.

Equipment and trip blank samples should not contain target analytes. The equipment and trip blank sample data will be evaluated using the procedures specified in Section D.2 of this QAPP. Accuracy also will be ensured by adhering to all sample handling procedures, sample preservation requirements, and holding time periods.

Accuracy of field measurements obtained during groundwater monitoring will be assessed by analyzing calibration check samples. Accuracy acceptance criteria for field measurements obtained during the field activities are presented in the SOPs in the SAP.

Laboratory Accuracy Criteria

Laboratory accuracy will be assessed by determining percent recoveries from the analysis of laboratory control samples (LCSs) or standard reference materials (SRMs). Accuracy relative to the sample matrix will be assessed by determining percent recoveries from the analysis of MS/MSD or MS/Dup samples. MS/MSD and MS/Dup samples will be collected/designated for the organic and inorganic analyses, respectively, at a minimum frequency of 1 per 20 or fewer samples. The equation to be used to determine accuracy for this project is presented in Section D.3.2 of this QAPP. Accuracy control limits are presented in Table C-3.

The accuracy of the organics analyses also will be monitored through the analysis of surrogate compounds. Surrogate compounds are added to each sample, standard, blank, and QC sample prior to sample preparation and analysis. Surrogate compounds are not expected to be found occurring naturally in the samples, but behave analytically similar to the compounds of interest. Consequently, surrogate compound percent recoveries will provide information on the effect that the sample matrix exhibits on the accuracy of the analyses. Table C-3 provides surrogate compound percent control limits for the organic analyses.

A.7.2.3 Representativeness

Representativeness is a qualitative term that describes the extent to which a sampling design adequately reflects the environmental condition of a site. Representativeness also reflects the ability of the sample team to collect samples and laboratory personnel to analyze those samples in such a manner that the data generated accurately and precisely reflect the conditions at a site.

Field Representativeness Criteria

Representativeness is dependent upon the proper design of the sampling program. The representativeness criteria for field sampling will be to verify that the monitoring well locations are properly established on and off Site (as applicable), that the correct monitoring wells are sampled, and that the sampling procedures in the SAP are

followed. The sampling programs were designed to provide data representative of Site conditions. During development of these programs, consideration was given to past waste disposal practices, existing analytical data, and physical setting and processes. The rationale for the sampling network is provided in Section A.6 of this QAPP.

Laboratory Representativeness Criteria

The representativeness criteria for laboratory data will be to ensure that the proper analytical procedures are used for sample preparation (e.g., homogenizing the sample prior to subsampling), sample analysis, and that sample holding times are met. Additionally, the accuracy and precision of the laboratory data affect representativeness. The laboratory representativeness criteria will include achieving the accuracy and precision criteria for the sample analyses.

A.7.2.4 Comparability

Comparability is an expression of the confidence with which one data set can be compared with another.

Field Comparability Criteria

The criteria for field comparability will be to ensure and document that the sampling networks designed for the RI are properly implemented and the sampling procedures in the SAP are followed for the duration of the sampling programs described in this QAPP and any amendments to this QAPP.

Laboratory Comparability Criteria

The criteria for laboratory data comparability will be to ensure that the analytical methods used for the RI sampling and analysis events that are comparable to the methods used for previous sampling events. The analytical methods identified in Section B.4 of this QAPP generally are comparable to the methods used to generate data for previous investigations.

A.7.2.5 Completeness

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

Field Completeness Criteria

The criteria for field completeness will be that a minimum of 90 percent of the field-measured data are valid. The procedure for determining field data validity is provided in Section B.10.2 of this QAPP. The equation for calculating completeness is presented in Section D.3.4 of this QAPP.

Laboratory Completeness Criteria

The criteria for laboratory completeness will be that a minimum of 90 percent of the laboratory data are determined to be valid (usable) for the intended purpose. The procedure for determining laboratory data validity is provided in Section B.10.2 of this QAPP. The equation for calculating completeness is presented in Section D.3.4 of this QAPP.

A.7.2.6 Sensitivity

Sensitivity is the ability of a method or instrument to detect a parameter to be measured at a level of interest.

Field Sensitivity Criteria

The criteria for field measurement sensitivity are provided in the Attachment 1 of the SAP (Appendix B of the RI/FS Work Plan). The sensitivity of the field instruments (field-portable pH, temperature, conductivity, ORP, and DO meters) selected to measure the pH, temperature, conductivity, ORP, and DO of groundwater and surface water for this project will be measured by analyzing calibration check solutions, where appropriate, that equate to the lower end of the expected concentration range. The sensitivity of the PID used to screen soil samples for organic vapors is relative to background readings of ambient air.

Laboratory Sensitivity Criteria

The sensitivity requirements for the laboratory analyses are provided in Table C-3. The analytical methods are sufficiently sensitive for the project.

A.8 Special Training Requirements and Certification

Special training/certification requirements for this project were provided in Section A.4.5.

A.9 Documentation and Records

The documents, records, and reports generated during the RI are identified in the following subsections.

A.9.1 Field and Laboratory Records

Documents and records generated during the project include sample collection records, QC sample records, field measurement records, laboratory records, and data handling records. A brief description of these documents and records are provided below. Detailed information on these records is provided in subsequent sections of this QAPP.

Sample collection records that will be used during the sampling activities include field logbooks, stratigraphic logs, chain-of-custody records, and shipping papers.

QC sample records that will be used during the project to document the generation of QC samples include field logbooks for recording equipment blank samples, field duplicate samples, and MS/MSD and MS/Dup samples. The project laboratory will maintain appropriate documentation of trip blank sample preparation, quality records for deionized water sent for equipment blank samples, and sample integrity information. Records of sample preservation will be maintained in field logbooks and by the project laboratory.

Field measurements of organic vapors, depth to groundwater, pH, temperature, conductivity, ORP, and DO will be recorded in bound logbooks or standard field forms. Calibration data, where applicable, will also be recorded in these logbooks or forms.

Laboratory records that will be maintained for the project include sample receipt documentation, field and laboratory chain-of-custody documentation, sample container cleanliness certifications, reagent and standard reference material certifications, sample preparation records, sample analysis records (e.g., run logs), instrument/raw data, QC data, calibration data, corrective action reports, and final reports.

Data handling records that will be maintained include verification of computer programs used to manipulate or reduce raw data into final results and data validation reports. The project laboratory will maintain documentation of data verification and reduction procedures as necessary for the analyses used during the RI activities. ARCADIS will maintain checklists, notes, and reports generated during the external data validation process.

A.9.2 Data Reporting Format

Field data will be recorded in bound logbooks or on standard forms (e.g., stratigraphic logs). The details for recording field data are provided in Section B.3.2.1 of this QAPP. Field data primarily will be from direct-reading meters, consist of field readings (e.g., depth to water measurements), or field observations. These data will be tabulated and included in project reports or submittals, as appropriate.

Laboratory reports for samples collected during the RI to determine the nature and extent of contamination or for risk assessment purposes will consist of the following data deliverables:

1. Case Narrative

    - Date of issuance;
    - Any deviations from intended analytical strategy;
    - Laboratory batch number;
    - Number of samples and respective matrices;
    - Project name and number;
    - Condition of samples "as received";
    - Discussion of whether or not sample holding times were met;
    - Discussion of technical problems or other observations that may have created analytical difficulties; and
    - Discussion of any laboratory quality control checks that failed to meet project criteria.

2. Chemistry Data Package

    - Dates of sample collection, receipt, preparation, and analysis;

- Cross-reference of laboratory to project sample identification numbers;
- Description of data qualifiers used;
- Methods of sample preparation and analysis;
- Sample results in tabular format;
- MS/MSD and MS/Dup data, LCS data, method blank data, surrogate compounds data, internal standards data;
- Raw instrument data (including calibration data and instrument performance checks); and
- Fully executed chain-of-custody document.

Laboratory reports for samples collected during the RI for screening purposes will consist of the data deliverables identified above, with the exception of raw instrument data. Method detection limit studies, instrument detection limit studies, and method performance and validation studies will be maintained by the laboratory.

A.9.3 Data Archiving and Retrieval

Section XIV of the AOC specifies that all records be maintained for a minimum of ten years following completion of the actions required by the AOC. U.S. EPA is to be notified at least 90 days before the documents are scheduled to be destroyed. All records for the RI/FS will be maintained consistent with the requirements of the AOC.

B. Data Generation and Acquisition

The design and implementation of the measurement systems that will be used during the RI, including sampling procedures, analytical procedures, and data handling and documentation are detailed in the following subsections.

B.1 Sampling Process Design

The rationale for the RI sampling programs is provided in Section 3 of the RI/FS Work Plan and was detailed in Section A.6 of this QAPP.

B.2 Sampling Methods Requirements

Sampling methods for the collection of groundwater are provided in the SAP.

B.2.1 Field Equipment and Sample Container Cleaning Procedures

Equipment cleaning/decontamination procedures are provided in Section 6.0 of the SAP. Sample containers will be provided by STL Savannah. STL Savannah's vendor for sample containers is QEC of Jackson, Michigan. All containers will be precleaned in accordance with the U.S. EPA guidance document entitled "Specifications and Guidance for Contaminant-Free Sample Containers," EPA 540/R-93/051. Certificates of analysis for each lot of containers will be maintained by STL Savannah.

B.2.2 Field Equipment Maintenance, Testing, and Inspection Requirements

Field equipment will be inspected and tested prior to being shipped to the field, unless the equipment is rented. Prior to use in the field, the equipment is checked again, generally during field calibration, and the performance information is recorded in the field logbook. All equipment shipped back from the field is inspected and tested upon return unless the equipment is rented. Any required maintenance is performed and documented in the field logbook prior to the equipment being returned to service.

Critical spare parts for field equipment and replacement field equipment are available at each ARCADIS office and can be shipped for overnight delivery, picked up at the ARCADIS office, or delivered to the field when the need is identified. Alternately, field equipment vendors can provide replacement equipment if needed. The replacement equipment can be shipped for overnight delivery as necessary.

B.2.3 Inspection and Acceptance Requirements for Supplies and Sample Containers

The field supplies for the RI sampling activities consist of calibration standard solutions for field instrument calibration and calibration checks, detergent (Alconox) for equipment cleaning, deionized water for collecting inorganics field (equipment rinsate) blank samples, purge-and-trap grade water for collecting VOC equipment blank samples, chemical preservatives for pH adjustment of the appropriate aliquots of samples (e.g., hydrochloric acid for VOCs and nitric acid for metals), and sample containers to collect the water samples.

Field calibration standards (e.g., pH buffers, conductivity solutions) will be obtained from Cole Parmer and are traceable to National Institute of Standards and Technology (NIST) standards. ARCADIS' Field QA Officer is ultimately responsible for ensuring that the field calibration standards for the project are acceptable. The calibration standards will be checked prior to being sent to the field to ensure that they have not expired or otherwise degraded. New calibration standards will be purchased if existing standards are found to be expired or degraded. Alconox, which is a standard laboratory-grade detergent, also is obtained from Cole Parmer. Distilled water will be purchased as needed from a variety of vendors.

Deionized water, purge-and-trap grade water, chemical preservatives, and sample containers will be provided by STL Savannah. The project laboratory will maintain documentation of the purity/cleanliness for these materials. The project laboratory QA Officer is ultimately responsible for ensuring that these materials are acceptable for the project. The acceptability of these materials for use will be evaluated by reviewing lot analysis certificates (deionized water, chemical preservatives, and containers). Purge-and-trap grade water will be obtained from STL Savannah's volatile organic analysis laboratory and will meet the acceptability requirements for method blank samples specified in their VOC analysis SOP. Water, preservatives, and containers that do not meet STL Savannah's acceptability requirements will not be shipped to the field.

B.3 Sample Handling and Custody Requirements

The procedures for sample handling, labeling, shipping, and chain-of-custody documentation are provided in the subsections that follow.

B.3.1 Sample Handling

The procedures used to collect the samples are provided in the SAP. Sample aliquots will be containerized in order of decreasing analyte volatility. Groundwater samples will be containerized in the following sequence: VOCs; light gases; and inorganic parameters. Table C-4 identifies the requirements for the number of containers, container volume, container type (material of construction), preservation, holding time periods, packaging, and shipping for the analyses associated with each sampling program.

Each sample container will be labeled with a unique sample number that will facilitate tracking and cross-referencing of sample information and will be recorded in the field logbook. The unique sample number will be recorded with the sample location in the field logbook at the time of sample collection. The field logbook will form part of the permanent field record. The sample numbering system to be used is described as follows (the information entered on the sample labels will be printed by the field sampler):

Example: LOC- XX-MMDDYY

Where:

LOC	-	designates sample location (i.e., LC10, P02, etc.);
XX	-	designates types of sample (GW-groundwater); and
MMDDYY	-	designates date of collection presented as month, day, year.

QC samples also will be numbered with a unique sample number. The sample location of each QC sample will be recorded in the field log book only. The sample numbering system to be used for such samples is described as follows (the information entered on the sample labels will be printed by the field sampler):

Example:

TB - MMDDYY-N

Where:

TB	-	designates type of field QC sample (Dup – field duplicate, EB – equipment blank, TB – trip blank, and MS/MSD – matrix spike/matrix spike duplicate);
MMDDYY	-	designates date of collection presented as month, day, year; and
N	-	designates sequential number for each sample.

Samples will be placed in shipping coolers containing bagged, cubed ice immediately following collection. The samples will be grouped in the shipping cooler by the order in which the samples are collected. The samples will be shipped to the laboratory via an overnight courier service, generally on the day they are collected. The only exceptions to this procedure will be for samples collected after the courier service has picked up the shipment for the day (generally only at remote sites) and samples collected on a Sunday or holiday. In these instances, the samples will be shipped on the next business day.

The laboratory will group the samples in sample delivery groups (SDGs) by sampling program. An SDG is a group of 20 or fewer field samples (including field QC samples) received by the laboratory within 14 calendar days.

B.3.2 Sample Custody

Chain-of-custody is the sequence of possession of an item. An item (such as a sample or final evidence file) is considered to be in custody if the item is in actual possession of a person, the item is in the view of the person after being in his/her actual possession, or the item was in a person's physical possession but was placed in a secure area by that person. Field, laboratory, and final evidence files custody procedures are described in the subsections that follow.

B.3.2.1 Field Custody Procedures

Logbooks will used to record field data collection activities. Entries into field logbooks will be described in as much detail as possible to ensure that a particular situation could be reconstructed solely from logbook entries. Field logbooks will be bound field survey books or notebooks with consecutively numbered pages. Logbooks will be assigned to field personnel and will be stored at ARCADIS's Chicago, Illinois office when not in use. Each logbook will be identified by the project-specific document number (CI001286.0004).

The title page of each logbook will contain the following information:

- Person to whom or task for which the logbook is assigned;
- Project number;
- Project name;
- The starting date for entries into the logbook; and
- The ending date for entries into the logbook.

Entries into the logbook will contain a variety of information. At the beginning of each day's logbook entry, the date, start time, weather, names of all sampling team members present, and the signature of the person making the entry will be entered. The names of individuals visiting the site or field sampling team and the purpose of their visit will also be recorded in the field logbook.

All field measurements obtained and samples collected will be recorded. All logbook entries will be made in ink, signed, and dated with no erasures. If an incorrect logbook entry is made, the incorrect information will be crossed out with a single strike mark which will be initialed and dated by the person making the erroneous entry. The correct information will be entered into the logbook adjacent to the original entry.

Whenever a sample is collected or a measurement is made, a detailed description of the location will be recorded in the logbook. Photographs taken at a location, if any, will also be noted in the logbook. All equipment used to obtain field measurements will be recorded in the field logbook. In addition, the calibration data for all field measurement equipment will be recorded in the field logbook or on standard field forms.

Samples will be collected following the sampling procedures documented in the SAP. The equipment used to collect samples, time of sample collection, sample description, volume and number of containers, preservatives added (if applicable) will be recorded in the field logbook. Each sample will be uniquely identified using the sample numbering system provided in Section B.3.1 of this QAPP.

The sample packaging and shipping procedures summarized below will ensure that the samples arrive at the laboratory with the chain-of-custody intact:

- The field sampler is personally responsible for the care and custody of the samples until they are transferred to another person or the laboratory. As few people as possible will handle the samples.
- All sample containers will be identified by using sample labels which will include the date of collection, unique sample number, and analyses to be performed.
- Sample labels will be completed for each sample using waterproof ink.
- Samples will be placed in coolers containing ice immediately after collection.
- Samples will be accompanied by a properly completed chain-of-custody form. An example chain-of-custody form is in the SAP. The sample identification numbers will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving the samples will sign and record the date and time on the form. The chain-of-custody form documents sample custody transfers from the sampler to another person, to the laboratory, or to/from a secure storage area.
- All sample shipments will be accompanied by the chain-of-custody form identifying its contents. The chain-of-custody form is a three-part carbonless-copy form. The form is completed by the sampling team and, after signing and relinquishing custody to the shipper, retains the bottom (pink) copy. The yellow copy is retained by the laboratory and the fully executed top copy is returned as part of the data deliverables package.
- Samples will be properly packaged for shipment (see Table C-4) and dispatched to the appropriate laboratory for analysis with a separate signed chain-of-custody form enclosed in and secured to the inside top of each shipping cooler. Shipping coolers will be secured with custody tape for shipment to the laboratory. The custody tape is then covered with clear plastic tape to prevent accidental damage to the custody tape.
- If the samples are sent by common carrier, a bill of lading will be used and copies will be retained as permanent documentation. Commercial carriers are not required to sign the chain-of-custody form as long as the form is sealed inside the sample cooler and the custody tape remains intact.
- If samples are not shipped to the laboratory the same day the samples are collected in the field, additional ice will be placed in the coolers, the coolers will be sealed and kept in a designated secure area until they are shipped to the laboratory as described above.

B.3.2.2 Laboratory Custody Procedures

Laboratory sample custody begins when the samples are received at the laboratory. The sample custodian will assign a unique laboratory sample identification number to each incoming sample. The field sample identification numbers, laboratory sample identification numbers, date and time of sample collection, date and time of sample receipt, and requested analyses will be entered into the sample receiving log. Sample log-in, custody, and document control procedures are detailed in the Laboratory Quality Manual (LQM) in Attachment C-1.

Following log-in, all samples will be stored within an access-controlled location and will be maintained properly preserved (as defined in Table C-4) until completion of all laboratory analyses. Unused sample aliquots and sample extracts/digestates/distillates will be maintained properly preserved for a minimum of 30 days following receipt of the final report by ARCADIS. The project laboratory will be responsible for the disposal of unused sample aliquots, sample containers, and sample extracts/digestates/distillates in accordance with all applicable local, state, and federal regulations.

The laboratory will be responsible for maintaining analytical log books and laboratory data. Raw laboratory data files will be inventoried and maintained by the laboratory for a minimum period of seven years, after which time ARCADIS will advise the laboratory regarding additional storage.

B.3.2.3 Final Evidence Files Custody Procedures

The final evidence file for the project will be maintained by ARCADIS and will consist of the following:

1. Project plan;
2. Project log books;
3. Field data records;
4. Sample identification documents;
5. Chain-of-custody records;
6. Correspondence;
7. References, literature;

8. Final laboratory reports;
9. Miscellaneous - photos, maps, drawings, etc.; and
10. Final report.

The final evidence file materials will be the responsibility of the evidentiary file custodian (ARCADIS' Project Manager) with respect to maintenance and document removal. Section XIV of the AOC specifies that all records be maintained for a minimum of ten years following completion of the actions required by the AOC. U.S. EPA is to be notified at least 90 days before the documents are scheduled to be destroyed. All records for the RI/FS will be maintained consistent with the requirements of the AOC.

B.4 Analytical Methods Requirements

The field and laboratory analytical methods that will be used during the RI are detailed in the following subsections.

B.4.1 Field Analytical Methods

Groundwater samples will be analyzed in the field for pH, temperature, conductivity, ORP, and DO. The data from these analyses will be used to determine when the groundwater is suitable for the collection of representative samples. Field-portable pH, temperature, conductivity, ORP, and DO meters will be used to analyze the samples. SOPs for these field measurements are presented in the SAP.

Measurements of surface water pH, temperature, specific conductance, and DO will be recorded in the field using a YSI model 6820 probe or equivalent instrument. SOPs for these field measurements are presented in the SAP.

B.4.2 Laboratory Analytical Methods

Groundwater samples will be analyzed off Site by the project laboratory. The following presents a brief discussion of each analytical technique that will be used for chemical analysis of samples collected during the RI.

VOCs in water samples will be analyzed using purge-and-trap sample concentration/introduction followed by gas chromatography/mass spectrometry (GC/MS) analysis.

Samples analyzed for total metals will be acid digested and the digestates will be analyzed using inductively coupled plasma (ICP) emission spectrometry and cold vapor mercury atomic absorption spectrometry. Nitrate and sulfate will be analyzed in water samples by ion chromatography/electrical conductivity separation/detection techniques. Sulfide in water samples will be analyzed by the iodometric method, which consists of back-titrating excess iodine added to oxidize sulfide in the samples. Ammonia in water samples will be determined potentiometrically using an ion-selective electrode.

The analytical methods that will be used by the project laboratory for analyzing groundwater samples are presented in Table C-5. Laboratory LQM and SOPs for the analytical methods are presented in Attachment C-1.

The quantities and types of QC samples for the groundwater investigation are included in Table C-2.

B.5 Quality Control Requirements

The field and laboratory QC requirements for the RI activities are discussed in the following subsections. Specific QC checks and acceptance criteria are provided in the field SOPs in the SAP and laboratory SOPs and LQM in Attachment C-1.

B.5.1 Field Sampling Quality Control

Field QC requirements include analyzing reference standards for instrument calibration and for routine calibration checks. The acceptance criteria are provided in the SOPs in the SAP. Field QC samples for this project include equipment blank samples to determine the existence and magnitude of sample contamination resulting from ambient conditions or sampling procedures, field duplicate samples to assess the overall precision of the sampling and analysis events, and trip blank samples to monitor cross-contamination of samples by VOCs. The frequency of collection of these field QC samples was provided in Section A.7 of this QAPP. The evaluation of field QC data is provided in Section B.10 of this QAPP.

B.5.2 Analytical Quality Control

The laboratory QC requirements for groundwater samples analyzed for VOCs include analyzing instrument performance check (mass tuning) standards, method blanks, initial calibration standards, continuing calibration standards, surrogate standards,

internal standards, MS/MSDs, and LCSs. The acceptance criteria for all these QC checks except MS/MSD samples are provided in STL Savannah's SOPs.

The laboratory QC requirements for groundwater samples analyzed for metals include analyzing preparation blanks, initial calibration blanks, continuing calibration blanks, initial calibration verification standards, continuing calibration verification standards, interference check standards, serial dilution samples, MS/MSD or MS/Dup samples, and LCSs. The analysis frequency for these QC samples, with the exception of MS/MSD, is included in STL Savannah's LQM in Attachment C-1. The acceptance criteria for all these QC checks except MS/MSD or MS/Dup samples are in STL Savannah's LQM.

The laboratory QC requirements for groundwater samples analyzed for nitrate, nitrite, and sulfate include analyzing method blanks, initial calibration standards, continuing calibration standards, MS/MSD or MS/Dup samples, and LCSs. The acceptance criteria for all these QC checks except MS/MSD or MS/Dup samples are in STL Savannah's SOPs and LQM. The acceptance criteria for MS/MSD or MS/Dup samples are provided in Table C-3 of this QAPP.

The laboratory QC requirements for groundwater samples analyzed for sulfide include analyzing method blanks, MS/MSD or MS/Dup samples, and LCSs. The acceptance criteria for method blank and LCS samples are in STL Savannah's SOP and LQM. The acceptance criteria for MS/MSD or MS/Dup samples are provided in Table C-3 of this QAPP.

The laboratory QC requirements for groundwater samples analyzed for ammonia includes analyzing method blanks, MS/MSD or MS/Dup samples, and LCSs. The acceptance criteria for method blank samples and LCSs are in STL Savannah's LQM and SOP. The acceptance criteria for MS/MSD or MS/Dup samples are provided in Table C-3 of this QAPP.

B.6 Equipment Testing, Inspection, and Maintenance Requirements

The procedures used to verify that instruments and equipment are functional and properly maintained are described in the following subsections.

B.6.1 Field Instrument Maintenance

The field equipment for this project includes field-portable pH, temperature, conductivity, ORP, and DO meters. Specific preventive maintenance procedures to be followed for field equipment are those recommended by the manufacturer. Field instruments will be checked and calibrated daily before use. The maintenance schedule and trouble-shooting procedures for field instruments are presented in the SAP.

B.6.2 Laboratory Instrument Maintenance

As part of its QA/QC program, STL Savannah conducts a routine preventive maintenance program to minimize the occurrence of instrument failure and other system malfunctions. Designated laboratory employees will regularly perform routine scheduled maintenance and repair of (or coordinate with the instrument manufacturer for the repair of) all instruments. All maintenance that is performed will be documented in the laboratory's maintenance logbooks. All laboratory instruments are maintained in accordance with manufacturer's specifications.

Table C-6 provides examples of the frequency at which components of key analytical instruments or equipment will be serviced. The LQM in Attachment C-1 provides complete details for instrument preventive maintenance.

B.7 Instrument Calibration and Frequency

The procedures for maintaining the accuracy for all the instruments and measuring equipment which are used for conducting field tests and laboratory analyses are described in the following subsections. These instruments and equipment will be calibrated prior to each use or according to a periodic schedule.

B.7.1 Field Instruments/Equipment

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specification and requirements presented in the SOPs in the SAP.

Equipment to be used during field sampling will be examined to confirm that it is in operating condition. This includes checking the manufacturer's operating manual for

each instrument to ensure that all maintenance requirements are being observed. Individual calibration records for each field instrument that will be used for the project will be reviewed to ensure that any prior equipment problems have not been overlooked and all necessary repairs to equipment have been completed.

B.7.2 Laboratory Instruments

Calibration of laboratory equipment will be based on approved written procedures. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing quality control activities. These records will be filed at the location where the work is performed and will be subject to QA audit. For all instruments, the laboratory will maintain a properly trained repair staff with in-house spare parts or will maintain service contracts with vendors.

The records of calibration will be kept as follows:

1. If possible, each instrument will have record of calibration permanently affixed with an assigned record number.
2. A logbook will be assigned to each instrument showing description, manufacturer, model numbers, date of last calibration and the signature of the person who calibrated the instrument, due date of next calibration and compensation or correction figures, as appropriate.
3. A written stepwise calibration procedure will be available for each piece of test and measurement equipment.
4. Any instrument that is not calibrated to the manufacturer's original specification will display a warning tag or will otherwise be removed from service, as appropriate.

Specific calibration procedures and frequencies are detailed in the LQM in Attachment C-1.

B.8 Inspection / Acceptance Requirements for Supplies and Consumables

The procedures that will be used to ensure that supplies and consumables used in the field and laboratory will be available as needed and free of contaminants are detailed in the following subsections.

B.8.1 Field Supplies and Consumables

Supplies and consumables for field measurements and sampling will be obtained from various vendors and include standards for field meter calibration, sample containers, preservatives, detergent and water for equipment decontamination, and equipment blank water. The vendors and inspection and acceptance criteria for these field supplies were presented in Section B.2 of this QAPP. Additional field supplies and consumables include pump tubing and personnel protective equipment (PPE). Pump tubing will be constructed of pre-cleaned high density polyethylene. This material will not introduce contaminants into the samples or interfere with the analyses. All field supplies will be consumed or replaced with sufficient frequency to prevent deterioration or degradation that may interfere with the analyses.

B.8.2 Laboratory Supplies and Consumables

STL Savannah's vendor for general labware and reagents is Fisher Scientific or equivalent. Vendors for chromatography supplies and organic standards include Ultra Scientific, Supelco, Accustandard, Restek, ChemService, and Aldrich Chemical or equivalent. Vendors for metals and general chemistry parameters supplies and standards include Ultra Scientific, High Purity Standards, and Inorganic Ventures or equivalent. The lot numbers of reagents and standards are recorded and dates of receipt, first use, and expiration are documented. Certificates of analysis are maintained on file to document reagent/standard purity.

The LQM in Attachment C-1 provide details on identifying contaminants in reagents and standards, determining deterioration of reagents and standards, and the corrective actions required if contaminants or deterioration are identified. The laboratory QA Officer is ultimately responsible for the ensuring the acceptability of supplies and consumables.

B.9 Data Acquisition Requirements

Historical data for the Site were generated during the various monitoring events identified in the RI/FS Work Plan.

B.10 Data Management

The procedures for managing data from generation to final use and storage are detailed in subsections that follow.

B.10.1 Data Recording

Field data will be recorded in field logbooks or on standard forms and consist of measurements from direct reading instruments or direct measurements. Field staff are responsible for recording field data and the Field QA Officer is responsible for identifying and correcting recording errors.

Laboratory data are recorded in a variety of formats. Data from instruments are recorded on magnetic media, strip charts, or bench sheets. The laboratory SOPs and LQM in Attachment C-1 provides the data-recording requirement for each preparation and analysis method.

B.10.2 Data Validation

Validation of field data for this project will primarily consist of checking for transcription errors and review of data recorded in field logbooks or on standard forms. Data transcribed from the field logbook or standard forms into summary tables for reporting purposes will be verified for correctness by the Field QA Officer or his designee. Any limitations on the use of field data will be included in the RI reports.

Validation of the analytical data will be performed by ARCADIS' QA Officer or his designee based on the evaluation criteria outlined in "USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review," EPA 540/R-99/008, October 1999 and "USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review," EPA 540/R-94-013, February 1994. The evaluation and action criteria specified in these documents (referred to hereafter as the National Functional Guidelines) will be used for validating the data. However, the acceptance limits for QC data will be the control limits determined statistically by the laboratory, not the control limits specified in the National Functional Guidelines. Calibration data will be validated using the acceptance criteria specified in the analytical methods, not the National Functional Guidelines. Qualifiers assigned to the data will be consistent with the data qualifiers specified in the National Functional Guidelines.

The following QC data deliverables will be evaluated on 100 percent of the data used for screening purposes at the Site.

Organic Analyses

- Technical Holding Times;
- Blanks;
- Surrogate Spikes;
- MS/MSD Results;
- LCS Results;
- Equipment Blanks;
- Field Duplicates; and
- Trip Blank Samples.

Inorganic Analyses

- Technical Holding Times;
- Blanks;
- MS/MSD or MS/Dup results;
- Equipment Blanks;
- LCS Results; and
- Field Duplicates.

The results of the data validation process will be documented in a memorandum that specifies all limitations on the usability of the analytical data.

B.10.3 Data Transformation/Data Reduction

Field data reduction procedures will be minimal in scope compared to those implemented for laboratory data. Only direct reading instrumentation will be employed in the field. The use of field instrument meters will generate data read directly from the meters following calibration as outlined in the SOPs in the SAP. These data will be recorded into field logbooks immediately after the measurements are taken.

Laboratory data reduction procedures will be followed according to the following protocol:

1. Raw data produced and checked by the responsible analyst is turned over for independent review by another analyst.
2. The area supervisor or senior chemist reviews the data for attainment of quality control criteria established by the QAPP.
3. The area supervisor will decide whether any sample re-analysis is required.
4. Upon completion of all reviews and acceptance of the raw data by the area supervisor, a report will be generated and sent to the laboratory Project Manager.
5. The laboratory Project Manager will complete a thorough inspection of all reports.
6. Following review and approval of the preliminary report by the laboratory Project Manager, final reports will be generated and signed by the laboratory Project Manager.

Specific equations used for data reduction are contained in the SOPs in Attachment C-1.

B.10.4 Data Transmittal/Transfer

Field data from surveying and water level measurements will be entered into a standard Microsoft Excel spreadsheet format. ARCADIS' Field QA Officer is responsible for verifying the correctness of the field data after the data are transferred to a spreadsheet format.

The project laboratory will provide electronic data deliverables (EDDs). The laboratory data are downloaded into the EDDs directly from the laboratory information management system (LIMS), thus eliminating the possibility of manual transcription errors. The EDDs are imported into Microsoft Access and the data are maintained in the database for manipulation and presentation.

ARCADIS' QA Officer is responsible for verifying the correctness of the analytical database after the laboratory data for each event have been imported. The review is accomplished by comparing the data from the database to the hardcopy analytical reports for a minimum of 10 percent of the sample results. If discrepancies between the database and hardcopy analytical reports are detected, a complete verification of the database will be performed or a new EDD will be submitted, imported, and verified as described previously.

B.10.5 Data Analysis

The data from the RI will be used to delineate the source, nature, and extent of constituents, and to delineate affected media. Fate and transport mechanisms for the constituents of concern will also be evaluated. Groundwater data will be analyzed to verify flow direction, contours, and concentration gradients.

B.10.6 Data Assessment

Assessment of laboratory data by the project laboratory will be performed using the procedures detailed in the LQM in Attachment C-1. These assessments included determining the mean, standard deviation, relative standard deviation (RSD), percent difference, RPD, and percent recovery for certain QC elements.

Assessment of QC data for data validation purposes will include determining the mean, standard deviation, RSD, percent difference, percent recovery, RPD, and percent completeness. The statistical equations to determine percent recovery, RPD, and percent completeness are provided in Section D.3 of this QAPP.

B.10.7 Data Tracking

Data generated in the field, such as water level measurements and elevation survey data, will be recorded in field logbooks or on standard forms. There are no unique or special tracking requirements for these data. The data will be transcribed for analysis and reporting as discussed in Section B.10.3, and the original field logbooks will be maintained in the final evidence file.

Laboratory data tracking procedures are provided in the LQM in Attachment C-1. The LQM provides the procedures for tracking data from generation to reporting. STL Savannah's LIMS also provides a means for tracking data in the laboratory. The laboratory Operations Manager is ultimately responsible for data tracking in the laboratory.

Tracking of analytical data in the Access database includes recording the laboratory generating the data, the date when the EDD was received and imported, the date when qualifiers were applied to the results, and the level of data validation performed. ARCADIS' Project Manager is ultimately responsible for tracking data from entry into the database to reporting.

B.10.8 Data Storage and Retrieval

Laboratory data will be stored by the project laboratory in hardcopy format at their Savannah, Georgia facility. Data are archived on site for a period of 5 years, after which time the data are warehoused off site. Electronic instrument data are maintained on magnetic media (i.e., magnetic tape) for this same time period. STL Savannah's records manager is Andrea Teal, who is responsible for data archiving and retrieval. All laboratory records for this project will be maintained consistent with the storage requirements presented in Attachment C-1.

ARCADIS' Project Manager is responsible for project data storage and retrieval. Field logbooks will be maintained in ARCADIS' Chicago, Illinois office between sampling events. Upon completion of the RI/FS, the final evidence file will be archived at ARCADIS' Chicago, Illinois office.

B.10.9 Data Security

Laboratory data security is the responsibility of STL Savannah's records manager. Archived data cannot be accessed without authorization and the name of purpose of personnel accessing archived data are recorded. STL Savannah's LIMS is password protected and access rights are restricted by job function.

ARCADIS' data security procedures include limiting project database access to database analysts and general building security procedures.

C. Assessment and Oversight

The following subsections describe the procedures used to ensure proper implementation of this QAPP and the activities for assessing the effectiveness of the implementation of the project and associated QA/QC activities.

C.1 Assessment and Response Actions

Assessments consisting of internal and external audits may be performed during the project. Internal technical system audits of both field and laboratory procedures will be conducted to verify that sampling and analysis are being performed in accordance with the procedures established in the SAP and QAPP. External field and laboratory audits may be conducted by U.S. EPA.

An internal field technical system audit of field activities, including sampling and field measurements, will be conducted by the Field QA Officer or his designee at the beginning of the field sampling activities to identify deficiencies in the field sampling and documentation procedures. The field technical system audit will include examining field sampling records, field instrument operating records, field instrument calibration records, and chain-of-custody documentation. In addition, sample collection, handling, and packaging in compliance with the established procedures will be reviewed during the field audit. Any deficiencies identified will be documented and corrective actions will be taken to rectify the deficiencies.

Corrective action resulting from internal field technical system audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The Field QA Officer will identify deficiencies and recommended corrective action to the Project Manager. Implementation of corrective actions will be performed by the Field QA Officer and field team. Corrective action will be documented in the field logbook and/or the project file. Follow-up audits will be performed as necessary to verify that deficiencies have been corrected, and that the QA/QC procedures described in this QAPP and the SAP are maintained throughout the project.

An external field technical system audit may be conducted by U.S. EPA Region 5 FSS any time during the field operations. These audits may or may not be announced and are conducted at the discretion of U.S. EPA Region 5.

An internal laboratory technical system audit will be conducted by the Project laboratory QA Officer or her designee. The laboratory technical system audit is conducted on an annual basis and includes examining laboratory documentation regarding sample receiving, sample log-in, storage and tracking, chain-of-custody procedures, sample preparation and analysis, instrument operating records, data handling and management, data tracking and control, and data reduction and verification. The laboratory QA Officer will evaluate the results of the audit and provide a final report to section managers and the Operations Manager that includes any deficiencies and/or noteworthy observations.

Corrective action resulting from deficiencies identified during the internal laboratory technical system audit will be implemented immediately. The Operations Manager or section leaders, in consultation with the laboratory supervisor and staff, will approve the required corrective action to be implemented by the laboratory staff. The laboratory QA Officer will ensure implementation and documentation of the corrective action. All problems requiring corrective action and the corrective action taken will be reported to the laboratory Project Manager. Follow-up audits will be performed as necessary to verify that deficiencies have been corrected, and that the QA/QC procedures described in the QAPP are maintained throughout the project.

An external laboratory audit may be conducted by U.S. EPA Region 5 FSS personnel. These audits may or may not be announced and are at the discretion of U.S. EPA Region 5. The external laboratory audits will include, but not be limited to, reviewing laboratory analytical procedures, laboratory on-site audits, and/or submitting performance evaluation samples to the laboratory for analysis.

An external laboratory audit may be conducted at least once prior to the initiation of the sampling and analysis activities.

C.2 Reports to Management

Quality Assurance Management Reports will be prepared during the RI/FS. These QA Management Reports will be included with the monthly progress reports that are submitted to U.S. EPA and Illinois EPA when data gathering or assessment activities are being conducted. Minimally, these reports will include project status, results of performance evaluations and system audits, results of periodic data quality validation and assessment and data use limitations, and any significant QA problems identified and corrective actions taken.

ARCADIS' QA Officer will be responsible within the organizational structure for preparing these reports. ARCADIS' Project Manager will be provided with these reports for distribution with monthly status reports. The Final RI Report will also include a separate QA/QC section that will summarize data quality information contained in the periodic QA Management Reports and provides an overall data quality assessment compared to the data quality objectives outlined in this QAPP.

D. Data Validation and Usability

The QA activities that will be performed to ensure that the RI data are scientifically defensible, properly documented, of known quality, and meet the project objectives are described in the following sections.

D.1 Data Review, Validation, and Verification Requirements

All field and laboratory data will be reviewed and verified. The procedures and criteria used to verify and validate field and laboratory data will consist of evaluating the data to the measurement performance criteria in Section A.7 of this QAPP. Field data and logbooks will be reviewed to ensure that the requirements of the sampling program, including the number of samples and locations, sampling procedures, and sample handling, were fulfilled. Acceptable departures from the planned sampling program, such as collecting a sample from an adjacent location because of a subsurface obstruction, will not impact the data usability.

Sample collection procedures will be reviewed for compliance with the requirements of the SAP and QAPP. If alternate sampling procedure were used, the acceptability of the procedure will be evaluated to determine the affect on the usability of the data. Data usability will not be affected if the procedure used is determined to be an acceptable alternative that fulfills the measurement performance criteria in Section A.7 of this QAPP. However, data generated from sampling procedures that do not provide representative samples will be rejected. An example would be a groundwater sample collected from a monitoring well that was not properly purged prior to sampling.

Sample handling records will be reviewed to ensure that sample integrity remained intact from collection to laboratory receipt and that samples were properly preserved. Chain-of-custody documentation and sample condition upon laboratory receipt will be reviewed. The data from samples for which the chain-of-custody or sample identification cannot be verified will be rejected. The data for samples that were not properly preserved will be qualified or rejected depending on the severity of the deviation from the requirements of the SAP and QAPP. The criteria for rejecting improperly preserved samples will be that the sample has been rendered unsuitable for analysis. An example of this situation is preserving a water sample designated for cyanide analysis with acid. If minor pH adjustments are required at the laboratory to account for sample buffering affects, data qualification may be required. The criteria for qualifying or rejecting data for samples that are received at the laboratory without being properly preserved, but not rendered unsuitable for analysis, will be based on the

sample holding time period evaluation criteria for unpreserved samples specified in the National Functional Guidelines. Data qualification will be consistent with the action specified in the National Functional Guidelines.

Field and laboratory data will be verified to ensure that the methods used to analyze the samples were consistent with the requirements of this QAPP. Data generated from the use of unapproved methods will be rejected. Acceptable departures from the methods, LQM, and SOPs specified in this QAPP and the SAP include using an alternate field meter of comparable capability if the specified meter becomes inoperable.

QC data will be reviewed to determine compliance with the acceptance criteria in Section B.4 of this QAPP. QC data that do not meet the acceptance criteria will result in sample data qualification. Significant departures from the QC acceptance criteria may result in rejected data. Situations that result in data rejection include samples analyzed beyond twice the technical holding time period, analyte relative response factor less than 0.010 for GC/MS analyses, calibration internal standard recoveries less than 10 percent for non-detected analytes quantitated with that internal standard, surrogate standard recoveries less than 10 percent for non-detected analytes in that sample, inorganic LCS analyte recoveries less than 50 percent if the analyte is not detected in the associated samples, inorganic matrix spike analyte recoveries less than 30 percent if the analyte is not detected in the associated samples, organic matrix spike compound recoveries less than 10 percent if the compound is not detected in the MS/MSD sample, and organic LCS compound recoveries less than 10 percent if the compound is not detected in the associated samples.

D.2 Validation and Verification Methods

Field data will be verified by reviewing field documentation and chain-of-custody records. Data from direct-reading instruments used to measure pH, conductivity, ORP, and DO will be internally verified by reviewing calibration and operating records. The project laboratory will internally verify the laboratory data by reviewing and documenting sample receipt, sample preparation, sample analysis (including internal QC checks), data reduction and reporting. Any deviations from the acceptance criteria, corrective actions taken, and data determined to be of limited usability (i.e., laboratory-qualified data) will be noted in the case narrative of the laboratory report.

Data validation will be conducted by ARCADIS consistent with the procedure identified in Section D.1 of this QAPP. The data verification/validation procedure will

identify data as being acceptable, of limited usability (qualified as estimated), or rejected. The conditions that result in data being qualified as estimated or rejected are identified in Section D.1 of this QAPP. The results of the data verification/validation will be provided in data validation memoranda that are provided to ARCADIS' Project Manager and are included in Quality Assurance Management Reports.

Data determined to be unusable may require that corrective action to be taken. Potential types of corrective action may include resampling by the field team or reanalysis of samples by the laboratory. The corrective actions taken are dependent upon the ability to mobilize the field team and whether the data are critical for project DQOs to be achieved. Should ARCADIS' QA Officer identify a situation requiring corrective action during data verification/validation, ARCADIS' Project Manager will be responsible for approving the implementation of the corrective action.

D.3 Usability and Reconciliation with Data Quality Objectives

The overall usability of the data for the RI will be assessed by evaluating the PARCCS of the data set to the measurement performance criteria in Section A.7 of this QAPP using basic statistical quantities as applicable. The procedures and statistical formulas to be used for these evaluations are presented in the following subsections.

D.3.1 Precision

Project precision will be evaluated by assessing the RPD data from field duplicate samples. Analytical precision will be evaluated by assessing the RPD data from either duplicate spiked sample analyses or duplicate sample analyses. The RPD between two measurements is calculated using the following simplified formula:

$$RPD = \frac{|R_1 - R_2|}{R_1 + R_2} \times 100$$

where: R_1 = value of first result

R_2 = value of second result

Overall precision for the sampling programs will be determined by calculating the mean RPD for all field duplicates in a given sampling program. This will provide an evaluation of the overall variability attributable to the sampling procedure, sample matrix, and laboratory procedures in each sampling program.

The overall precision requirement will be the same as the project precision. It should be noted that the RPD of two measurements can be very high when the data approach the quantitation limit of an analysis. The calculation of the mean RPD will only include the RPD values for field duplicate sample analyte data that are greater than or equal to 5 times the quantitation limit for an analysis.

D.3.2 Accuracy/Bias

The data from method/preparation blank samples, equipment blank samples, trip blank samples, surrogate spikes, MS/MSD samples, and LCSs will be used to determine accuracy and potential bias of the sample data.

The data from method/preparation blank samples provide an indication of laboratory contamination that may result in bias of sample data. Sample data associated with method/preparation blank contamination will have been identified during the data verification/validation process. Sample data associated with method/preparation blank contamination are evaluated during data validation procedure to determine if analytes detected in the samples and the associated method/preparation blanks are "real" or are the result of laboratory contamination. The procedure for this evaluation involves comparing the concentration of the analyte in the sample to the concentration in the method/preparation blank taking into account adjustments for sample dilutions and dry-weight reporting. In general, the sample data are qualified as not detected if the sample concentration is less than five times (ten times for common laboratory contaminants) the method/preparation blank concentration. Typically, the quantitation limit for the affected analyte is elevated to the concentration detected in the sample.

The data from equipment blanks and trip blanks provide an indication of field and transportation conditions that may result in bias of sample data. Sample data associated with contaminated field and trip blank samples will have been identified during the data verification/validation process. The evaluation procedure and qualification of sample data associated with equipment blank and trip blank contamination is performed in the same manner as the evaluation procedure for method blank sample contamination, taking into account the difference in units for aqueous equipment blank samples collected during soil sampling programs.

Surrogate spike recoveries provide information regarding the accuracy/bias of the organic analyses on an individual sample basis. Surrogate compounds are not expected to be found in the samples and are added to every sample prior to sample preparation/purging. The percent recovery data provide an indication of the effect that

the sample matrix may have on the preparation and analysis procedure. Sample data exhibiting matrix effects will have been identified during the data verification/validation process.

Matrix spike sample data provide information regarding the accuracy/bias of the analytical methods relative to the sample matrix. Matrix spike samples are field samples that have been fortified with target analytes prior to sample preparation and analysis. The percent recovery data provide an indication of the effect that the sample matrix may have on the preparation and analysis procedure. Sample data exhibiting matrix effects will have been identified during the data verification/validation process.

Analytical accuracy/bias will be determined by evaluating the percent recovery data of LCSs. LCSs are artificial samples prepared in the laboratory using a blank matrix that is fortified with analytes from a standard reference material that is independent of the calibration standards. LCSs are prepared and analyzed in the same manner as the field samples. The data from LCS analyses will provide an indication of the accuracy and bias of the analytical method for each target analyte.

Percent recovery is calculated using the following formula:

$$\%R = \frac{SSR - SR}{SA} \times 100$$

where: SSR = Spiked Sample Result

SR = Sample Result or Background

SA = Spike Added

The percent recovery of LCSs samples are determined by dividing the measured value by the true value and multiplying by 100.

Overall accuracy/bias for the sampling events will be determined by calculating the percent of accuracy measurements that meet the measurement performance criteria specified in Section A.7 of this QAPP. Overall accuracy will be considered acceptable if the surrogate percent recoveries are met for at least 75 percent of the samples and the LCS percent recoveries are met for all the samples and the MS/MSD percent recoveries are met for at least 75 percent of the samples.

D.3.3 Sample Representativeness

Representativeness of the samples will be assessed by reviewing the results of field audits and the data from field duplicate samples. Overall sample representativeness will be determined by calculating the percent of field duplicate sample data that achieved the RPD criteria specified in Section A.7 of this QAPP. Overall sample representativeness will be considered acceptable if the results of field audits indicate that the approve sampling methods or alternate acceptable sampling methods were used to collect the samples and the field duplicate RPD data are acceptable for at least 75 percent of the samples.

D.3.4 Completeness

Completeness will be assessed by comparing the number of valid (usable) sample results to the total possible number of results within a specific sample matrix and/or analysis. Percent completeness will be calculated using the following formula:

$$\% \text{ Completeness} = \frac{\text{Number of Valid (usable) measurements}}{\text{Number of Measurements Planned}} \times 100$$

Overall completeness will be assessed by calculating the mean percent completeness for the entire set of data obtained for each sampling program. The overall completeness for the RI will be calculated when all sampling and analysis is concluded. Overall completeness will be considered acceptable if at least 90 percent of the data are determined to be valid.

D.3.5 Comparability

The comparability of data sets will be evaluated by reviewing the sampling and analysis methods used to generate the data for each data set. Project comparability will be determined to be acceptable if the sampling and analysis methods specified in this QAPP and any approved QAPP revisions or amendments are used for generating the groundwater data.

D.3.6 Sensitivity and Quantitation Limits

The quantitation limits for the sample data will be reviewed to ensure that the sensitivity of the analyses was sufficient to achieve appropriate objectives. The method/preparation blank sample data and LCSs percent recovery data will be

reviewed to assess compliance with the measurement performance criteria specified in Section A.7 of this QAPP.

Overall sensitivity will be assessed by comparing the sensitivity for each monitoring program to the detectability requirements for the analyses. Overall sensitivity will be considered acceptable if quantitation limits for the samples are less than the applicable evaluation criteria. Laboratory reporting limits and method detection limits are provided in Table C-3 and Attachment C-1.

It should be noted that quantitation limits may be elevated as a result of high concentrations of target compounds, non-target compounds, and matrix interferences (collectively known as sample matrix effects). In these cases, the sensitivity of the analyses will be evaluated on an individual sample basis relative to the applicable evaluation criteria. The need to investigate the use of alternate analytical methods may be required if the sensitivity of the analytical methods identified in this QAPP cannot achieve the evaluation criteria because of sample matrix effects.

D.3.7 Data Limitations and Actions

Data use limitations will be identified in data quality assessment reports. Data that do not meet the measurement performance criteria specified in this QAPP will be identified and the impact on the project quality objectives will be assessed and discussed in these reports. Specific actions for data that do not meet the measurement performance criteria depends on the use of the data, and may require that additional samples be collected or the use of the data be restricted.

Data quality assessment reports will be prepared at the conclusion of each sampling event. Determination of the overall data quality for a specific sampling program will be conducted at the completion of the program. Data quality assessment reports will be included with the project reports identified in the RI/FS Work Plan.

E. References

U.S. Environmental Protection Agency Office of Emergency and Remedial Response, 1988, Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA; October 1988, OSWER Directive No. 9355.3-01.

U.S. Environmental Protection Agency, 1999, EPA Requirements for Quality Assurance Project Plan. EPA QA/R-5. November 1999.

U.S. Environmental Protection Agency, Region 5 Superfund Division, 2000, Instructions on the Preparation of a Superfund Division Quality Assurance Project Plan. Revision 0. June 2000.

TABLES

Table C-1. Rationale for Sampling Locations
Lake Calumet Cluster Site, Chicago, Illinois

Category	ID Numbers	Rationale
First Transect	LC07, P02, and LC14	Groundwater samples to assess potential northeasterly groundwater flow direction
Second Transect	LC07, LC10, and LC15	Groundwater samples to assess potential westerly groundwater flow direction
Third Transect	LC07, LC16, and LC04	Groundwater samples to assess potential southeasterly groundwater flow direction
South-Southeastern Site Boundary	LC18, LC19, LC20, and LC21	Groundwater samples to assess groundwater along south-southeastern boundary
Off-Site	LC17	Groundwater sample to upgradiant groundwater quality
Test Trench	LCT01	Groundwater sample from test trench to assess groundwater at interface of Site and Marsh

Notes:
Samples will be collected during one sampling event

Table C-2. Summary of Sampling and Analysis Program
Lake Calumet Cluster Site, Chicago, Illinois

Matrix	Field Parameters	Laboratory Parameter	Number of Samples	Number of Equip. Blanks	Number of Trip Blanks	Number of Duplicates	Number of MS/MSD	Matrix Total Samples
Groundwater Sampling [a]								
Water (onsite) [b]	Temperature, pH, conductivity, DO, ORP	VOCs, light gases [c], inorganic parameters [d]	11	1	1 [e]	1	1	15
Water (offsite)	Temperature, pH, conductivity, DO, ORP	VOCs, light gases [c], inorganic parameters [d]	1			1		2

Notes:
(a) The on-Site and off-Site groundwater samples will collected during one event
(b) Includes open test trench sample
(c) Light gases include methane, ethene, ethane
(d) Inorganic parameters include nitrate, total and dissolved iron, sulfate, sulfide, ammonium, TSS, and total TAL metals
(e) One trip blank will be submitted for each cooler submitted. The number of trip blanks listed is estimated based on sampling experience.

Field Blanks are one per sampling event or every twenty or fewer samples collected.
Trip Blanks are one per sampling event or each cooler containing sample media for analysis of aqueous VOCs.
MS/MSD are one per sampling event or every twenty or fewer samples collected.
Duplicates are one per sampling event or every ten or fewer samples collected.

Light gases	Methane, ethene, ethane
Inorganic parameters	Nitrate, total and dissolved iron, sulfate, sulfide, ammonium, TSS, and total TAL metals
MS/MSD	Matrix Spike/Matrix Spike Duplicate
TAL	Target Analyte List
TCL	Target Compound List
TSS	Total Suspended Solids
VOC	Volatile Organic Compound

Table C-1. Targeted Quantitation Limits for Groundwater and Surface Water Samples, Lake Calumet Cluster Site, Chciago, Illinois.

PARAMETER	METHOD	Accuracy (% Recovery)	Precision (%RPD)	Method Detection Limit (ug/L)	Reporting Limit (ug/L)	*Project Action Limit*[1] (ug/L)
TCL Volatiles in Water						
Acetone	8260(5030)(low level)	32-174	<=52	12	25	10
Benzene (MS)	8260(5030)(low level)	62-135	<=37	0.1	1	10
Bromodichloromethane	8260(5030)(low level)	65-125	<=28	0.14	1	10
Bromoform	8260(5030)(low level)	52-148	<=31	0.24	1	10
Bromomethane	8260(5030)(low level)	40-141	<=32	0.44	1	10
2-Butanone (MEK)	8260(5030)(low level)	42-167	<=31	5.5	10	10
Carbon disulfide	8260(5030)(low level)	28-152	<=23	0.35	1	10
Carbon tetrachloride	8260(5030)(low level)	57-128	<=38	0.09	1	10
Chlorobenzene (MS)	8260(5030)(low level)	72-127	<=22	0.09	1	10
Chloroethane	8260(5030)(low level)	47-148	<=34	0.22	1	10
Chloroform	8260(5030)(low level)	62-130	<=20	0.14	1	10
Chloromethane	8260(5030)(low level)	34-145	<=44	0.3	1	10
Dibromochloromethane	8260(5030)(low level)	68-126	<=31	0.17	1	10
1,2-Dibromoethane	8260(5030)(low level)	45-137	<=40	0.13	1	10
1,1-Dichloroethane	8260(5030)(low level)	51-140	<=47	0.38	1	10
1,2-Dichloroethane	8260(5030)(low level)	65-131	<=23	0.46	1	10
cis-1,2-Dichloroethene	8260(5030)(low level)	50-128	<=28	0.51	1	10
trans-1,2-Dichloroethene	8260(5030)(low level)	43-136	<=22	0.19	1	10
1,1-Dichloroethene	8260(5030)(low level)	46-147	<=30	0.19	1	10
1,2-Dichloropropane	8260(5030)(low level)	67-128	<=24	0.09	1	10
cis-1,3-Dichloropropene	8260(5030)(low level)	66-125	<=21	0.17	1	10
trans-1,3-Dichloropropene	8260(5030)(low level)	49-136	<=24	0.49	1	10
Ethylbenzene	8260(5030)(low level)	74-122	<=18	0.11	1	10
2-Hexanone	8260(5030)(low level)	48-155	<=36	1.5	10	10
Methylene chloride	8260(5030)(low level)	47-140	<=50	0.25	5	10
4-Methyl-2-pentanone (MIBK)	8260(5030)(low level)	50-150	<=42	0.59	10	10
Styrene	8260(5030)(low level)	66-130	<=28	0.16	1	10
1,1,2,2-Tetrachloroethane	8260(5030)(low level)	67-133	<=22	0.13	1	10
Tetrachloroethene	8260(5030)(low level)	60-148	<=24	0.38	1	10
Toluene (MS)	8260(5030)(low level)	68-131	<=33	0.28	1	10
1,1,1-Trichloroethane	8260(5030)(low level)	69-120	<=27	0.14	1	10
1,1,2-Trichloroethane	8260(5030)(low level)	63-133	<=21	0.15	1	10
Trichloroethene(MS)	8260(5030)(low level)	56-143	<=35	0.17	1	10
Vinyl chloride	8260(5030)(low level)	43-142	<=21	0.28	2	10
Xylenes (total)	8260(5030) (low level)	73-135	<=26	0.31	2	10
Surrogate						
Toluene-d8	8260(5030)(low level)	77-122	NA	NA	NA	NA
p-Bromofluorobenzene	8260(5030)(low level)	74-126	NA	NA	NA	NA
Dibromofluoromethane	8260(5030)(low level)	70-130	NA	NA	NA	NA

Table C-1. Targeted Quantitation Limits for Groundwater and Surface Water Samples, Lake Calumet Cluster Site, Chciago, Illinois.

PARAMETER	METHOD	Accuracy (% Recovery)	Precision (%RPD)	Method Detection Limit (ug/L)	Reporting Limit (ug/L)	Project Action Limit[1] (ug/L)
Dissolved Gases in Water						
Methane	RSK175/STL SOP	75-125	<=30	0.04	0.19	NA
Ethane	RSK175/STL SOP	75-125	<=30	0.05	0.35	NA
Ethene	RSK175/STL SOP	75-125	<=30	0.051	0.33	NA
Inorganic Parameters in Water						
Ammonia (as N)	350.1/4500-NH3-H	85-115	<=30	0.015	0.03	NA
Iron (ICP)	6010(3005/3010)	75-125	<=20	18	50	100
Nitrate (as N)	300.0/9056	90-110	<=30	0.009	0.1	NA
Sulfate	300.0/9056	90-110	<=30	0.081	1	NA
Sulfide	376.1 (undistilled)	75-125	<=30	0.4	1	NA
Total Suspended Solids	160.2	80-120	<=25	NA	5	NA
TAL Metals in Water						
Aluminum (ICP)	6010(3005/3010)	75-125	<=20	27	200	200
Antimony (ICP)	6010(3005/3010)	75-125	<=20	5	20	60
Arsenic (ICP)	6010(3005/3010)	75-125	<=20	3.2	10	15
Barium (ICP)	6010(3005/3010)	70-130	<=20	1.2	10	200
Beryllium (ICP)	6010(3005/3010)	75-125	<=20	0.54	4	5
Cadmium (ICP)	6010(3005/3010)	75-125	<=20	0.71	5	5
Calcium (ICP)	6010(3005/3010)	75-125	<=20	44	500	5000
Chromium (ICP)	6010(3005/3010)	75-125	<=20	1.7	10	10
Cobalt (ICP)	6010(3005/3010)	75-125	<=20	1.4	10	50
Copper (ICP)	6010(3005/3010)	75-125	<=20	0.9	20	25
Iron (ICP)	6010(3005/3010)	75-125	<=20	18	50	100
Lead (ICP)	6010(3005/3010	75-125	<=20	1.5	5	10
Magnesium (ICP)	6010(3005/3010)	75-125	<=20	110	500	5000
Manganese (ICP)	6010(3005/3010)	75-125	<=20	1.4	10	15
Mercury (CVAA)	7470	80-120	<=20	0.072	0.2	0.2
Nickel (ICP)	6010(3005/3010)	75-125	<=20	4.7	40	40
Potassium (ICP)	6010(3005/3010)	75-125	<=20	190	1000	5000
Selenium (ICP)	6010(3005/3010)	75-125	<=20	4.2	10	35
Silver (ICP)	6010(3005/3010)	75-125	<=20	1.9	10	10
Sodium (ICP)	6010(3005/3010)	75-125	<=20	310	500	5000
Thallium (ICP)	6010(3005/3010)	75-125	<=20	4.9	10	25
Vanadium (ICP)	6010(3005/3010)	75-125	<=20	2.2	10	50
Zinc (ICP)	6010(3005/3010)	75-125	<=20	5.9	20	60

Notes:

(1) Project action limits will be determined after the remedial investigation and baseline risk assessment activities have been completed. Preliminary project action limits are listed. Source: *U.S. EPA SAS/CLP Semivolatile Target Compound List and Corresponding Contract Required Quantitation Limits, OLM04.2*

%RPD Relative Percent Difference

Table C-4. Sample Containers, Preservatives, and Holding Time Requirements
Lake Calumet Cluster Site, Chicago, Illinois

	Container	Preservative	Maximum Holding Time
Groundwater Analysis			
Volatiles	3 x 40 mL Glass	0.3-mL, 1:1 hydrochloric acid, cool to 4°C	14 Days
Light Gases			
Methane	3 x 40 mL Glass	Cool to 4°C	14 Days
Ethene	3 x 40 mL Glass	Cool to 4°C	15 Days
Ethane	3 x 40 mL Glass	Cool to 4°C	16 Days
Inorganic Parameters			
Nitrate	120 mL Plastic	Cool to 4°C	2 Days
Total Iron	500 mL Plastic	2mL 1:1 nitric acid, cool to 4°C	6 Months
Dissolved Iron (field filtered)	500 mL Plastic	2mL 1:1 nitric acid, cool to 4°C	6 Months
Sulfate	120 mL Plastic	Cool to 4°C	28 Days
Sulfide	500 mL Plastic	2mL 2N zinc acetate, cool to 4°C	7 Days
Ammonium	125 mL Plastic	Sulfric acid, cool to 4°C	28 Days
Total Dissolved Solids	500 mL Plastic	Cool to 4°C	7 Days
Total TAL Metals	500 mL Plastic	2-mL, 1:1 nitric acid, cool to 4°C	6 Months

Notes:
(1) Vials must be weighed by the project laboratory prior to sampling.

Table C-5. Summary of Analytical Methods
Lake Calumet Cluster Site, Chicago, Illinois

Parameter	Method
Groundwater	
VOCs	SW-846 5030A/8260B
Methane	RSK SOP 175
Ethane	RSK-175
Ethene	RSK-175
Nitrate	EPA 300.0
Total Iron	EPA 200.7
Dissolved Iron (field filtered)	EPA 200.7
Sulfate	EPA 300.0
Sulfide	EPA 376.1
Ammonia-nitrogen	EPA 350.1
Total Suspended Solids	160.2
Metals (Total)	SW-846 6010B/7470A
Field Parameters	
pH	pH meter
Temperature	Temperature meter
Conductivity	Conductivity meter
Oxidation-Reduction Potential (ORP)	ORP meter
Dissolved Oxygen (DO)	DO meter

Table C-6. Routine Preventative Maintenance Procedures and Schedules
Lake Calumet Cluster Site, Chicago, Illinois.

LABORATORY EQUIPMENT PREVENTIVE MAINTENANCE SCHEDULE

EQUIPMENT ITEM	Service Interval							SERVICE LEVEL
	D	W	M	Q	SA	A	AN	
ICAP								
Pump Tubing	X							Change.
Nebulizer							X	Clean.
Filters			X					Inspect monthly, clean or replace as needed.
Spray Chamber							X	Clean.
Quartz Torch							X	Clean and realign.
D-Shaped Mirrors			X					Inspect monthly, clean or replace as needed.
SMITH-HIEFTJE FURNACE AA SPECTROPHOTOMETER								
Sapphire Window	X							Remove and clean.
Flow Rate	X							Check.
Graphite Tube							X	Replace.
Quartz Windows	X							Clean.
Contact Rings and Plates	X							Clean daily, replace if worn.
Filters			X					Inspect monthly, clean or replace as needed.
ZEEMAN FURNACE AA SPECTROPHOTOMETER								
Sampler syringe	X							Check for air daily, flush syringe as needed.
Graphite Tubes	X							Inspect daily, replace as needed.
Graphite Electrodes				X				Inspect quarterly, replace if worn.
Quartz Windows	X							Remove and clean.
LEEMAN PS200 MERCURY ANALYZER AND AUTOSAMPLER								
Pump Tubing	X							Inspect daily, replace as needed.
Standard Cup	X							Inspect daily, replace as needed.
Drying Tube	X							Repack daily at a minimum.
Mixing Coil		X						Inspect weekly, clean or replace as needed.
Sample Probe			X					Inspect monthly, clean or replace as needed.
Mercury Lamp							X	Clean or replace.
LEEMAN AP200 PREP STATION								
Autosampler		X						Clean and oil rails.
Tubing					X			Inspect semi-annually, replace as needed.
Bottle Caps				X				Inspect quarterly, replace as needed.
Dispenser				X				Inspect semi-annually, replace as needed.
Water Bath			X					Clean.

Table C-6. Routine Preventative Maintenance Procedures and Schedules
Lake Calumet Cluster Site, Chicago, Illinois.

LABORATORY EQUIPMENT PREVENTIVE MAINTENANCE SCHEDULE

EQUIPMENT ITEM	Service Interval							SERVICE LEVEL
	D	W	M	Q	SA	A	AN	
CEM MDS 2100 MICROWAVE								
Pressure Control System	X							Flush.
Cavity and exhaust		X						Clean.
Door			X					Inspect seals and locks.
CONTINUUM FURNACE AA SPECTROPHOTOMETER								
Quartz Windows	X							Remove and clean.
Graphite Tubes	X							Inspect daily, replace as needed.
Contact Rings	X							Clean daily and replace if worn.
Filters			X					Inspect monthly, clean or replace as needed.
D2 Arc Lamp							X	Adjust or replace.
TURBIDIMETER				X				Standardize against formazin.
CONDUCTIVITY METER							X	Replatinize cell when 1 umho/cm range exceeds 90-100%, and when erratic readings cannot be corrected.
pH METER							X	Clean or replace probe.
TOX ANALYZER								
Pyrolysis Tube							X	Clean or replace.
Electrodes							X	Clean.
Electrolytes	X							Replace.
ION CHROMATOGRAPH								
Separator Column				X				Clean.
Guard Column				X				Clean.
Pump Pistons						X		Inspect.
Conductivity Cell						X		Clean.
AUTOANALYZER (TRAACS/LACHAT)								
Pump Platen							X	Replace.
Pump Tubes							X	Replace.
Flow Cell							X	Inspect and clean.
BLOCK DIGESTOR						X		Check calibration.
UV/VIS SPECTROPHOTOMETER					X			Check for wavelength verification.
ION SELECTIVE ELECTRODE							X	Polish electrode.
BOMB CALORIMETER							X	Replace seals.

Table C-6. Routine Preventative Maintenance Procedures and Schedules
Lake Calumet Cluster Site, Chicago, Illinois.

LABORATORY EQUIPMENT PREVENTIVE MAINTENANCE SCHEDULE

EQUIPMENT ITEM	Service Interval							SERVICE LEVEL
	D	W	M	Q	SA	A	AN	
AUTOCLAVE								
Pressure Verification	X							Check and document; replace gauge or seals as needed.
Drain Autoclave	X							Visually inspect for leaks and signs of degradation.
Temperature Verification	X							Check with autoclave thermometer; document; replace thermometer as needed.
Cleaning		X						Wash with soapy water; visually inspect for leaks and degradation.
Times				X				Check with stop-watch; replace as needed.
Seals							X	Visually inspect and replace as needed.
TOC ANALYZER								
Catalyst							X	Replace.
Meters (Internal)			X					Check against internal flow meter.
Detector Windows		X						Check and clean.
Humidifiers							X	Fill levels.
Syringe			X					Perform zero point calibration.
GAS CHROMATOGRAPH - SEMIVOLATILES								
Autosampler System							X	Syringe and tubing cleaned. Needles and tubing replace.
Septa	X							Replace as needed.
Column/Injector							X	Change sleeve and cut front of guard column. Replace as needed.
Gas Cylinder	X							Inspect daily, change when pressure reads <500 psi.
Hydrocarbon/Moisture Trap							X	Replace.
GAS CHROMATOGRAPH - MASS SPEC SEMIVOLATILES								
Column/Injector							X	Change sleeve and cut front of column.
Septum	X							Replace as needed.
Gas Cylinder	X							Inspect daily, change when pressure reads <500 psi.
Hydrocarbon/Moisture Trap							X	Replace.
Splitless Disc							X	Replace.
Autosampler							X	Syringe and tubing cleaned. Needles and tubing replaced.
Rough Pump							X	Oil changed by HP service.
Mass Spectrometer							X	Clean.

Table C-6. Routine Preventative Maintenance Procedures and Schedules
Lake Calumet Cluster Site, Chicago, Illinois.

LABORATORY EQUIPMENT PREVENTIVE MAINTENANCE SCHEDULE								
EQUIPMENT ITEM	**Service Interval**							**SERVICE LEVEL**
	D	**W**	**M**	**Q**	**SA**	**A**	**AN**	
Tape Head							X	Clean.
Tape Drive							X	Clean.
GAS CHROMATOGRAPH - VOLATILES								
Column							X	Replace.
Septum							X	Replace as needed.
Gas Cylinder	X							Inspect daily, change when pressure reads <500 psi.
Hydrocarbon/Moisture Trap							X	Replace.
GAS CHROMATOGRAPH - MASS SPEC VOLATILES								
Column							X	Replace.
Gas Cylinder	X							Inspect daily, change when pressure reads <500 psi.
Hydrocarbon/Moisture Trap							X	Replace.
Rough Pump							X	Oil change by HP service.
Gas Manifold	X							Inspect daily, change when pressure reads <500 psi.
Tape Head							X	Clean.
Tape Drive							X	Clean.
GAS CHROMATOGRAPH - SCREENING FOR VOLATILES								
Autosampler							X	Syringe and tubing cleaned. Needles and tubing replaced.
Septa	X							Replace as needed.
Column							X	Replace.
Gas Cylinder	X							Inspect daily, change when pressure reads <500 psi.
Hydrocarbon/Moisture Trap							X	Replace.
GAS CHROMATOGRAPH - DAI								
Autosampler							X	Syringe and tubing cleaned. Needles and tubing replaced.
Column							X	Replace.
Septa	X							Replace as needed.
Gas Cylinder	X							Inspect daily, change when pressure reads <500 psi.
Hydrocarbon/Moisture Trap							X	Replace.
GAS CHROMATOGRAPH - MASS SPEC AIR ANALYSIS								
TDC Detector								
Gas Cylinder	X							Inspect daily, change when pressure reads <500 psi.
Hydrocarbon/Moisture Trap							X	Replace.

Table C-6. Routine Preventative Maintenance Procedures and Schedules
Lake Calumet Cluster Site, Chicago, Illinois.

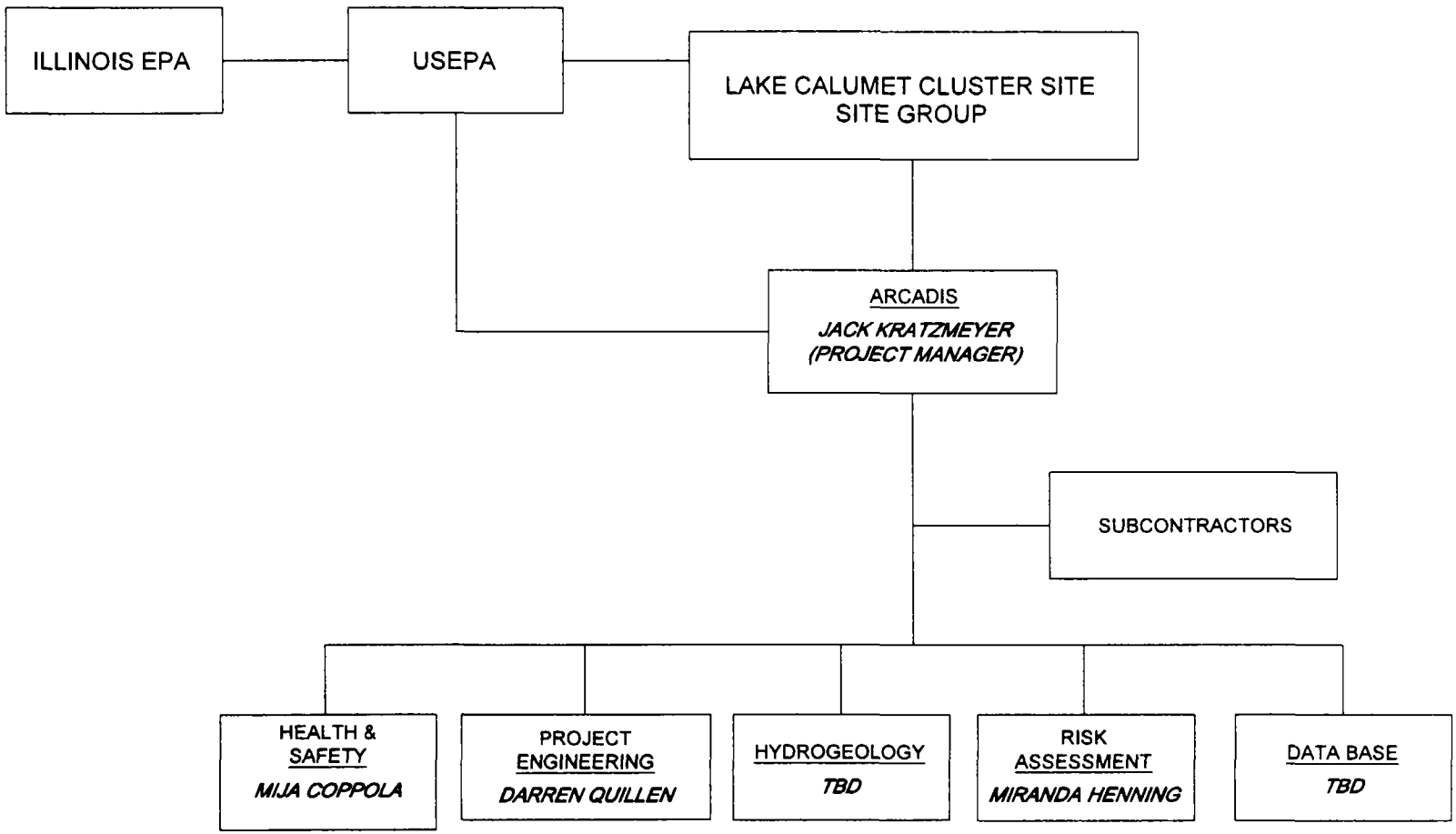
LABORATORY EQUIPMENT PREVENTIVE MAINTENANCE SCHEDULE

EQUIPMENT ITEM	Service Interval							SERVICE LEVEL
	D	W	M	Q	SA	A	AN	
Filament	X							Checked for proper temperature when analysis required.
Injector Loop	X	X						Change daily for analysis of atmospheric gases. Change weekly for analysis of non-atmospheric gases.
Column							X	Replace.
Mass Spec								
Cryo-column	X							Inspect for breaks.
Septa		X						Replace as needed.
Column							X	Replace.
Rough Pump							X	Oil change by HP service representative.
Mass Spectrometer							X	Clean.
PURGE AND TRAP								
Sorbent Trap							X	Change.
Purge Flow					X			Inspect semi-annually. Adjust as needed.
HPLC SYSTEMS								
Pumps	X							Pressure check daily, change guard column as needed. Visual leak check daily.
Pump Seals				X				Inspect seals quarterly, replace as needed.
Column	X							Pressure check. Visual leak check.
Detector Fittings	X							Visual leak check.
Detector Optics				X				Remove and inspect filter quarterly, clean or replace as needed.
Autosampler	X							Check seal pack for leaks.
ZYMARK EXTRACT CONCENTRATOR								
Bath		X						Change water and scrub bath; dust outside.
Temperature Verification		X						Verify bath temperature and adjust.
Sensor Diagnostic Test		X						Check each position and adjust.
TENNELEC LB5100								
Sample Change				X				Inspect moving parts quarterly, lubricate as needed.
Detector	X							Inspect for proper operation and response. Serviced by manufacturer only.
Detector gas			X					Inspect monthly, change tank when pressure reads <500 psi. Allow new tanks to dissipate radon for two weeks before use.

Table C-6. Routine Preventative Maintenance Procedures and Schedules
Lake Calumet Cluster Site, Chicago, Illinois.

LABORATORY EQUIPMENT PREVENTIVE MAINTENANCE SCHEDULE								
EQUIPMENT ITEM	**Service Interval**							**SERVICE LEVEL**
Flow Meter	X							Inspect for proper operation.
BECKMAN LS6500 Liquid Scintillation Counter		X						Inspect for proper operation prior to use. Serviced by manufacturer only.
LUDLUM MEASUREMENTS 2000	X							Inspect for proper operation prior to use. Serviced by manufacturer only.
LUDLUM MEASUREMENTS 182	X							Inspect push rod for high voltage engagement. Inspect instrument noise level without flask.
TCLP EQUIPMENT								
Volatile Rotator			X					Check rotation.
Semivolatiles/Metals Rotator		X						Check rotation.

FIGURES



ARCADIS

PROJECT ORGANIZATION
LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

DATE 4/29/05	PROJECT MANAGER J. KRATZMEYER	DRAWING NAME RIFS-SAP
DRAWN R. SMITH	LEAD DESIGN PROF	CHECKED A. SENN
PROJECT NUMBER CI001286.0001		FIGURE NUMBER C-1

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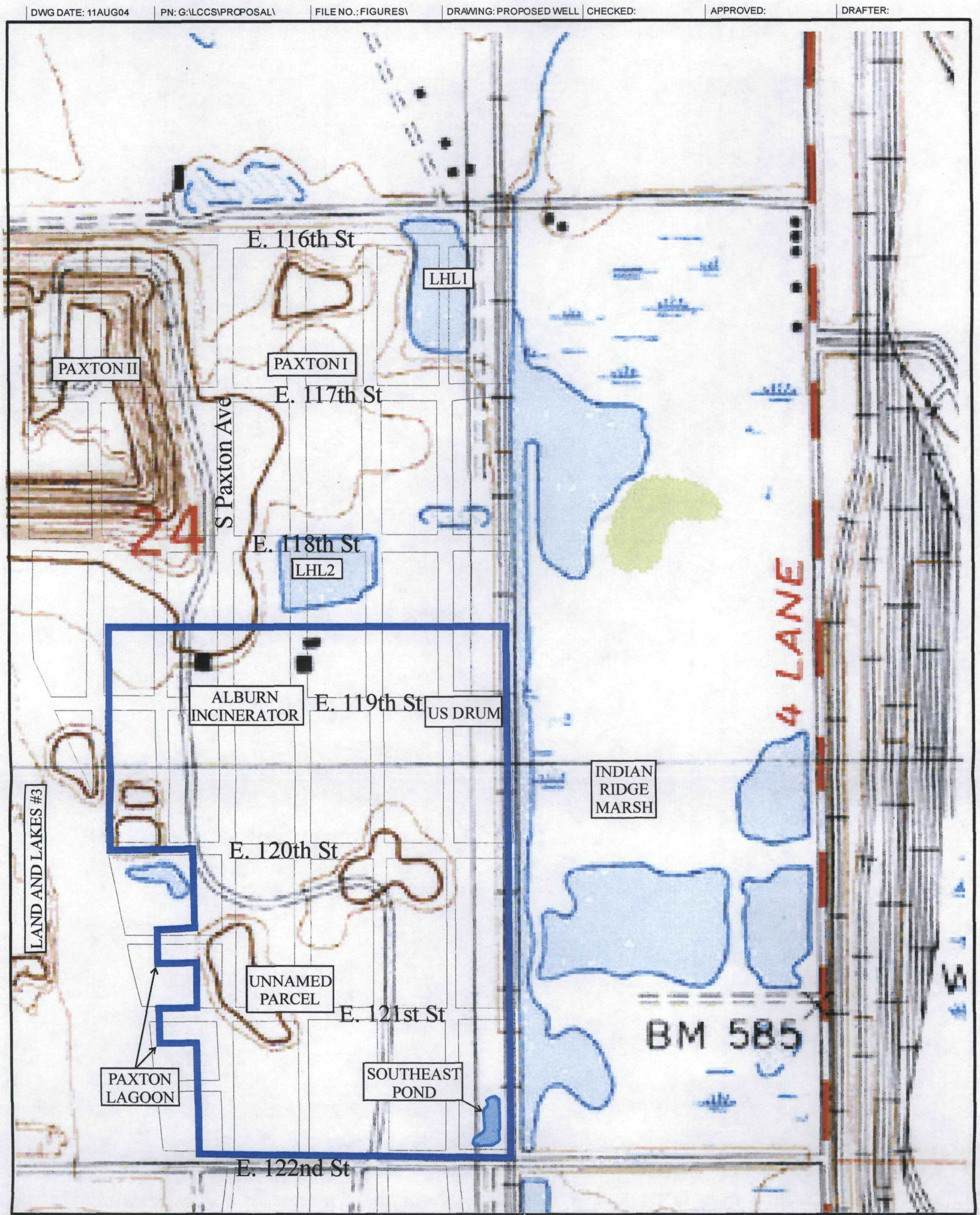

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APPROXIMATE SCALE IN FEET

Legend

ApproximateSite Boundary

ARCADIS

SITE PLAN

LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

FIGURE

C-2

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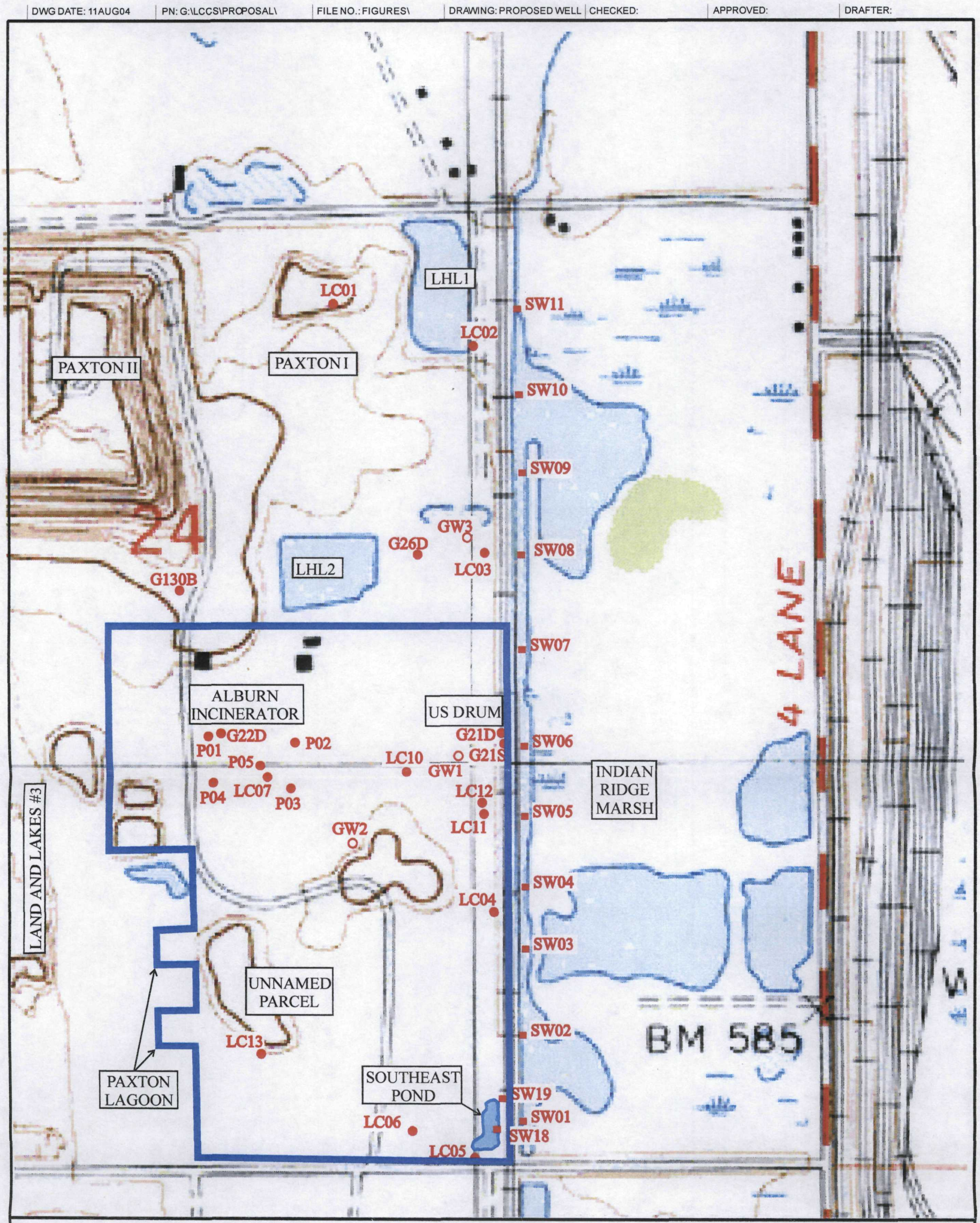

Source: USGS 7.5 Minute Topographic Map, 1991, Lake Calumet Quadrangle, Illinois- Cook County

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APPROXIMATE SCALE IN FEET

Legend

GW3 Geoprobe Location

LC06 Monitoring Well Location

Approximate Site Boundary

SW05 Surface Water Sample Location

ARCADIS

EXISTING MONITORING WELL LOCATIONS AND SURFACE WATER SAMPLE LOCATIONS

LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

FIGURE

C-3

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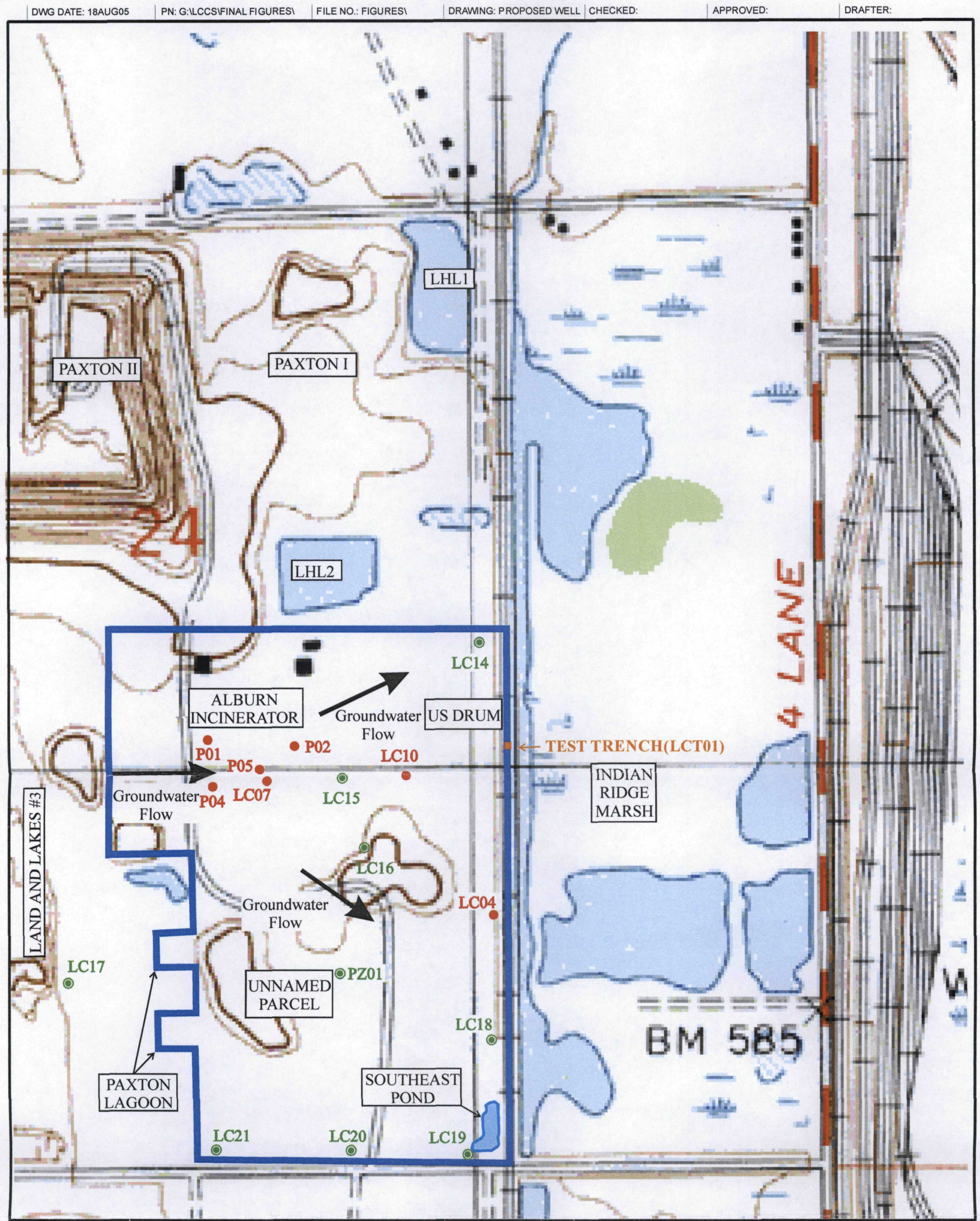

Source: USGS 7.5 Minute Topographic Map, 1991, Lake Calumet Quadrangle, Illinois- Cook County

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APPROXIMATE SCALE IN FEET

Legend

- LCT01 Test Trench Location
- LC04 Monitoring Well Location
- Approximate Site Boundary
- LC14 Proposed Monitoring Well Location

ARCADIS

REMEDIAL INVESTIGATION SAMPLE LOCATIONS

LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

FIGURE

C-4

ATTACHMENTS

ARCADIS

Attachment C-1

Standard Operating Procedures and Laboratory Quality Manual

SEVERN TRENT STL

LABORATORY QUALITY MANUAL

Revision: 0
Effective Date: February 3, 2003

Prepared by and for:

STL Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Approved Signatures

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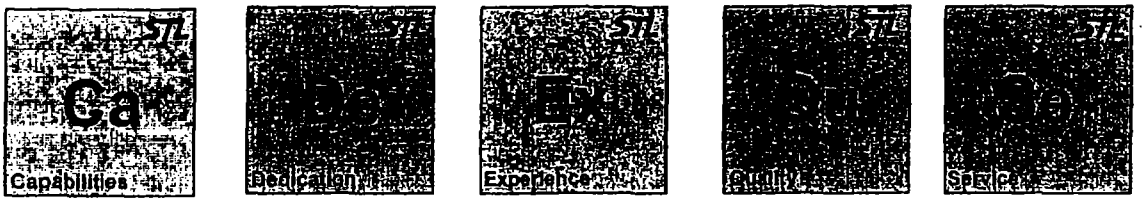
Andrea Teal 01/30/03
Andrea Teal **Date**
Quality Assurance Manager



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5.0 SAMPLE CUSTODY

5.1 Sample Custody Objectives

The primary objective of STL Savannah's sample chain-of-custody procedures is to provide accurate, verifiable, and traceable records of sample possession and handling from sample container shipment through laboratory receipt and sample disposition.

Evidence of documentation of sample collection, shipment, laboratory receipt and custody is accomplished utilizing a chain-of-custody record (Figure 5.1). A sample is considered in custody if it is:

- in actual possession of the sampler or transferee
- in view after being in physical possession of the sampler or transferee
- sealed so that sample integrity will be maintained while in possession of the sampler or transferee
- in a secured area, restricted to authorized personnel.

5.2 Facility Security Policy

All external doors are either visually monitored by STL staff or kept locked. Visitors are required to sign in and wear a visitor's badge during their visit and are accompanied at all times by an STL staff member when in the laboratory. Secure refrigerators and storage cabinets are available for samples requiring this level of security.

5.3 Custody Record Maintenance

Field and laboratory records, including copies of the chain-of-custody forms and associated field documentation, are maintained in a secure area with other project records. All field and laboratory data are reported in bound notebooks and entries are made in waterproof ink. Field and laboratory data entry errors are deleted with a one-line strike through. The correction is initialed and dated by the sampling or analytical staff member making the change. Correction tape or other substances designed to obliterate documentation are strictly prohibited in the laboratory or custody areas. Field and laboratory information is documented on prepared forms. All forms for recording field and laboratory data include spaces for date and initials which must be completed by the data recorder. Field and laboratory documentation not recorded on prepared forms is also dated and initialed.

5.4 Laboratory and Field Sample Custody Procedures

All samples are received by the custody technician using custody procedures detailed in SOP CU01: *Receipt, Log Number Assignment, and Distribution of Field Samples*. The procedures for the preparation of sampling kits are described in SOP CU15: *Preparation of Sampling Containers*.

5.4.1 Selection and Preparation of Sample Containers Supplied to a Client or Sampling Team

Sample containers provided by STL are constructed from EPA-designated materials and contain EPA-prescribed preservatives. The recommended containers are listed in Section 4.0. If requested, an STL Savannah or client supplied identification label is affixed to the container. A 100-mL plastic container labeled "Container Temperature - For Laboratory Use Only" is pre-filled with tap water and supplied with each sample shipment to monitor sample temperature upon receipt.

Pre-cleaned sample containers are purchased by STL. Containers from each lot are pre-certified in-house prior to use in accordance with SOP CU35: *Procedure for Contaminant-Free Containers.*

A color-coded dot, affixed to the outside of the container, is used to identify preservatives. The color code scheme for the various preservatives used in STL Savannah's sample containers is described on the Sample Container Request Form (Figure 5.2) which is submitted to the client along with the sample containers.

5.4.2 Chain of Custody Documentation, Traceability, and Sample Integrity

Formal chain-of-custody procedures are initiated by a custody technician who is responsible for organization and relinquishment of sample containers to the client or field personnel.

All field information must be properly recorded on the chain-of-custody form. Proper completion of the form is the responsibility of the field sampling manager or client and is requested prior to the relinquishment of the samples. If the site location is different from the client address, the site location is recorded in the "Project Name" space on the chain-of-custody form or on the right hand side of the form if additional space is required. The sample identities assigned in the field are recorded in the "Sample Identification" column. Common carriers may identify themselves by signing the "Relinquished By" space on the chain-of-custody form.

For samples transported from the field to the laboratory by common carrier, chain of custody is maintained. Completed custody forms must accompany each sealed cooler, and are placed in a plastic bag and taped to the inside lid of the cooler. At the client's request, coolers are sealed in the field with the STL Savannah Custody Seal or custody tape by the field sampling team to ensure that tampering will be immediately evident. A unique identification number is recorded on the seal and accompanying chain-of-custody form with waterproof ink.

Custody personnel are responsible for the inspection of shipping containers upon laboratory receipt for overall integrity and to ensure that the contents have not been altered or tampered with during transit. If tampering is apparent, the custody personnel immediately contact the assigned project manager who is responsible for client notification. Any problems detected are documented on an Anomaly Report (Figure 5.3), which is initiated by the custody personnel. Any corrective action required by the client is also documented.

Upon arrival, shipping containers are immediately opened by the custody technician in the receiving area and the chain-of-custody form and temperature container removed for inspection. Container temperature upon receipt is documented on the Sample Internal Custody Form (Figure 5.6) and on the laboratory's copy of the COC, or, if requested by the client, documented on the client's chain-of-custody form.

5.4.3 Field Custody

When sample collection is performed by STL, the field sampling manager is responsible for ensuring that chain-of-custody procedures for all sampling events are properly documented. The custody forms and login procedures follow the protocol outlined in Section 5.3.

Prior to field sampling, it is preferable to place waterproof sample labels on each sample container and complete each sample label with as much information as possible in waterproof ink. Field sampling technicians are responsible for ensuring that labels are complete. Each sample is identified in the field by a unique alphanumeric designation on the label.

Adequate sample identification information included on each container label must be included on all field-generated records including: permanent field notebook, individual well log, groundwater elevation form, and chain-of-custody form. This field documentation demonstrates traceability of the containers and samples and links all ancillary records to specific sampling events.

Each sample is packed to ensure against leakage and breakage and to maintain individual sample integrity. All glass containers are secured individually with bubble wrap. All VOA sample vials are wrapped in bubble bags. Plastic bags are supplied by STL to hold ice necessary to maintain the samples at less than 6°C during transit. An attempt should be made by the field sampling team to pre-cool samples to 4°C prior to packing the sample cooler for shipment. Additional information regarding sample containers can be found in Section 4.0 and the appropriate SOP.

When applicable to the site, the following information is documented by the field technicians in the bound field notebook. This field documentation is reviewed, approved, and initialed by the field sampling manager prior to client submission.

Site location
Date/time of sampling
Sample identification (including specific location)
Sample sequence number
Site conditions7
Weather conditions
Description of QC samples collected
Names of personnel/visitors
Sampling/purging equipment used
Field analysis data
Field documentation techniques
Well casing composition and diameter
Drilling/boring method
Drilling well type/name
Water table and well depth

Purge volume calculations
Volume of water purged
Date/time of purging
Analytical data to monitor stabilization of well
Use of fuel powered units
Plumbing/tap material construction
Purging flow rate
Purging time
Flow rate at sampling collection
Depth samples taken
Beginning/ending time for composite sampling
Depth soil samples taken
Soil sampling technique used
Type/description of drums
Phases sampled in drums

5.4.4 Sample Documentation, Identification, and Login

A sequential identification number is assigned to the project and recorded on the chain-of-custody form, on each sample container submitted with the project, and in the bound Sample Registry (Figure 5.4). Accurate and complete sample documentation must be provided on the chain-of-custody form in order to log samples into the sample registry. The sample registry includes all information necessary to maintain chain of custody including laboratory ID, client (field) ID, and initials of the custody technician. Ancillary information such as sample collection date and requested analyses is transferred from the chain-of-custody form into the LIMS, and appears on the client project-specific acknowledgement.

The custody technician checks each sample against the chain-of-custody form for discrepancies between information on the sample label and information provided on the chain-of-custody form (Figure 5.1). The custody technician also inspects all samples for leakage or obvious seal tampering (if provided). All samples are unpacked in a well-ventilated sample receipt area. Face shields are available to each sample receipt staff member for use with any hazardous samples. Samples which appear to be accumulating or evolving gas are treated cautiously and inspected under a chemical hood.

A space labeled "custody intact" provided on the chain-of-custody form is used to describe the sample condition upon receipt. A "Y" indicates no custody problem was identified and an "N" indicates samples or container integrity was compromised and client notification and corrective action is required. At client request, a "Cooler Receipt Form" (Figure 5.5) can be completed to document custodial concerns at sample login.

Discrepancies noted by the custody staff are communicated to the project and sample manager and are resolved with the client prior to laboratory work assignment. Discrepancies are documented on the Anomaly Report. The project manager and the custody department staff should attempt to resolve custody discrepancies expeditiously to avoid compromising hold times. After a decision concerning a sample has been made, the project manager or sample manager makes an initialed note on the original custody form which states person notified, time, date, and resolution, if applicable. This information is also documented on the Anomaly Report. A faxed or hard copy of custodial resolutions or project order alterations should be secured from the client prior to work initiation. Copies of this documentation are mailed to the client and maintained in the client file.

A sample barcode label containing the project number and sample designation is affixed to each container. The barcode label contains the following information:

- STL Savannah project log number (e.g., S242450)
- COC designation for the different field samples (e.g., S242450-1, S242450-2, S242450-3, etc.)
- Sample designation for each container for a particular field sample(e.g., S242450-1A, S242450-1B, S242450-2A, etc.)
- Barcode relating this information to the LIMS login

The barcode allows laboratory personnel to track the disposition of the sample from receipt into the laboratory until disposal.

5.4.5 Sample Preservation Checks and Storage

After the sample containers are labeled, the samples are distributed to the appropriate laboratory section. Samples are relinquished to the laboratory section from the custody department. This transfer is documented on the Sample Internal Custody Log. The samples are then transferred to the storage area or, if required, checked for proper preservation as soon after receipt as possible and then placed in storage areas. The preservation is documented and, if necessary, adjusted. Discrepancies are documented on the Anomaly Report.

Samples are logged into the department storage areas using barcode readers. The barcode system is also used to track the disposition of the samples when the sample is removed from the storage area, the sample is returned from the storage area after use, the sample container is empty, and the sample is removed from the storage area for disposal. Bound sample storage temperature logs are maintained for all sample storage refrigerators to assure proper temperature maintenance throughout the analytical process.

5.4.6 Sample Security, Accessibility, Distribution, and Tracking

Only authorized personnel are permitted within the laboratory areas where samples are stored. Sample storage areas are designed to segregate volatile and nonvolatile samples. Standards and extracts are also departmentally controlled and stored separately.

After sample registry login and verification, samples are relinquished from the receiving area to the appropriate sample analysis storage area. Transfer of samples from the sample receipt personnel to the department is documented on the Sample Internal Custody Log (Figure 5.6). Interdivisional sample custody is documented on the Remote Division Sample Internal Custody Log (Figure 5.7). Using LIMS-generated sample preparation worksheets for guidance, samples are extracted, digested, or distilled as appropriate. The extracts, digestates, or distillates are then transferred and relinquished to the appropriate analysis section, where analysis is performed.

For projects where in-laboratory custody records are required by the client, the project manager and custody department will coordinate the documentation of these records.

Sample holding times are tracked via the LIMS. Sample collection dates are entered into the LIMS with all sample logins. This information allows holding times specific to each department analysis to be tracked by department managers, supervisors, chemists, and analysts through the use of daily status sheets, reference sheets, and preparation worksheets. Date analyzed is recorded via instrument outputs or analysis forms/logs when applicable as an integral part of the raw data. For projects in which reporting the analysis or preparation date is appropriate, the dates are entered into the LIMS.

5.4.7 Interdivisional Custody

The laboratory manager monitors the sample load and turnaround time through LIMS-generated reports. If it appears that analysis demand will exceed capacity, samples may be transferred (provided client contracts or arrangements, project QA plans or certification limitations do not prohibit sample transfer) to another STL division to ensure that holding times and turnaround commitments are met. The procedures used by STL are described in SOP CU20: *Interlaboratory Sample Exchange* and are summarized below.

If samples are transferred to another division laboratory, full custody is maintained. A completed and signed fax of the Interdivisional Shipping Log is sent to the receiving division custody department. Special LIMS determination codes specific to each laboratory location are utilized to enable the project manager and laboratory director to track sample progress and maintain chain of custody. Copies of the original chain-of-custody form (executed for interdivisional sample submittal), computerized LIMS order information (LOI), and extract or digest preparation logs pertinent to the project order accompany the samples or sample preparations. The accompanying documentation also includes dates of sample preparation and requested analyses.

5.4.8 Sample Disposal

All waste disposal is carried out in accordance with SOP CA70:*Waste Management*. This document includes procedures for identification, storage, personnel training, tracking forms, report forms, safety, as well as details of the disposal.

After analysis completion, unused sample portions, extracts, or digests are transferred to a central secured storage area to await disposal. Unless a client requests the project manager to save unused samples, digests, or extracts, disposal from the central storage occurs as soon as holding times have expired or three weeks after results submission.

Requests for extended sample, digest, or extract storage must be provided by the client to the STL project manager in writing (or contract form) prior to sample receipt. Extended storage may result in additional fees to be negotiated by the STL project manager prior to sample receipt. STL is not responsible for evaporation or other deterioration of samples, extracts, or digests during extended storage periods.

Samples which are requested to be returned to the client may be picked up at the laboratory by the client, shipped by courier (at the client's expense for packaged shipping), or returned by any other legal means that is arranged by the client. Clients requesting the return of samples should provide detailed shipping instructions.

If a client by contract requires that samples be disposed of by a hazardous waste contractor, the client's name and EPA ID number are used on the manifest and the client is billed for all disposal related costs.

5.4.9 Sample Disposition Documentation

Upon completion of analytical work, sample custody of unused sample portions, extracts, or digests is relinquished to a central secured storage area. Here the samples, digest, or extracts await disposal, which is performed with the assistance of the LIMS. The LIMS stores clients' specific disposal instructions, compiles results from the analyses of composited samples, prepares sample disposal lists, invoices for disposal and sample return costs, and provides a disposal record for all excess samples.

1.0 INTRODUCTION, PURPOSE, AND SCOPE

1.1 STL Savannah Overview

STL Savannah is a part of Severn Trent Laboratories (STL), which is a subsidiary of Severn Trent, PLC, an international provider of water and wastewater services headquartered in Birmingham, UK.

STL Savannah offers a broad range of environmental testing services provided by over one hundred professionals. Testing capabilities include chemical, physical, and biological analyses of a variety of matrices, including aqueous, soil and sediment, solid, drinking water, waste, tissue, air, and saline/estuarine samples. The laboratory location and contact information are outlined below:

Facility	Address	Telephone	Facsimile
STL Savannah	5102 LaRoche Avenue Savannah, GA 31404	(912) 354-7858	(912) 352-0165

1.2 Quality Assurance Policy

It is the policy of STL Savannah to:

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

The key to STL Savannah's quality system is strict adherence to the program during all phases of the project including pre-sampling discussions, sample collection, preservation, transportation and storage, sample login and tracking, laboratory analyses, and validation and reporting of results.

1.3 Management Commitment to Quality Assurance

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

STL Mission Statement

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

STL Savannah is committed to providing quality data and will endeavor to use good quality control and quality assurance practices for all field sampling and laboratory analytical procedures. It is the laboratory's policy to follow this Laboratory Quality Manual (LQM), the standard operating procedures (SOP), and EPA guidance for all procedures referenced in this manual, and to conform to EPA and state regulatory agency guidelines for each project reported. Changes in EPA or other regulatory procedures and guidance will be incorporated during periodic revisions of this plan and the appropriate SOP. When allowed by the EPA guidelines, Performance-Based Methods (PBM) may be utilized. Internal laboratory and corporate audits assure adherence to the procedures of this plan and approved SOP.

The QA Manager implements and administers the LQM and SOP. The QA Manager is independent of production, and in his/her absence, the Laboratory Director will serve as the QA Manager's backup on quality issues.

Each project is directed by an individual Project Manager who is involved in various phases of the project including pre-project planning, sample bottle preparation, field sampling, computer entry of work orders, and discussion of results with client. In the absence of the Project Manager, another knowledgeable Project Manager or the Lab Director will serve as backup.

STL's quality assurance procedures are designed to ensure protection of the client's confidentiality and proprietary rights. Data and associated client records are stored in secure locations, and all employees sign an agreement not to divulge information to any third party without written authorization from the client. In addition, these procedures are designed to minimize conflicts of interest and ensure freedom from financial constraints by allowing QA personnel, who are independent of production, to reject non-compliant data.

1.4 Purpose of the LQM

The purpose of the Laboratory Quality Manual (LQM) is to describe the Quality System and to outline how that system enables all employees to meet the Quality Assurance (QA) policy. The LQM also describes specific QA activities and requirements and prescribes their frequencies. Roles and responsibilities of management and laboratory staff in support of the Quality System are also defined in the LQM. This manual is based on the procedures and requirements of the STL Quality Management Plan (QMP), the National Environmental Laboratory Accreditation Conference (NELAC), and ISO Guide 17025 (A2LA).

1.5 Scope of the LQM

The requirements set forth in this document are applicable to STL Savannah. The policies and practices outlined in the LQM are set forth as minimum guidelines only. Requirements that are more rigorous may be applied for specific client or regulatory programs.

STL Savannah operates under the regulations and guidelines of the following federal programs:

Air Force Center for Environmental Excellence (AFCEE)
US Army Corp of Engineers, Hazardous, Toxic and Radioactive Waste (USACE HTRW)
Clean Air Act (CAA)
Clean Water Act (CWA)
Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
Navy Facilities Engineering Service Center (NFESC)
National Pollution, Discharge, and Elimination System (NPDES)
Resource Conservation and Recovery Act (RCRA)
Safe Drinking Water Act (SDWA)

STL Savannah also provides services under various state and local municipal guidelines. A current Table of Analytical Services and list of certifications is provided in the Statement of Qualifications (SOQ) maintained by the laboratory and available upon request.

Appendices A through H of this document list the parameters (field of testing) routinely determined by the laboratories, along with the methodology, QA objectives for accuracy and precision, reporting limits (RL), and method detection limits (MDL) for clean environmental matrices.

Appendix	Matrix
A	Water
B	Soils
C	TCLP
D	Air
E	Biological
F	Wipes
G	Waste
H	Routine Target Lists and CLP SOW
J	Drinking Water

1.6 Subcontracting

Subcontracting is arranged with the consent of the client. All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Where applicable, specific QC guidelines, quality assurance project plans (QAPP), and/or standard operating procedures (SOP) are transmitted to the subcontract laboratory. Samples are shipped to subcontractors under formal Chain of Custody (COC).

Subcontract laboratories may receive an on-site audit by a representative of STL's QA staff if it is deemed appropriate by the QA Manager. The audit involves a measure of compliance with the required test method, QC requirements, as well as any special client requirements.

Project reports from external subcontract laboratories are not altered and are included in original form in the final project report provided by STL.

Subcontracting may also occur among STL facilities. Subcontracting within STL is subject to the same requirements as detailed above.

2.0 LABORATORY ORGANIZATION AND RESPONSIBILITIES

2.1 Overview

STL Savannah has a staff of over 100 professional and support personnel. The responsibilities of key personnel are described below. In the case of temporary absence, the direct supervisor or designee will assume the responsibilities of the absent employee or delegate the responsibility to qualified personnel.

An organizational chart of STL Savannah is provided in Table 2.1. This chart lists the roles and job titles of key personnel.

The roles and responsibilities of the corporate management of Severn Trent Laboratories are described in the current revision of the STL Quality Management Plan, which may be obtained from the laboratory Quality Assurance Manager.

2.2 Personnel Responsibilities

2.2.1 Laboratory Management and Personnel

Laboratory Director

1) Directs and provides guidance to Laboratory Manager and Project Managers
2) Develops and maintains company-client relationships
3) Reviews proposals
4) Supervises project management
5) Interviews and hires technical and administrative personnel
6) Other administrative and budgetary functions

Operations/Laboratory Manager

1) Coordinates all production activities
2) Works with Project Managers to ensure project objectives are met
3) Provides guidance to Department Supervisors
4) Interviews and hires laboratory personnel
5) Establishes production priorities and coordinates day-to-day operation of the laboratory

Compliance Officer/Environmental Health and Safety Officer

1) Provides technical assistance in complying with corporate policies concerning safety, waste, and shipping
2) Assists Laboratory Director, Laboratory Manager, and Project Managers in developing appropriate safety precautions for new projects
3) Monitors collection and disposal of chemical wastes
4) Ensures employees comply with safety and waste disposal plans

Custody Supervisor

1) Schedules bottle orders and supervises bottle prep staff
2) Supervises custody staff
3) Coordinates with Project Managers and Field/Sampling Supervisor on scheduling field sampling efforts
4) Identifies and documents custody discrepancies and notifies Project Managers about custody problems

Custody Technician

1) Prepares and ships sample containers and/or receives samples from clients
2) Checks sample temperature and sample integrity upon receipt
3) Maintains and signs appropriate chain-of-custody records
4) Distributes samples to the appropriate lab department

Department Manager/Supervisor

1) Organizes workflow in department
2) Assures adequate inventory of reagents and equipment
3) Ensures effective maintenance and repair of instrumentation
4) Investigates and evaluates new methodology and equipment
5) Ensures proper training is conducted
6) Reviews data, assures quality objectives are met for each project, and approves results

Technical Manager

1) Evaluates and implements new instrumentation, technology, and methods
2) Reviews and edits Standard Operating Procedures in conjunction with QA Manager
3) Evaluates technical Non-Conformances and Corrective Actions
4) Assists in instrument and method trouble-shooting and maintenance
5) Reviews data and evaluates trends
6) Participates in reviewing, editing, and updating of Laboratory Quality Manual in conjunction with QA Manager

Analyst/Chemist

1) Performs preparation and/or analysis of samples using approved procedures
2) Calculates, checks, and reports data in accordance with approved SOP and the Laboratory Quality Manual
3) Performs instrument maintenance and maintains instrument logs
4) Maintains proper documentation of all analytical steps

Lab Technician

1) Assists analysts in sample preparation and data collection
2) Performs routine checks for data quality objectives-surrogate recoveries, LCS/MS recoveries, initial evaluation of dilutions, internal standards areas, and method blanks
3) Assists analysts in maintaining traceability of standards and samples
4) Assists analysts in preparing samples, extracts, or digests for analysis
5) Checks samples for proper preservation and maintains department sample receipt and chain-of-custody logs

Data Technician

1) Checks data packages against data quality objectives
2) Checks final results against the LIMS report
3) Paginates and collates all items in data packages

Field/Sampling Supervisor

1) Coordinates and schedules sampling crews
2) Prepares sampling reports
3) Ensures sampling protocols are followed

2.2.2 Project Management and Personnel

Client Services Director

1) Coordinates corporate marketing efforts with General Manager, Laboratory Director, Project Managers, and corporate marketing group
2) Assists in defining corporate marketing policy
3) Coordinates proposal process
4) Schedules trade shows, presentations, advertising, and regional marketing efforts

Client Services Manager

1) Coordinates marketing efforts with General Manager, Laboratory Director, Project Managers, and laboratory marketing group
2) Supervises Project Managers
3) Coordinates proposal and contract review and response process
4) Responds to client inquiries

Project Manager

1) Serves as primary contact with client on individual job tasks
2) Prepares work plans, schedules manpower allocations
3) Initiates all procurement for each project
4) Provides day-to-day coordination of the project team
5) Coordinates financial and contractual aspects of the projects
6) Provides formatting and technical review of all reports
7) Provides day-to-day communication with the client
8) Exercises final review and approval on all reports and invoices for the project
9) Responds to post project inquiries

2.2.3 QA/QC Management and Personnel

QA Manager

1) Implements the provisions of the Quality System as specified in the Corporate Quality Management Plan and Laboratory Quality Manual
2) Consults with project management and laboratory personnel about QA/QC activities, data results, and data deliverables
3) Prepares QA reports for management
4) Performs periodic system audits, coordinates all external QA audits
5) Manages the PT program and maintains laboratory certifications
6) Reviews, tracks, and evaluates non-conformance and corrective action reports
7) Coordinates the preparation and approval of Laboratory Quality Manual, QA project-plans, method SOP, QA audit responses, and data packages
8) Supervises the tracking and storage of analytical data
9) Coordinates training program

QA Assistant

1) Assists QA Manager in review, implementation, and tracking of QA/QC activities
2) Reviews data, data deliverables, and case narratives
3) Investigates client inquires and laboratory non-conformances

2.2.4 Administrative Management and Personnel

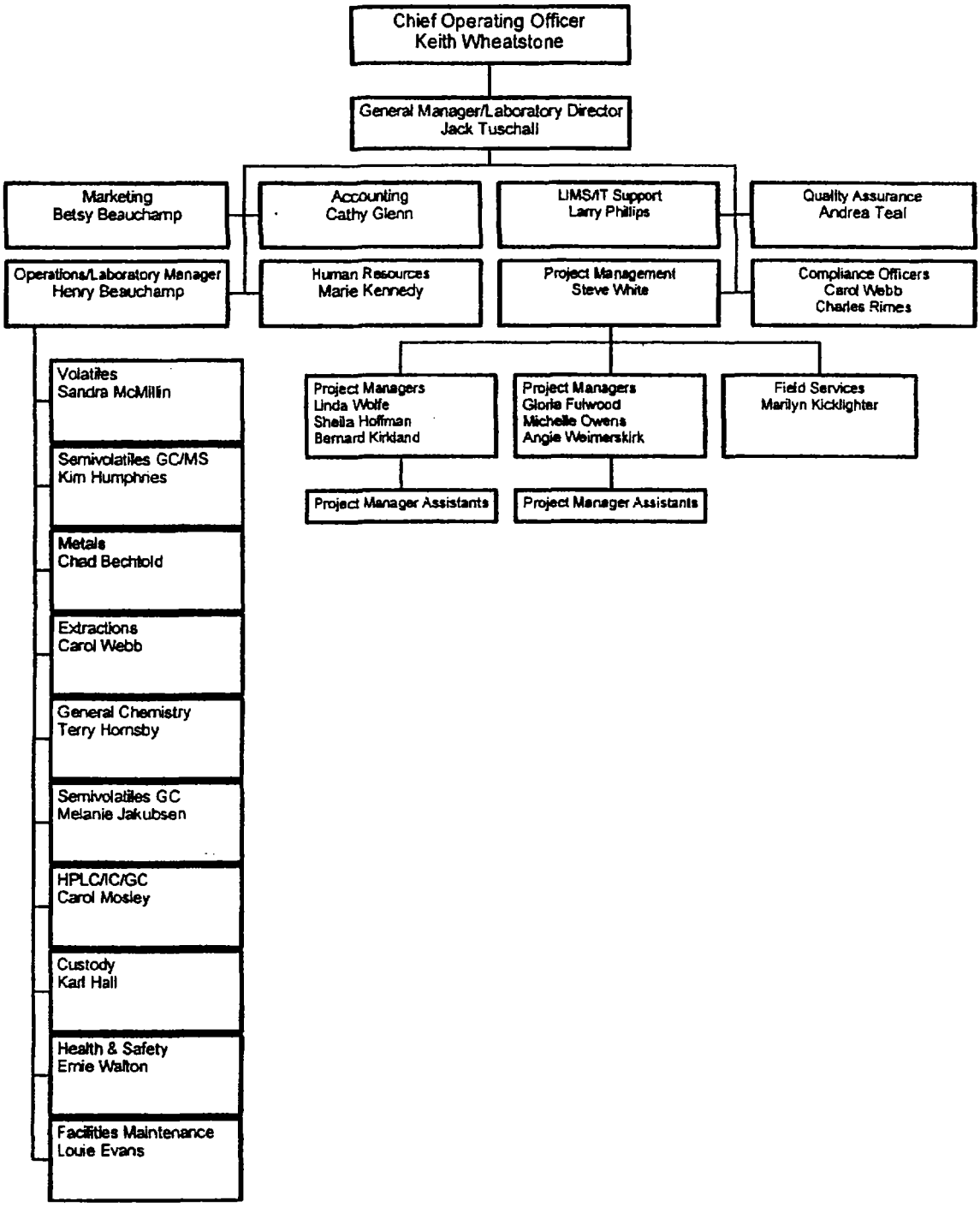
Human Resources Manager

1) Manages Human Resources and Personnel Departments
2) Coordinates Office Managers, administrative staff and Human Resources activities

Office Manager

1) Assists Laboratory Director with all administrative and financial activities
2) Coordinates all procurement/receiving with corporate procurement department
3) Coordinates posting of all invoices with corporate accounts receivable department
4) Assists with collection of receivables
5) Maintains inventory of all facilities and equipment
6) Maintains petty cash and coordinates laboratory expenditures with corporate accounting department

ORGANIZATIONAL STRUCTURE OF STL SAVANNAH AND KEY PERSONNEL



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3.0 MANAGEMENT RESPONSIBILITIES

3.1 Laboratory Facilities

The management of STL Savannah is committed to ensuring that the necessary resources are available to meet the quality objectives and deliverable requirements of each project. The laboratory is custom designed to accommodate modern instrumentation, permit highly efficient utilization of space, minimize employee exposure to hazardous materials, and reduce the potential of sample contamination. For example, the volatile organics (VOC) analytical areas are completely isolated from the semivolatile extraction areas in order to prevent sample and blank contamination by methylene chloride, acetone, carbon disulfide, and other solvent vapors. State-of-the-art automation equipment is utilized, as appropriate per the methods, to operate each instrument at maximum efficiency.

Laboratory operations are highly computerized in order to efficiently collect and archive data and QC results. Over 100 individual computers are used in the data generation and archiving process. The primary LIMS software runs on an IBM 6FI, which is shared by STL Savannah, STL Mobile, STL Pensacola, STL Tallahassee, and STL Tampa. The main computer is centralized at the Savannah facility and communicates with each of the laboratories via wide area network (WAN) dedicated telephone/data lines. The software utilized on the system is designed around a highly versatile UNIX/JBASE relational database. Each module of the system interacts with the other modules in order to eliminate the need for re-entry of information, thus improving production and reducing entry errors. The policies and procedures for the LIMS and other computer systems are described in the current revision of the *Software Quality Assurance Plan*.

Management is responsible for the security of the facility. All external doors are either visually monitored by STL staff or kept locked. Visitors are required to sign in and wear a visitor's badge during their visit and must be accompanied at all times by an STL staff member when in the laboratory. Secure refrigerators and storage cabinets are available for samples requiring this level of security.

3.2 Project Management

Each project is directed by an individual Project Manager who is involved in various phases of the project including pre-project planning, sample bottle preparation, field sampling, computer entry of work orders, and discussion of results with client. In the absence of a Project Manager, another knowledgeable Project Manager or the Lab Director will serve as backup.

STL Savannah's project management and quality assurance procedures are designed to ensure protection of the client's confidentiality and proprietary rights. Data and associated client records are stored in secure locations and all employees sign an agreement not to divulge information to any third party without written authorization from the client. The policies for data archival are given in Section 8 of this document.

3.3 Commitment of Resources

Prior to accepting work into the lab, laboratory management evaluates the capacity and capability of the lab to ensure that the laboratory possesses the necessary physical, personnel, and information resources to meet client specified project objectives and requirements. If the resources are available to successfully complete the project, the work may be accepted.

3.4 Policy for Exceptionally Permitting Departures from Approved Policies and Procedures

STL policy is to follow the guidance in the approved SOP and LQM. Temporary deviations from approved SOP or the LQM that are necessary to meet specific data quality objectives of specific projects, clients, or programs will be noted in a job or site specific Quality Assurance Plan, pre-project plan, or LIMS notes and approved by a Project Manager. If the Project Manager deems the deviation substantially less stringent than the method requirements, approval for deviations must be obtained from laboratory management. In all cases, the deviation from the approved SOP must be with the client's knowledge and, if feasible, written consent, or documented in a project, client, or program specific Quality Assurance Plan. The project, client, or program specific changes in procedures are used only for the appropriate samples and are not incorporated into the routine procedures specified in the approved SOP.

3.5 Training and Qualifications

All laboratory personnel must be properly trained in the technical, quality assurance, safety, and ethics procedures of STL Savannah. SOP CA01: *Training SOP* describes the procedures and documentation required to adequately train the analytical staff. All new employees are required to undergo an introduction to STL's policies described in SOP CA10: *Procedures for New Employee Orientation*.

All analysts are required to successfully complete an initial demonstration of capability (IDOC) to perform a given procedure during or immediately following training. The demonstration must be performed and documented in accordance with SOP CA92: *Evaluation of Initial Demonstration of Capability*. In addition, on-going demonstration of capability (ODOC) must be completed annually.

Establishing and maintaining high ethical standards are important elements of the Quality System. In order to ensure that all personnel understand the importance the company places on maintaining high ethical standards at all times, STL has established the Ethics Agreement provided in Figure 3.1. Each employee must sign the Ethics Agreement, signifying agreed compliance with its stated purpose.

Ethics is also a major component of the STL QA training program. Each employee must be trained in ethics within three months of hire in a standardized QA training program that includes an overview of regulatory programs and program goals, a review of the ethics statement, and group discussions about data integrity and data misrepresentation. Employees must be trained as to the legal and environmental repercussions that result from data misrepresentation. A data integrity hotline is maintained by STL and administered by the Corporate QA Director.

The duties and responsibilities of management and staff positions are described in Section 2.0 of this manual. In addition, the qualifications for each of these positions can be obtained from the Human Resources Manager at STL Savannah.

3.6 Procurement

The management of STL is committed to providing the proper materials for each field of testing and for ensuring that the quality is sufficient to meet the requirements of the test methods. The policies and procedures for procurement are described in SOP CA 45: *Procurement.*

3.7 Systems Audits

Annual laboratory audits are conducted by the QA Manager or by qualified quality assurance personnel designated by STL. The scope and depth of the audit are determined according to the requirements of the division. The system audit includes, but is not limited to:

- evaluation of the procedures and items listed on the audit checklist
- review of compliance with the SOPs
- review of the compliance with this quality assurance plan
- review of the training records
- review of the nonconformance and anomaly reports and follow up on corrective actions from previous audits, external audits, or PE samples.

Some items may require more frequent auditing to determine if non-compliant procedures have been corrected. The internal audit may be performed quarterly for one or two sections with the goal of auditing all systems once per year.

STL Savannah is certified by a number of state agencies, governmental agencies, or private certification programs. Most of these programs require continuing on-site system audits of the laboratory. The laboratories submit to these on-site audits as required by these certifying agencies and organizations and respond to any noted non-conformances with corrective actions.

Field system audits are performed periodically by various federal and state regulatory agencies. Field sampling and documentation procedures are examined to ensure sampling is performed according to the agency protocols.

3.8 Performance Audits

Internal performance audits or evaluations are routinely performed by the laboratories. Single blind performance audits are employed for several reasons. One purpose is to provide corrective action for parameters judged to be unacceptable on external or internal performance audits. Periodic internal performance audits are also used to test parameters that are not routinely tested by external performance audits. Finally, single blind performance audits are employed to satisfy certain certification requirements, to satisfy auditors' specific requests for performance audit samples, or to provide additional evidence of data quality to clients with specific questions regarding laboratory performance.

STL Savannah participates in proficiency testing (PT) audits as required by the appropriate regulatory agencies. In addition, the laboratory complies with the requirements of the National Environmental Laboratory Accreditation Conference. The laboratory must also participate annually in a double blind performance evaluation administered and scheduled by the Corporate QA Director.

These performance audits include both single and double blind PT samples. Internal performance audits must be logged into the LIMS and analyzed and reported in the same manner as field samples. Results from these performance audits are reported to management, clients, or to the appropriate agencies as requested. Nonconformance Reports (NCR) and Corrective Action Reports (CAR) must be initiated to address any results that are judged "unacceptable." Results from agency performance audits are supplied to clients upon request.

3.9 QA Reports to Management

A monthly QA Report shall be prepared by the QA Manager and forwarded to the Laboratory Director, the General Manager, and the Corporate QA Director . The reports include statistical results that are used to assess the effectiveness of the Quality System. The format of the monthly report is shown in the following table:

1.	Audits
	Internal systems audits performed
	External systems audits performed
	Data audits performed (in percent)
2.	Revised Reports/Client Complaints
	Revised reports in percent
	Total number of client complaints, reason, and resolution
3.	Certifications/Parameters Changes
4.	Proficiency Testing
	Score for each PT as a percent
	Note repeat failures and/or significant problems
5.	Miscellaneous QA and Operational Issues
	Narrative outlining improvements, regulatory compliance issues, general concerns, and assistance required from Corporate QA.

3.10 Quality Improvement/Management Assessment

Laboratory management is committed to quality improvement and customer service. All aspects of the laboratory's operations are monitored and input from clients is evaluated to determine if present policies and procedures are meeting the objectives defined in this manual. The following SOPs have been implemented to address and document quality improvement:

Procurement of Laboratory Materials - SOP CA45: *Procurement*
Analytical Training- SOP CA01: *Training*
Client Satisfaction and Complaint Resolution - SOP CA95: *Complaint Resolution*
Non-Conformance and Corrective Action - SOP CA85: *Nonconformance and Corrective Action Procedures*
Auditing - SOP CA05: *Technical and Systems Audits*

3.11 Complaint Resolution

Client inquiries regarding any aspect of the project are handled by the laboratory Project Manager or designee. Questions about the project may be resolved directly by the Project Manager or, if more information is required, an Inquiry Form is initiated and routed to the appropriate laboratory personnel. Client complaints are documented, communicated to laboratory management, and addressed promptly and thoroughly. For all complaints, the nature of the complaint is identified and the cause is investigated using procedures described in laboratory SOP CA85: *Nonconformance and Corrective Action Procedures*. The Laboratory Director and QA Manager are informed of all client complaints and may assist in resolving the situation. Recurring problems are noted in the monthly QA Report and resolved by laboratory management using procedures described in laboratory SOP CA06: *QA Reports and Management Review*.

3.12 Contingency Plan

In case of a disaster such as a hurricane, other STL facilities would be available to provide continuity for all projects to ensure meeting sample holding time or critical project schedule requirements. In general, the laboratory has at least one backup unit for each critical unit. In the event of instrument failure, portions of the sample load may be diverted to duplicate instrumentation within the facility or samples may be shipped to another properly certified or approved laboratory.

The LIMS is linked to a UPS system in order to respond to power outages, hurricanes, computer failure and other disasters. In addition to this provision, a back-up computer is available at STL Denver. In case of emergency, this backup system can be accessed by the laboratory and allows continuous functioning until the primary system is back on line.

Figure 3.1 STL Ethics Agreement

It is the policy of STL to incorporate the highest standard of quality with all analytical programs by adhering to the following practices:

STL will only offer environmental analyses for which it can consistently demonstrate compliance with high quality, traceable and legally defensible performance standards. All STL staff is committed to the practice of complete honesty in the production and reporting of data.

Staff who are aware of misrepresentation of facts or data manipulation to bypass established QA/QC requirements, are required to immediately inform their supervisor or any member of the upper management.

All employees are asked to sign a copy of the statement below upon their first day of employment.

I, _____(print name) understand that high standards of integrity are required of me with regard to the duties I perform and the data I report in connection with my employment at the Company. I agree that in the performance of my duties at the Company:

I will not intentionally report data values that are not the actual values obtained;

I will not intentionally report the dates, times, sample or QC identifications, or method citations of data analyses that are not the actual dates, times, sample or QC identifications, or method citations;

I will not intentionally misrepresent another individual's work; and If a supervisor or a member of STL management requests me to engage in or perform an activity that I feel is compromising data validity or quality, I will not comply with the request and report this action immediately to a member of the upper management, up to and including the president of Severn Trent Laboratories Inc.

I will not intentionally report data values that do not meet established quality control criteria as set forth in the Method and/or Standard Operation Procedures, or as defined by Company Policy.

I agree to inform my Supervisor of any accidental reporting of non-authentic data by me in a timely manner. I agree to inform my Supervisor of any accidental or intentional reporting of non-authentic data by other employees. I have read this Ethics Agreement and understand that failure to comply with the conditions stated above will result in disciplinary action, up to and including termination from the Company.

Compliance with this policy of business ethics and conduct is the responsibility of every STL employee. Disregard or failing to comply with this standard of business ethics and conduct could lead to disciplinary action, up to and including possible termination of employment.

4.0 SAMPLING AND SAMPLE CONTAINERS

When STL Savannah is contracted to provide sampling services, a field crew is assigned to each project. Each crew is composed of experienced field sampling technicians and a highly qualified field sampling manager who is trained in EPA protocols for groundwater and other environmental sampling. On numerous past projects, these managers have had their field sampling techniques audited by Florida DEP, Georgia EPD, Alabama DEM, South Carolina DHEC, and EPA Region IV QA or field personnel. The field sampling crews at STL Savannah are responsible for collection, handling, field screening, documentation, packaging, and shipment of samples to the lab in accordance with client requests.

The crew adheres to the sampling protocol defined by the appropriate regulatory agency or the requirements defined in the project sampling plan (QAPP). In some cases, sampling procedures may be modified to comply with project requirements. QA objectives for parameters routinely measured in the field are the same as for those analyzed in the laboratory; e.g., Appendix A for water, Appendix B for soils, etc.

4.1 Sampling Capabilities

STL Savannah has the capability for sampling groundwater, surface water, wastewater, soils, sediments/sludges, drinking water, and tissues for the following analyte classes:

Analyte Class	Sample Source
Volatile Organic Compounds (VOC)	Drinking water, groundwater, surface water, wastewater, soils, sediments, fish, shellfish, plant and animal tissues, liquid, hazardous wastes, sludges, solid and hazardous wastes, and domestic waste sludges
Extractable Organics	Drinking water, groundwater, surface water, wastewater, soils, sediments, fish, shellfish, plant and animal tissues, liquid hazardous wastes, sludges, solid and hazardous wastes, and domestic waste sludges
Metals	Drinking water, groundwater, surface water, wastewater, soils, sediments, fish, shellfish, plant and animal tissues, liquid hazardous wastes, sludges, solid and hazardous wastes, and domestic waste sludges
Microbiology	Drinking water, groundwater, surface water, wastewater, soils, sediments, and tissues
Cyanide/Sulfide	Drinking water, groundwater, surface water, wastewater, soils, sediments, liquid hazardous wastes, sludges, solid and hazardous waste, and domestic waste sludges
Inorganic Anions	Drinking water, groundwater, surface water, wastewater, soils, sediments, liquid hazardous wastes, sludges, solid and hazardous waste, and domestic waste sludges
Organics: TOC, COD, BOD, Total Recoverable Petroleum Hydrocarbons, Oil & Grease, Phenolics, MBAS	Drinking water, groundwater, surface water, wastewater, soils, sediments, liquid hazardous wastes, sludges, solid and hazardous waste, and domestic waste sludges
Physical Properties: Color, Specific Conductance, Hardness, Odor, pH, Residues, Temperature, Turbidity	Drinking water, groundwater, surface water, wastewater, soils, sediments, liquid hazardous wastes, sludges, solid and hazardous waste, and domestic waste sludges

4.2 Sampling Equipment

The following is a list of the equipment and sample preservation reagents employed by STL's field sampling crews:

Routinely Used Equipment	Use
Ice chests, Styrofoam or insulated plastic	Sample container and sample transport
Sampling vehicles	Sample container and sample transport
Field thermometer	Field measurement of temperature
Field pH meter	Field measurement of pH
Field conductivity meter	Field measurement of conductivity
Electronic water level indicator	Well volume calculation
Stainless steel tape measure	Well volume calculation
Nylon, monofilament, or polypropylene line	Well volume calculation
Sheet plastic	Contamination control
Aluminum foil	Contamination control
Plastic or metal buckets	Collection of purge water or cleaning wastes
Cleaning brushes	Equipment decontamination
Liquinox detergent in original container	Equipment decontamination
Analyte free water contained in contaminant-free glass or plastic bottles	Equipment decontamination
Isopropyl alcohol (nanograde) contained in contaminant-free glass bottles or Teflon squeeze bottles	*Equipment decontamination*
10% Nitric acid (metals grade) contained in contaminant-free glass bottles	Equipment decontamination (except for stainless steel equipment)
Glass or plastic bottles and dispensers	Equipment decontamination
Glass or plastic jugs	Transport of cleaning wastes
Field carrier (covered, divided tray or box)	Transport of preservation reagents
Narrow range pH paper	Field check of sample preservation
Disposable pipettes glass (organic) and plastic (inorganic)	Addition of preservation reagents
Standard buffer solutions (pH 4,7, and 10)	Calibration of field pH meter
Standard KCl solution(100, 500, 1000, 1413, 12880 micro ohms/cm)	Calibration check of field conductivity and salinity meter
Disposable unpowdered latex gloves	Contamination control
Ice	Sample preservation
Sealing Tape	Sealing sample containers (except VOA vials)
Shipping labels and forms	Shipping samples
Sample container labels	Labeling samples
Bubble pack	Packing samples
Clothing and goggles	Sampling safety
Notebooks	Documentation
Waterproof pens, markers	Documentation, labeling
Custody seals	Monitor for tampering
Custody forms	Document custody
Camera	Document site
Calculator	Calculations
Site maps	Determine locations
SOPs	Reference procedures
MSDS on all chemicals	Safety emergency
Turbidity meter with 0.75 , 10, and 100 NTU standards	Field measurement of turbidity
Chlorine test kit with pocket colorimeter	Field determination of chlorine
Sulfite test kit with calibration burets	Field determination of sulfite
Paper towels	General use

Preservation Reagents	Grade
HCl,1:1	Metals grade, pre-assayed
HNO_3, 1:1	Metals grade, pre-assayed
H_2SO_4, 1:1	Metals grade, pre-assayed
NaOH	ACS reagent grade
$Na_2S_2O_3$, 10%, 0.008%	ACS reagent grade
Zn $(C_2H_3O_2)_2$, 2N	ACS reagent grade
Ascorbic acid, neat; 0.06%	ACS reagent grade
Chloroacetic acid	ACS reagent grade

4.3 Field QC Checks

STL Savannah recommends to their clients that proper control procedures meet or exceed the appropriate regulatory agency field QC requirements. Generally, it is the client's responsibility to specify the types and frequency of field QC samples when STL Savannah is contracted to perform sampling.

Blanks which are collected in the field are an important link in the quality control data chain for a set of samples. The analytical data derived from these blanks are necessary to assess field-sampling operations. These blanks are used to verify that sample containers, preserving reagents, and equipment are contaminant-free. Blanks are also used as a check for potential on-site environmental contamination, to evaluate personnel expertise in sample collection, and to reveal problems that may occur in sample storage and transport.

The field quality control blanks should not be isolated from actual samples. They must be considered as samples and treated identically (preserved with the same reagents, and stored and transported in the same containers as the samples.)

The types and frequency of blanks should be included in all quality assurance plans. In cases where data quality objectives dictate more stringent controls, additional field quality control blanks may be required. The following protocol outlines the minimum field blank requirements necessary to assure the validity and integrity of any sampling episode.

Field QC check samples will be analyzed according to the client's instructions and invoiced as samples. Since field QC check samples are usually liquids, they are prepared and analyzed by liquid procedures and reported as liquids. However, for batching purposes, unless requested by clients or required by a project specific QA plan, lab QC deliverables are not provided for field QC check samples. Liquid QC samples associated only with soils are batched with soil samples for methods where preparation procedures are the same for both matrices (i.e., volatiles, cyanide, etc.).

The recommended frequency of field blanks and duplicates is summarized below:

No. Samples	Pre-cleaned Equipment Blanks	Field-Cleaned Equipment Blanks	Trip Blank (VOCs)	Duplicates
10+	Minimum of one, then 5%	Minimum of one, then 5%	One per cooler	Minimum of one, then 10%
5-9	One	One	One per cooler	One
< 5	One	One	One per cooler	Not required

Note: For nine or fewer samples, one equipment blank is recommended from either pre-cleaned or field-cleaned equipment.

If any equipment is cleaned in the field, the blank should be taken from the field-cleaned equipment.

4.3.1 Trip Blanks

PURPOSE: The trip blank is to be used when sampling for volatile organics. The purpose is to determine if contamination has occurred as a result of improper sample container cleaning, contaminated blank source water, sample contamination during storage and transportation due to exposure to volatile organics (e.g., gasoline fumes), and other environmental conditions during the sampling event.

PREPARATION: Trip blanks are prepared prior to the sampling event either by the laboratory providing sample containers, or by field team personnel who are responsible for the initial preparation of sample containers and field equipment. The water must be free of volatile organic contaminants. Any appropriate preservatives must be added at the time that the blanks are prepared. The sample containers are sealed, labeled appropriately, and transported to the field in the same sampling kits as the sample vials. These blanks are not to be opened in the field. They are to be transferred to the sample container designated for volatile sample storage and transported with the samples to the laboratory.

FREQUENCY: One trip blank for each volatile organic analysis should be provided per cooler used for storing and transporting volatile sample vials. If a laboratory requires submission of multiple vials for a method, the same number of vials must be submitted for the trip blank.

4.3.2 Field Blanks

PURPOSE: Field blanks are used to evaluate the effects of on-site environmental contaminants, the purity of reagents used as preservatives or additives, and the general sample collection techniques. Field blanks are recommended for all parameters but are not mandatory.

PREPARATION: Field blanks are prepared on-site by filling the sample container(s) with analyte-free water, adding preservatives, sealing the containers, and completing the appropriate documentation. The field blanks must be handled in the same manner as the sample group for which it was intended (i.e., blanks must be stored and transported with the sample group).

FREQUENCY: One field blank per parameter group per day or at a frequency of 5% of the samples in the parameter group per day, whichever is greater.

4.3.3 Equipment Blanks

PURPOSE: Equipment blanks are recommended if sampling equipment is field-cleaned. These blanks are used to determine the effectiveness of field cleaning procedures as well as to reveal those sources of contamination that may be found in a trip blank. Equipment blanks should be collected and analyzed for all parameter groups and matrices.

PROCEDURE: The final rinse water (analyte-free) shall be rinsed on or through the sampling equipment, whether pre-cleaned or field cleaned, collected, and placed in appropriate preserved containers. These blanks must be stored and transported with the samples.

FREQUENCY: When less than five samples of a similar matrix are taken, one equipment blank prepared on-site for pre-cleaned or field-cleaned equipment should be collected and analyzed for each parameter. When five to ten samples of a similar matrix are taken, one equipment blank should be collected on field-cleaned equipment or one on-site blank should be collected in pre-cleaned equipment if no equipment is cleaned in the field.

For sampling events involving ten or more samples, a minimum of one blank should be taken on pre-cleaned equipment or at the rate of 5% (whichever is greater) of the samples in each analyte group for all matrices. One blank should be taken on field-cleaned equipment or at the rate of 5% (whichever is greater) of the samples in each analyte group for all matrices.

4.3.4 Field Duplicates

Field duplicates are taken, analyzed, reported, and invoiced as required. A minimum of one duplicate for 10% of samples should be taken for all parameter groups and matrices to be collected and analyzed.

4.3.5 Field Preservative Checks

When preservation is required, sample containers used by the STL field sampling team contain pre-measured portions of preservatives. Preservatives are obtained prior to each sampling event from parent stocks assayed and maintained by the laboratory. The effectiveness of pH adjustment by addition of acid or base to the samples is checked after sampling by pouring a small amount of the preserved sample into a small specimen cup and testing with narrow range pH paper. Because of the risk of compromising sample integrity, VOA samples cannot be checked in the field.

4.4 Routine Sample Containers

Tables 4.1 through 4.5 list the parameters, the routine containers, the chemical preservative required to maintain the integrity of the sample, and the hold time (preparation and analytical) of the analytes.

Table	Matrix	Pages
4.1	Wastewater and Groundwater	6-12
4.2	Drinking water	13-17
4.3	Soils, Sediments, and Solids	18-21
4.4	Hazardous Waste Parameters	22
4.5	Wipes	23
4.6	Air	23
4.7	Biota	24

The chemical preservative is the solution added to the sampling containers or supplied as separate solutions or neat materials that preserve the integrity of the sample. Chemical preservatives are generally analyte specific; however, parameters requiring the same type of container and preservation can be analyzed from the same container. In addition to chemical preservation, the samples must be iced at the time of collection and maintained in the laboratory at the required temperature, usually 0-4C (control limits of less than 6C with no frozen samples).

The hold time is the maximum time from collection that the sample can be held prior to preparation or analysis. Some parameters, for example semivolatile organics, have separate hold times for preparation of the sample and analysis of the extract.

The routine reporting limits listed in the LQM are based on the correct containers being used and the proper volume or weight of sample being supplied; however, the routine reporting limit for some analyses can be attained when a less than optimum sample volume or weight is supplied. For some analyses (e.g., organic extractions), the final volume of the extract or digest can be adjusted to meet the routine reporting limits. If a client requires a normal reporting limit from a reduced sample amount, the client must inform their project manager, who will alert the lab prior to sample analysis that special sample preparation procedures are required.

The minimum volume or weight required for TCLP is determined by the procedure. The lab must have these minimum amounts of sample in order to meet the Regulatory Threshold Limits for hazardous wastes. If less than the required weight or volume is supplied, the data may be flagged, or the results for the TCLP analysis will be invalidated by the regulatory agency.

Table 4.1 - Recommended Sample Containers, Preservation, and Hold Times for Parameters Measured in Wastewater and Groundwater Matrices

General Chemistry

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Absorbable organic halides (AOX)	1650	500-ml Amb G	2ml 1:1 nitric acid	6 months
Acetate ion	300/9056	120-ml P	None	28 days
Acidity	305.1/SM 2310B	120-ml P	None	14 days
Alkalinity	310.1/SM2320B	120-ml P	None	14 days
Ammonia	350.1/ SM4500-NH3-H)	120-ml P	0.5ml 1:1 sulfuric acid	28 days
Bicarbonate	See alkalinity	See alkalinity	See alkalinity	See alkalinity
Biochemical Oxygen Demand (BOD)	405.1/SM5210B	1.0-L P	None	2 days
Bromide (IC)	300/9056	120-ml P	None	28 days
Carbonaceous Biochemical Oxygen Demand (CBOD)	405.1/SM5210B	1.0-L P	None	2 days
Carbonate	See alkalinity	See alkalinity	See alkalinity	See alkalinity
Chloride (autoanalyzer)	325.2/SM4500-Cl-E/9251	120-ml P	None	28 days
Chloride (IC)	300/9056	120-ml P	None	28 days
Chlorine, total residual	330.3/4500-C-B	250-ml Amb G	None	Analyze ASAP
Chemical Oxygen Demand (COD)	Titrimetric:410.1/SM5220C Colorimetric:410.4/ SM5220D	120-ml P	0.5ml 1:1 sulfuric acid	28 days
Color	110.1/SM2120B	120-ml P	None	2 days
Corrosivity (pH)	9040/SM4500-H-B	120-ml G or 120-mL P	None	analyze ASAP
Corrosivity (saturation index)	See alkalinity, hydrogen ion(pH), Total dissolved solids, metals (calcium)	See alkalinity, hydrogen ion(pH), Total dissolved solids, metals (calcium)	See alkalinity, hydrogen ion(pH), Total dissolved solids, metals (calcium)	See alkalinity, hydrogen ion(pH), Total dissolved solids, metals (calcium)
Cyanide	CLP ILMO 2.1/4.0	250-ml P	4-5 pellets sodium hydroxide	12 days (2)
Cyanide, reactive	SW-846 7.3.3.2/9014	250-ml P	None	14 days
Cyanide, free	ASTM D42982-89	250ml-P	4-5 pellets sodium hydroxide	14 days
Cyanide, weak acid dissociable	SM4500-Cn-I	250ml-P	4-5 pellets sodium hydroxide	14 days
Cyanide, total and amenable to chlorination	335.1/335.2/ SM4500-Cn-[G]/ 9012	250-ml P 500-ml P	4-5 pellets sodium hydroxide 8-10 pellets sodium hydroxide	14 days
Fluoride (electrode)	340.2/SM4500-F-C	120-ml P	None	28 days
Fluoride (IC)	300/9056	120-ml P	None	28 days
Formate ion	300/9056	120-ml P	None	28 days

Table 4.1 - Recommended Sample Containers, Preservation, and Hold Times for Parameters Measured in Wastewater and Groundwater Matrices

General Chemistry (cont')

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Hardness (calculation from metal's concentrations)	SM2340B	250 ml P or 500-ml P	1ml 1:1 nitric acid 2ml 1:1 nitric acid	6 months
Hardness (EDTA titration)	130.2/SM2340C	250-ml P	1ml 1:1 sulfuric acid	28 days
Hexane Extractable Materials (HEM)	1664	1-L G (3)	2ml 1:1 sulfuric acid	28 days
Hydrazine	ASTM 1385	120-ml P	None	Analyze ASAP
Hexavalent chromium	7196/SM3500-Cr-D	250-ml P	None	1 day
Hydrogen ion (pH)	150.1/9040/SM4500-H-B	120-ml P	None	Analyze ASAP
Iodide ion	300/9056	120-ml P	None	28 days
Kjeldahl (TKN) and organic nitrogen	351.2	250-ml P	1ml 1:1 sulfuric acid	28 Days
Nitrate + Nitrite	353.2/SM4500-NO3-F	120-ml P	0.5ml 1:1 sulfuric acid	28 days
Nitrate (colorimetric)	353.2/SM4500-NO3-F	120-ml P	None	2 days
Nitrate (IC)	300/9056	120-ml P	None	2 days
Nitrite (colorimetric)	353.2/SM4500-NO3-F (w/o Cd reduction)/ 354.1	120-ml P	None	2 days
Nitrite (IC)	300/9056	120-ml P	None	2 days
Nitrogen, organic	See TKN and Ammonia	See TKN and Ammonia	See TKN and Ammonia	See TKN and Ammonia
Nitrogen, total	See TKN and nitrate plus nitrite	See TKN and nitrate plus nitrite	See TKN and nitrate plus nitrite	See TKN and nitrate plus nitrite
Odor	140.1/2150B	1-L G	None	Analyze ASAP
Oil and Grease (gravimetric)	1664(HEM)/9071	1-L G (3)	2ml 1:1 hydrochloric acid	28 days
Oil and Grease (IR)	413.2	125-ml Amb G (3)	1ml 1:1 hydrochloric acid	28 days
Organic Carbon, Total (TOC)	415.1/9060	125-ml Amb G	1ml 1:1 hydrochloric acid	28 days
Orthophosphate	365.2/SM4500-P-E	120-ml P	None	2 days
Oxidation-Reduction Potential (ORP)	ASTM1498-76/2580	120-ml P	None	Analyze ASAP
Oxygen, dissolved (electrode)	360.1/SM4500-O-G	BOD Bottle G	None	analyze ASAP
Oxygen, dissolved (Winkler)	360.2/SM4500-O-C	BOD Bottle G	HACH DO reagent powder pillows	analyze ASAP
Perchlorate	314.0	120-ml P	None	28 days
Petroleum hydrocarbons (gravimetric)	1664(HEM-SGT)/9071	1-L G (3)	2ml 1:1 hydrochloric acid	28 days
Petroleum hydrocarbons by IR	418.1	125-ml Amb G (3)	1ml 1:1 hydrochloric acid	28 days

Table 4.1 - Recommended Sample Containers, Preservation, and Hold Times for Parameters Measured in Wastewater and Groundwater Matrices

General Chemistry (cont')

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
pH (hydrogen ion)	150.1/9040/SM4500-H-B	120-ml P	None	Analyze ASAP
Phenolics, total recoverable (direct)	420.1/9065/SM5530[B+D]	125-ml Amb G	1ml 1:1 sulfuric acid	28 days
Phenolics, total recoverable (chloroform extraction)	420.1/9065/ SM5530[B+C+D]	2 x 500-ml Amb G	2ml 1:1 sulfuric acid	28 days
Phosphorus, acid hydrolyzable	365.2	120-ml P	0.5ml 1:1 sulfuric acid	28 days
Phosphorus, organic	See total and acid hydrolyzable phosphorus	See total and acid hydrolyzable phosphorus	See total and acid hydrolyzable phosphorus	See total and acid hydrolyzable phosphorus
Phosphorus, total	365.4	120-ml P	0.5ml 1:1 sulfuric acid	28 days
Residue, filterable (TDS)	160.1/SM2540C	500-ml P	None	7 days
Residue, non-filterable (TSS)	160.2/SM2540D	500-ml P	None	7 days
Residue, settleable	160.5/SM2540F	500-ml P	None	2 days
Residue, total (total solids)	160.3/SM2540B	500-ml P	None	7 days
Residue, volatile (VS)	160.4/SM2540E	500-ml P	None	7 days
Salinity	2520B	See specific conductance	See specific conductance	See specific conductance
Settable Solids (settable matter)	160.5/SM2540F	500-ml P	None	2 days
Specific Conductance	120.1/9050/SM2510B	120-ml P	None	28 days
Specific gravity				
Sulfate (IC)	300/9056	120-ml P	None	28 days
Sulfate (turbidimetric)	375.4/9038/SM4500-S04-E	120-ml P	None	28 days
Sulfide	376.1/376.2/SM4500-S2-D/ SM4500-S2-E/9034	2 x 250-ml P (3)	2ml 2N zinc acetate	7 days
Sulfide, reactive	SW 7.3.4.2 (9034)	2 x 250-ml P (3)	None	14 days
Sulfite	377.1/SM4500-503-B	120-ml P	None	analyze ASAP
Surfactants (MBAS)	425.1/SM5540C	500-ml P	None	48 hours
Tannins and Lignins	5550B	120-mL P	None	Analyze ASAP
Thiocyanate	4055-CN	120-ml P	0.5ml 1:1 sulfuric acid	Analyze ASAP

Table 4.1 - Recommended Sample Containers, Preservation, and Hold Times for Parameters Measured in Wastewater and Groundwater Matrices

General Chemistry (cont')

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Total Dissolved Solids (TDS)	160.1/SM2540C	500-ml P	None	7 days
Total Suspended Solids (TSS)	160.2/SM2540D	500-ml P	None	7 days
Total Solis (TS)	160.3/SM2540B	500-ml P	None	7 days
Total Organic Carbon (TOC)	415.1/9060	125-ml Amb G	1ml 1:1 hydrochloric acid	28 days
Total organic halogens (TOX)	450.1/9020/SM5320B	500-ml Amb G	2ml 1:1 sulfuric acid	28 days
Turbidity	180.1/SM2130B	120-ml P	None	2 days
Volatile Solids (VS)	160.4/SM2540E	500-ml P	None	7 days

Metals

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Ferrous Iron (Dissolved)	SM3500-Fe-D (colorimetric)	250-ml P	Lab filtration: un-preserved Field filtration: 2ml 1:1 hydrochloric acid	analyze ASAP
Hexavalent chromium	7196/SM3500-Cr-D	250-ml P	None	1 day
Mercury	245.1/7470	250-ml P or 500-ml P	1ml 1:1 nitric acid 2ml 1:1 nitric acid	28 days
Mercury	CLP ILMO 4.0	250-ml P or 500-ml P	1ml 1:1 nitric acid 2ml 1:1 nitric acid	26 days (2)
Metals (except Mercury)	CLP ILMO 4.0	250 ml P or 500-ml P	1ml 1:1 nitric acid 2ml 1:1 nitric acid	6 months (2)
Metals (except Hexavalent Chromium and Mercury)	ICP: 200.7/6010 ICP/MS:200.8/6020 GFAA:200/7000	250 ml P or 500-ml P	1ml 1:1 nitric acid 2ml 1:1 nitric acid	6 months
Silica, dissolved	ICP: 200.7/6010	250 ml P or 500-ml P	None	6 months

Table 4.1 - Recommended Sample Containers, Preservation, and Hold Times for Parameters Measured in Wastewater and Groundwater Matrices

Volatile Organics – GC

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Acetates (Direct Aqueous Injection - DAI)	8015B	3 x 40-ml G	None	14 days
Alcohols (DAI)	8015B	3 x 40-ml G	None	30 days
Cellosolves (DAI)	8015B	3 x 40-ml G	None	14 days
Dissolved Gases in water	RSK SOP 175	3 x 40-ml G	None	14 days
Glycols (DAI)	8015B	3 x 40-ml G	None	14 days
Gasoline Range Organics (GRO)	8015B	3 x 40-ml G	0.3ml 1:1 hydrochloric acid (6)	14 days (7)
Petroleum products (volatile)	8015B	3 x 40-ml G	0.3ml 1:1 hydrochloric acid (6)	14 days (7)
Halocarbons and Aromatics	601/602, 8021	3 x 40-ml G	0.3ml 1:1 hydrochloric acid (6)	14 days (7)
Methanol and other Solvents(NCASI)	NCASI 99.01	3 x 40-ml G	None	14 days
Methanol (NCASI)	NCASI 94.03	3 x 40-ml G	None	30 days
Non-halogenated Volatiles	8015B	3 x 40-ml G	0.3ml 1:1 hydrochloric acid (6)	14 days (7)
Purgeable Aromatic Hydrocarbons	602,8021	3 x 40-ml G	0.3ml 1:1 hydrochloric acid (6)	14 days (7)
Purgeable Halocarbons	601, 8021	3 x 40-ml G	0.3ml 1:1 hydrochloric acid (6)	14 days (7)
Solvents-miscellaneous (DAI)	8015B	3 x 40-ml G	None	14 days
Tennessee GRO	Tenn GRO	3 x 40-ml G	0.3ml 1:1 hydrochloric acid (6)	14 days (7)

Volatiles by GC/MS

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Volatiles	CLP OLCO 2.1/ OLMO 3.2/4.2	3 x 40-ml G	0.3ml 1:1 hydrochloric acid (6)	10 days(2)
Volatiles	624, 8260	3 x 40-ml G	0.3ml 1:1 hydrochloric acid (6)	14 days (7)
Volatiles by Isotope Dilution	1624	3 x 40-ml G	0.3ml 1:1 hydrochloric acid (6)	14 days

Table 4.1 - Recommended Sample Containers, Preservation, and Hold Times for Parameters Measured in Wastewater and Groundwater Matrices

Semivolatiles by GC

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Chlorinated Herbicides	615/8151	2 x 1-L Amb G	None (6)	7 days/40 days (4)
Chlorinated Pesticides	608, 8081	2 x 1-L Amb G	None (6)	7 days/40 days (4)
Chlorinated Pesticides and PCBs as Aroclors	CLP OLMO 3.2/4.2/ OLCO 2.1	2 x 1-L Amb G	None (6)	5 days/40 days (2,4)
Chlorinated Pesticides and PCBs as Aroclors	8081/8082	2 x 1-L Amb G	None (6)	7 days/40 days (4)
Microextractables	8011	3 x 40-ml G	0.3mL 1:1 hydrochloric acid (6)	28 days
Organophosphorous Pesticides	614/622, 8141	2 x 1-L Amb G	None (6)	7 days/40 days (4)
PCBs as Aroclors	608/8082	2 x 1-L Amb G	None (6)	7 days/40 days (4)
Petroleum Hydrocarbons/DRO				
Diesel Range Organics (DRO)	8015B/CALUFT	2 x 1-L Amb G	5mL 1:1 HCl	7 days/40 days (4)
Petroleum products (diesel, mineral spirits, kerosene, motor oil)	8015B	2 x 1-L Amb G	5mL 1:1 HCl	7 days/40 days (4)
Extractable Petroleum Hydrocarbons (EPH)	Tenn. EPH	2 x 1-L Amb G	5mL 1:1 HCl	7 days/40 days (4)
Petroleum Hydrocarbons	Texas TPH (1005)	3 x 40-ml G	0.3mL 1:1 hydrochloric acid (6)	14/14 days
Petroleum Range Organics	FLPRO	2 x 1-L Amb G	5mL 1:1 HCl	7 days/40 days (4)

Semivolatiles by GC/MS

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Base/Neutrals/Acids	625/8270	2 x 1-L Amb G	None (6)	7 days/40 days (4)
Base/Neutrals/Acids	CLP OLCO 2.1/OLMO3.2/4.2	2 x 1-L Amb G	None (6)	7 days/40 days (2,4)
Chlorinated Phenolics	1653	2 x 1-L Amb G	2mL 1:1 sulfuric acid(6)	30 days/30 days (4)
Dioxins and Furans	8280	2 x 1-L Amb G	None (6)	30 days/45 days (4)
PCB Homologs	680	2 x 1-L Amb G	None (6)	7 days/40 days (4)
2,3,7,8-TCDD	613	2 x 1-L Amb G	None (6)	7 days/40 days (4)

Liquid Chromatography

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
PAHs	610/8310	2 x 1-L Amb G	None(6)	7 days/ 40 days (4)

Table 4.1 - Recommended Sample Containers, Preservation, and Hold Times for Parameters Measured in Wastewater and Groundwater Matrices

Microbiological

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Bacteria plate count	9215	2 x 250-mL sterile Nalgene or sterile Whirl-paks	0.2mL 10% sodium thiosulfate	6 hours
Chlorophyll	0200H	125-mL Amb G	None	6 months frozen
Coliform, fecal and total (in drinking water)	9222D (Fecal MF) 9222B (Total MF) 9221C (Fecal MPN) 9221B, C (Total MPN)	2 x 250-mL sterile Nalgene or sterile Whirl-paks	0.2mL 10% sodium thiosulfate	30 hours (If sample is shipped)
Coliform, fecal and total	9222D (Fecal MF) 9222B (Total MF) 9221C (Fecal MPN) 9221B, C (Total MPN)	2 x 250-mL sterile Nalgene or sterile Whirl-paks	0.2mL 10% sodium thiosulfate	6 hours

Table 4.2 - Recommended Sample Containers, Preservation, and Hold Times for Parameters Measured in Drinking Water

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE	STORAGE(2)	Hold Time	
					Prep	Analysis
GENERAL CHEMISTRY						
Alkalinity, Total	SM2320B/EPA310.1	125-mL Nalgene	None	4C		14 days
Bromide by IC	EPA 300.0A	125-mL Nalgene	None	4C		28 days
Bromide by IC	EPA 300.1B	125-mL Nalgene	None or (LAB) 0.01mL (10uL) of ethylene diamine (EDA) + 1mL reagent water per container (1)	4C		28 days
Bromate by IC	EPA 300.1B	125-mL Nalgene	None or (LAB) 0.01mL (10uL) of ethylene diamine (EDA) + 1mL reagent water per container (1)	4C		28 days
Chlorate by IC	EPA 300.1B	125-mL Nalgene	None or (LAB) 0.01mL (10uL) of ethylene diamine (EDA) + 1mL reagent water per container (1)	4C		28 days
Chloride	EPA 300.0A	125-mL Nalgene	None	4C		28 days
Chloride	EPA 325.2/SM4500-Cl-E	125-mL Nalgene	None	4C		28 days
Chlorite by IC	EPA 300.1B	125-mL Nalgene	(LAB) 0.01mL (10uL) of ethylene diamine (EDA) + 1mL reagent water per container (1)	4C		14 days
Color (Apparent)	SM2120B/EPA110.2	500-mLGlass	None	4C		48 hours
Conductivity (Specific Conductance)	SM2510B/EPA120.1	125-mL Nalgene	None	4C		28 days
Corrosivity/Langelier Index	SM2330B	(2) 500-mL Nalgene	None	4C		14 days
Cyanide, Free (dw)	EPA335.4/SM4500CN-E	125-mL Nalgene	(LAB) 0.10mL of 250mg/mL sodium arsenite solution per container (25mg sodium arsenite); (FIELD) after dechlorination, adjust to pH 12 with 10 drops 1:1 sodium hydroxide	4C		14 days

Table 4.2 - Recommended Sample Containers, Preservation, and Hold Times for Parameters Measured in Drinking Water

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE	STORAGE(2)	Hold Time	
					Prep	Analysis
GENERAL CHEMISTRY						
Fluoride	EPA 300.0A	125-mL Nalgene	None	4C		28 days
Fluoride	SM4500-F-C/EPA340.2	125-mL Nalgene	None	4C		28 days
Hardness (Total as CaCO3)	SM2340B	500-mL Nalgene	(LAB) 2mL 1:1 nitric acid per container	ambient		6 months
Nitrogen, Nitrate (NO3) as N by IC	EPA 300.0A	125-mL Nalgene	None	4C		48 hours
Nitrogen, Nitrate (NO3) as N	EPA 353.2/SM4500-NO3-F	125-mL Nalgene	None	4C		48 hours
Nitrogen, Nitrite (NO2) as N by IC	EPA 300.0A	125-mL Nalgene	None	4C		48 hours
Nitrogen, Nitrite (NO2) as N	EPA 353.2/SM4500-NO3-F	125-mL Nalgene	None	4C		48 hours
Odor	EPA 140.1/SM2150B	500-mLGlass	None	4C		28 days
Organic Carbon, Total (TOC)	EPA 415.1	250-mL Amber Glass	(LAB) 1.0mL 1:1 hydrochloric acid per container	4C		28 days
Perchlorate by IC	EPA 314.0	125-mL Nalgene	None	ambient		28 days
pH (laboratory)	EPA 150.1/SM4500-H-B	125-mL Nalgene	None	4C		ASAP
Phosphorus, ortho as P	EPA 365.2/SM4500-P-E	125-mL Nalgene	None	4C		48 hours
Phosphorus, Total as P	EPA 365.4/SM4500-P-F	250-mL Nalgene	(LAB) 1.0mL 1:1 sulfuric acid per container	4C		28 days
Solids, Total Dissolved	SM2540C/EPA160.1	500-mL Nalgene	None	4C		7 days
Sulfate by IC	EPA 300.0A	125-mL Nalgene	None	4C		28 days
Sulfate	SM4500-SO4-E/EPA375.4	125-mL Nalgene	None	4C		28 days
Surfactants (MBAS)	SM5540C	500-mL Nalgene	None	4C		7 days
Turbidity	EPA 180.1/SM2130B	125-mL Nalgene	None	4C		48 hours
UV-254 Aborbing Constituents	SM5910B	120-mL Amber Glass	None	4C		48 hours

Table 4.2 - Recommended Sample Containers, Preservation, and Hold Times for Parameters Measured in Drinking Water

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE	STORAGE(2)	Hold Time	
					Prep	Analysis
METALS						
Metals by ICP	EPA 200.7	500-mL Nalgene	(LAB) 2mL 1:1 nitric acid per container	ambient		6 months
Metals by ICP/MS	EPA 200.8	500-mL Nalgene	(LAB) 2mL 1:1 nitric acid per container	ambient		6 months
Metals by GFAA	EPA 200.9	500-mL Nalgene	(LAB) 2mL 1:1 nitric acid per container	ambient		6 months
Mercury	EPA 245.1	500-mL Nalgene	(LAB) 2mL 1:1 nitric acid per container	ambient		28 days
Chromium, Hexavalent	SM3500CR-D	500-mL Nalgene	None	ambient		24 hours
Hardness (Total as CaCO3)	SM2340B	500-mL Nalgene	(LAB) 2mL 1:1 nitric acid per container	ambient		6 months
MICROBIOLOGICAL						
Bacti - Total Coliform (MF)	SM9222B	250-mLSterile Nalgene	(LAB) 0.2mL 100mg/mL sodium thiosulfate solution	4C		30 hours
Bacti - Heterotrophic Plate Count	SM9215B	250-mLSterile Nalgene	(LAB) 0.2mL 100mg/mL sodium thiosulfate solution	4C		30 hours
MICROEXTRACTABLES AND SEMIVOLATILES						
Microextractables-EDB and DBCP	EPA 504.1	(3) 40-mL VOA	(LAB) 0.1mL of 100mg/mL sodium thiosulfate per vial	4C	14 days	24 hours
Microextractables-Chloral hydrate	EPA 551.1	(3) 60-mL Amber Glass	(LAB) 1g sodium sulfite/ phosphate buffer	4C	14 days	14 days (freezer)
Microextractables-Disinfection By-Products	EPA 551.1	(3) 60-mL Amber Glass	(LAB) 1g ammonium chloride/ phosphate buffer	4C	14 days	14 days (freezer)
Haloacetic Acids (HAA5)	EPA 552.2	(3) 60-mL Amber Glass	(LAB) 0.10mL of 100mg/mL ammonium chloride solution per container	4C	14 days	7 days
SOCs - Pesticides and PCBs, Chlorinated (dw)	EPA508.1	(2) 1-L Amber Glass	(LAB) 0.5mL of 100mg/mL sodium sulfite solution per container; (FIELD) adjust pH to <=2 with 4mL 1:1 HCl after dechlorinating samples	4C	14 days	30 days

Table 4.2 - Recommended Sample Containers, Preservation, and Hold Times for Parameters *Measured in Drinking Water*

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE	STORAGE(2)	Hold Time	
					Prep	Analysis
SOCs – Chlorophenoxy Herbicides	EPA 515.1	(2) 1-L Amber Glass	(LAB) 0.5mL of 100mg/mL sodium sulfite solution per container	4C	14 days	28 days
SOCs – Semivolatiles	EPA 525.2	(2) 1-L Amber Glass	(LAB) 0.5mL of 100mg/mL sodium sulfite solution per container; (FIELD) adjust pH to <=2 with 4mL 1:1 HCl after dechlorinating samples	4C	14 days	30 days
SOCs - Carbamates	EPA 531.1	(3) 60-mL Glass	(LAB) 1.8mL monchloroacetic acid and 0.15mL of 100mg/mL sodium thiosulfate solution per vial	4C		28 days
SOCs - Glyphosate	EPA 547	(3) 40-mL VOA	(LAB) 0.10mLof 100mg/mL sodium thiosulfate per vial	4C		14 days
SOCs - Endothall	EPA 548.1	1-L Amber Glass	(LAB) 0.8mL of 100mg/mL sodium thiosulfate solution per container (FIELD) adjust to pH<2 with 4mL 1:1 HCl after dechlorination	4C	7 days	14 days
SOCs - Diquat/Paraquat	EPA 549.2	500-mL Amber Nalgene	(LAB) 0.5ml 100mg/mL sodium thiosulfate solution per container; (FIELD) adjust sample to pH<2 with 20 drops of 1:1 sulfuric acid after dechlorination	4C	7 days	21 days

Table 4.2 - Recommended Sample Containers, Preservation, and Hold Times for Parameters Measured in Drinking Water

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE	STORAGE(2)	Hold Time	
					Prep	Analysis
VOLATILES						
TTHMs (Trihalomethanes) by 524.2	EPA 524.2	(3) 40-mL VOA	(LAB) 0.10mL of 100mg/mL sodium thiosulfate per vial NOTE: acidification not required if only THMs are target compounds and sodium thiosulfate used as dechlorinating agent	4C		14 days
VOCs - methyl-tert-butyl ether by 524.2	EPA 524.2	(3) 40-mL VOA	(LAB) 0.10mL of 100mg/mL sodium thiosulfate per vial NOTE: Current EPA guidance recommends that acid not be added to sample is MTBE is a target compound.	4C		14 days
VOCs - Drinking Water by 524.2	EPA 524.2	(1) 250-mL clear glass (3) 40-mL VOA	(LAB) 1.0mL of 250mg/mL ascorbic acid solution to 250-mL clear glass container; 0.10mL 1:1 HCl in each 40mL vial.	4C		14 days
UCMR PARAMETERS						
UCMR List 1 Volatiles (MTBE and nitrobenzene)	EPA 524.2	(3) 40-mL VOA	(LAB) 0.10mL of 100mg/mL sodium thiosulfate per vial NOTE: Current EPA guidance recommends that acid not be added to sample is MTBE is a target compound.	4C		14 days
UCMR List 1 Semivolatiles	EPA 525.2	(2) 1-L Amber Glass	(LAB) 0.5mL of 100mg/mL sodium sulfite solution per container; (FIELD) adjust pH to <=2 with 5mL 1:1 HCl after dechlorinating samples	4C	14 days	30 days
UCMR List 1 DCPA	EPA 515.1	(2) 1-L Amber Glass	(LAB) 0.5mL of 100mg/mL sodium sulfite solution per container	4C	14 days	28 days
UCMR List 1 Perchlorate by IC	EPA 314.0	125-mL Nalgene	None	ambient		28 days

NOTES: 1-Bromate, Bromide, and Chlorate require no chemical preservation if chlorite is not a target analyte. These parameters can be performed on sample preserved with EDA or unpreserved. Chlorite must be preserved with EDA.

Table 4.3 - Recommended Sample Containers, Preservation, and Hold Time for Parameters Measured in Soil and Solid Matrices

General Chemistry

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Ammonia	350.1/350.3 (EPA-CE)	250-mL P	None	28 days
BOD	EPA-CE:3-380	500-ml P	None	2 days
Bromide (IC)	300/9056	250-mL P	None	28 days
BTU (British Thermal Units) and Heat of Combustion	D240-87	125-mL G	None	28 days
Cation Exchange Capacity (CEC)	9080/9081	250-mL P	None	28 days
Chloride, extractable (autoanalyzer)	9251/SM4500-Cl-C	250-mL P	None	28 days
Chloride, extractable (IC)	300/9056	250-mL P	None	28 days
Chloride, total	5050/9056	125-mL G	None	28 days/28 days
Chemical Oxygen Demand (COD)	EPA-CE:3/373	250-mL P	None	28 days
Cyanide, amenable to chlorination	9014 (9013)	250-mL P	None	14 days
Cyanide, extractable	9014 (9013)	250-mL P	None	14 days
Cyanide, reactive	SW-846 7.3.3.2/9014	250-mL P	None	14 days
Cyanide, total	9012	250-mL P	None	14 days
Cyanide, total (CLP)	CLP ILMO 4.0	250-mL P	None	12 days (2)
Cyanide, total and amenable	9012/9014 (9013)	250-mL P	None	14 days
Extractable organic halogens (EOX)	9023	125-mL Amb G	None	28 days
Fluoride (electrode)	340.2/SM4500-F-C	250-mL P	None	28 days
Fluoride (IC)	300/9056	250-mL P	None	28 days
Halogens, total	5050/9056	125-mL G	None	28 days/28 days
Hydrogen ion (pH)	9045	250-mL P	None	Analyze ASAP
Ignitability	1010/1030	125-mL G	None	Analyze ASAP
Nitrate (autoanalyzer)	SM4500/NO3-F (EPA-CE: 3-183)	250-mL P	None	28 days
Nitrate (IC)	300/9056	250-mL P	None	28 days
Nitrite (colorimetric)	SM4500/NO3-F (EPA-CE: 3-183)	250-mL P	None	28 days
Nitrite (IC)	300/9056	250-ml P	None	28 days

Table 4.3 - Recommended Sample Containers, Preservation, and Hold Time for Parameters Measured in Soil and Solid Matrices

General Chemistry

Nitrogen, organic	EPA-CE: 3/201	250-mL P	None	28 days
Nitrogen, total	EPA-CE: 3/201	250-mL P	None	28 days
Nitrogen, total Kjeldahl (TKN)	EPA-CE: 3/201	250-mL P	None	28 days
Oil and Grease (gravimetric)	9071(HEM)	250-ml or 500-ml amb G	None	28 days
Oil and Grease (IR)	413.2(3550)	125-ml amb G	None	28 days
Organic Carbon, Total (TOC)	Lloyd Kahn (Combustion)	250-ml P	None	28 days
Orthophosphate	365.1/SM4500-P-F	250-ml P	None	28 days
Paint filter liquids	9095	125-mL G	None	Analyze ASAP
Perchlorate, extractable	314.0(300.0)	250-mL P	None	28 days
Petroleum hydrocarbons (gravimetric)	9071(HEM-SGT)	250-ml or 500-ml amb G	None	28 days
Petroleum hydrocarbons by IR	418.1(3550)	125-ml amb G	None	28 days
pH (laboratory)	9045	250-mL P	None	Analyze ASAP
Phenol, total recoverable (direct)	9065	125-ml Amb G	None	28 days
Phenols, total recoverable (chloroform extraction)	9065	125-ml Amb G	None	28 days
Phosphorus, total	EPA-CE : 3-212, 3-213	250-ml P	None	28 days
Residue, fixed (%ash)	EPA-CE:3-59	250-ml P	None	28 days
Residue, total	EPA-CE : 3-58/2540G	250-ml P	None	28 days
Residue, volatile (VS)	EPA-CE : 3-59/2540G	250-ml P	None	28 days
Specific Conductance	9050	250-ml P	None	28 days
Specific gravity	EPA-CE:3-61	125-mL G	None	28 days
Sulfate (IC)	300/9056	250-ml P	None	28 days
Sulfide	9034 (9030)	250-ml P	None	28 days
Sulfides, acid volatile (AVS)	Lab SOP	125-mL G	None	14 days/28 days
Sulfide, reactive	SW-846 7.3.4.2/9034	250-ml P	None	28 days
Sulfur, total	5050/9056	125-mL G	None	28 days/28 days
Surfactants (MBAS)	425.1/5540C	250-ml P	None	28 days
Total Kjeldahl Nitrogen(TKN)	EPA-CE : 3/201	250-mL P	None	28 days
Total Organic Carbon (combustion)	Lloyd Kahn	250-ml P	None	28 days
Total Organic Carbon (Walkley-Black)	Walkley-Black	250-ml P	None	28 days

Table 4.3 - Recommended Sample Containers, Preservation, and Hold Time for Parameters Measured in Soil and Solid Matrices

Microbiological

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Coliform, fecal	9221C (MPN)	2 x 250-mL sterile Nalgene	None	Analyze ASAP
Coliform, total	9221B (MPN)	2 x 250-mL sterile Nalgene	None	Analyze ASAP

Metals

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Hexavalent chromium	7196 (3060A)	250-ml P or 500-ml P	None	30 days/ 7 days (5)
Mercury	7471	250-ml P or 500-ml P	None	28 days
Mercury	CLP ILMO 4.0	250-ml P or 500-ml P	None	26 days (2)
Metals	CLP ILMO 4.0	250 ml P or 500-ml P	None	6 months (2)
Metals (except Chromium VI and Mercury)	ICP: 6010 ICP/MS: 6020 GFAA: 7000	250 ml P or 500-ml P	None	6 months
Simultaneously Extracted Metals (SEM)	Lab SOP	125-mL G	None	14 days/180 days

Volatile Organics – GC

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1, 8)	HOLD TIME
Acetates (Direct Aqueous Injection-DAI- of water leachate)	8015B	125-ml G Amb	None	14 days
Alcohols (DAI)	8015B	125-ml G Amb	None	30 days
Cellosolves (DAI)	8015B	125-ml G Amb	None	14 days
Gasoline Range Organics (GRO)	8015B	3 x 5-g or 2 x 25-g Encore plus 125-ml G Amb	5ml 5% sodium bisulfate solution, methanol, or frozen in water	14 days(9)
Gasoline Range Organics (GRO)	Tennessee GRO	3 x 5-g or 2 x 25-g Encore plus 125-ml G Amb	5ml 5% sodium bisulfate solution, methanol, or frozen in water	14 days(9)
Glycols (DAI)	8015B	125-ml G Amb	None	14 days
Petroleum products (volatile)	8015B	3 x 5-g or 2 x 25-g Encore plus 125-ml G Amb	5ml 5% sodium bisulfate solution, methanol, or frozen in water	14 days(9)
Non-Halogenated Volatiles	8015B	3 x 5-g or 2 x 25-g Encore plus 125-ml G Amb	5ml 5% sodium bisulfate solution, methanol, or frozen in water	14 days(9)
Halocarbons and Aromatics	8021	3 x 5-g or 2 x 25-g Encore plus 125-ml G Amb	5ml 5% sodium bisulfate solution, methanol, or frozen in water	14 days(9)
Miscellaneous Solvents (DAI)	8015B	125-ml G Amb	None	14 days
Purgeable Aromatic Hydrocarbons	8021	3 x 5-g or 2 x 25-g Encore plus 125-ml G Amb	5ml 5% sodium bisulfate solution, methanol, or frozen in water	14 days(9)
Purgeable Halocarbons	8021	3 x 5-g or 2 x 25-g Encore plus 125-ml G Amb	5ml 5% sodium bisulfate solution, methanol, or frozen in water	14 days(9)

Table 4.3 - Recommended Sample Containers, Preservation, and Hold Time for Parameters Measured in Soil and Solid Matrices

Volatile Organics – GC/MS

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Volatiles	8260(5035)	3 x 5-g or 2 x 25-g Encore plus 125-ml G Amb	5ml 5% sodium bisulfate solution, methanol, or frozen in water (8)	14 days(9)
Volatiles	CLP OLMO 3.2	125-ml G Amb	None	10 days(2,9)
Volatiles	OLMO 3.2/OLMO 4.2	3 x 5-g or 2 x 25-g Encore plus 125-ml G Amb	5ml 5% sodium bisulfate solution, methanol, or frozen in water (8)	14 days(9)

Semivolatiles by GC

PARAMETER	MEHTOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Chlorinated Herbicides	8151	250-ml or 500-ml G	None	14days/40 days (4)
Chlorinated Pesticides and PCBs as Aroclors	CLP OLMO 3.2/4.2	250-ml or 500-ml G	None	10days/40 days (2,4)
Chlorinated/ Pesticides	8081	250-ml or 500-ml G	None	14days/40 days (4)
Organophosphorous Pesticides	8141	250-ml or 500-ml G	None	14days/40 days (4)
PCB as Aroclors	8082	250-ml or 500-ml G	None	14days/40 days (4)
Petroleum Hydrocarbons/DRO				
Diesel range organics (DRO	8015B	250-ml or 500-ml G	None	14days/40 days (4)
Extractable Petroleum Hydrocarbons	Tennessee EPH	250-ml or 500-ml G	None	14days/40 days (4)
Petroleum Range Organics	FL-PRO	250-ml or 500-ml G	None	14days/40 days (4)
Petroleum Products	8015B	250-ml or 500-ml G	None	14days/40 days (4)
Petroleum hydrocarbons/EPH/ DRO	8015B	250-ml or 500-ml G	None	14days/40 days (4)
Petroleum Hydrocarbons (Texas TPH)	TNRCC 1005 (C6-C35)	2 x 10-g Encore	None	14/14 days(9)
	TNRCC 1005 (C6-C35)	2 x tared 40-ml G	None	14/14 days
	TNRCC 1005 (>C12-C35)	125-mL G w/ Teflon cap	None	14/14 days

Semivolatiles by GC/MS

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Base/Neutrals/Acids	8270	250-ml or 500-ml amb G	None	14 days/40 days (4)
Base/Neutrals/Acids	CLP OLMO 3.2/4.2	250-ml or 500-ml amb G	None	14 days/40 days (2,4)
Dioxins and Furans	8280	250-ml or 500-ml amb G	None	30 days/45 days (4)
PCB Homologs	680	250-ml or 500-ml amb G	None	14 days/40 days (2,4)

Liquid Chromatography

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
PAHs	8310	250-ml or 500-ml amb G	None	14days/40 days(4)

Table 4.4 - Recommended Sample Containers, Chemical Preservation, and Hold Time for Parameters Measured in Hazardous Waste Matrices

Solids

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Corrosivity (pH)	9040	250-ml G	None	analyze ASAP
Cyanide, reactive	SW-846 7.3.3.2/9014	250-ml P,G	None	14 days
Ignitability	1010/1030	250-ml G	None	NA
Sulfide, reactive	SW-846 7.3.4.2/9034	250-ml P,G	None	7 days
SPLP (volatile & nonvolatile fraction)	1312	500-ml G	None	Mercury: 28 days(11) Metals: 180 days(11) VOC: 14 days(11) SVOC:14 days(11)
SPLP (volatile fraction)	1312	250-ml G	None	14 days
TCLP (volatile & nonvolatile fraction)	1311	500-ml G	None	Mercury: 28 days(11) Metals: 180 days(11) VOC: 14 days(11) SVOC:14 days(11)
TCLP (volatile fraction)	1311	250-ml G	None	14 days(11)

Aqueous Hazardous Waste (SW1311-TCLP)

PARAMETER	METHOD REFERENCE	ROUTINE CONTAINER	CHEMICAL PRESERVATIVE(1)	HOLD TIME
Base/neutrals/acids	8270	1000-ml G	None	14 days/7 days/40 days (15)
Chlorinated herbicides	8151	1000-ml G	None	14 days/7 days/40 days(15)
Chlorinated pesticides	8081	1000-ml G	None	14 days/7 days/40 days(15)
Mercury	7470	500-ml P	None	28 days/28 days (15)
Metals	6010	500-ml P	None	180 days/180 days(15)
Volatiles	8260	3 x 40-ml G	None	14 days/14 days(15)

Table 4.5 - Recommended Sample Media and Containers, Solvent, Preservation, and Hold Time for Parameters Measured in Wipe Matrices

PARAMETER	METHOD REFERENCE	ROUTINE MEDIA AND CONTAINER	WIPE SOLVENT	HOLD TIME
Chlorinated Pesticides and PCBs	8081/8082/LAB SOP	2" x 2" gauze square / 40 ml G vial with TFE septa	Methanol	14 days/40 days (4)
Mercury	7470/LAB SOP	2" x 2" gauze square / 40 ml G vial with TFE septa	Reagent Water	28 days
Metals (except mercury)	6010/LAB SOP	2" x 2" gauze square / 40 ml G vial with TFE septa	Reagent Water	180 days
PAHs	8310/LAB SOP	2" x 2" gauze square / 40 ml G vial with TFE septa	Methanol	14 days/ 40 days (4)
Semivolatiles	8270/LAB SOP	2" x 2" gauze square / 40 ml G vial with TFE septa	Methanol	14 days/ 40 days (4)
Volatiles	8260/LAB SOP	2" x 2" gauze square / 40 ml G vial with TFE septa	Purge and trap methanol	14 days

Table 4.6 - Recommended Sample Media, Preservative, and Hold Time for Parameters Measured in Air Matrices

Volatiles

PARAMETER	METHOD REFERENCE	ROUTINE MEDIA(13, 17)	PRESERVATIVE	HOLD TIME
Volatiles	EPA 18, 0040	Vacusampler	None (Do Not Ice)	30 days
Volatiles and other gases collected in Tedlar Bags	EPA18, 0040	Tedlar Bag	None (Do Not Ice)	3 days

Semivolatiles

PARAMETER	METHOD REFERENCE	ROUTINE MEDIA(13, 16)	PRESERVATIVE	HOLD TIME
Pesticides and PCBs	TO10	PUF Assembly for Low Volume Sampler	None (14)	7 days/40 days
PAH compounds	TO13	PUF/Resin/Filter Assembly for High Volume Sampler	None (14)	7 days/40 days
Pesticides and PCBs	TO4	PUF/Filter Assembly for High Volume Sampler	None (14)	7 days/40 days

Table 4.7 - Recommended Sample Media and Containers, Solvent, Preservation, and Hold Time for Parameters Measured in Tissue Matrices

PARAMETER	METHOD REFERENCE	ROUTINE MEDIA AND CONTAINER	STORAGE	HOLD TIME
Chlorinated Pesticides and PCB as aroclors	8081/8082/LAB SOP	Aluminum foil or glass	Frozen	6 months
Chlorinated Pesticides	8081LAB SOP	Aluminum foil or glass	Frozen	6 months
Cyanide	9012/9014(9013)	Plastic freezer bag	Frozen	6 months
Dioxin/Furans (homologs by level of chlorination)	8280	Aluminum foil or glass	Frozen	6 months
Mercury	7471/LAB SOP	Plastic freezer bag	Frozen	6 months
Metals (except mercury)	6010/7000/LAB SOP	Plastic freezer bag	Frozen	6 months
PCB as aroclors	8082/LAB SOP	Aluminum foil or glass	Frozen	6 months
PCB Homologs by level of chlorination	680	Aluminum foil or glass	Frozen	6 months
Semivolatiles	8270/LAB SOP	Aluminum foil or glass	Frozen	6 months
Volatiles	8260/LAB SOP	Aluminum foil or 3 x tared 40-mL glass	Frozen	14 days

Key to Containers:

P=Plastic; G=Glass; Amb=Amber

Footnote References:

1. Containers should be iced at time of collection in addition to chemical preservation (if applicable).
2. The hold time for CLP methods is measured from the date of receipt in the laboratory.
3. The entire contents of each container must be used for analysis.
4. The first number is the hold time until the extraction; the second time is the hold time for the extract preparation; i.e., the extraction must take place within 7 days of collection and the extract must be analyzed within 40 days of the date of extraction.
5. The digestion must be completed within 30 days and the alkaline digestate must be analyzed within seven days of the digestion.
6. If the sample is chlorinated, sodium thiosulfate or ascorbic acid is added to the vials prior to shipment or is added the time of collection to destroy residual chlorine. If the sample is to also be preserved with acid, ascorbic acid should be used as the dechlorination agent.
7. The hold time for VOC is 7 days if the samples are not preserved with HCl at the time of collection.
8. The sample must be preserved with sodium bisulfate, methanol, or water within 48 hours of collection if not preserved in the field. If the sample contains high levels of carbonates that prevents the use of sodium bisulfate, the sample may be frozen in reagent water within 48 hours of collection.
9. The hold time for VOC is 48 hours if the samples are not preserved with sodium bisulfate, methanol or frozen in analyte-free water within 48 hours of collection.
10. Samples for VPH must be extracted with methanol within 48 hours of collection (1ml methanol per gram of sample). The extract must be analyzed within 28 days of collection.
11. The hold time is the maximum time until the leaching procedure is performed. After leaching, the routine liquid hold times apply for extraction and analysis.
12. If the TCLP or SPLP sample is a liquid or aqueous, a minimum volume of 1L should be supplied to support each analysis. The following are the minimum volumes of liquid sample or leachate to report the target analytes at the LQM limits and below the regulatory threshold limits.
13. Media may be purchased directly from the vendor.
14. No chemical preservative is required. Samples are iced at the time of collection and maintained at method-specified temperature until extraction and analysis.
15. The first number is the hold time until the TCLP extraction or filtration is performed; the second is the hold time of the leachate extraction or preparation and the third date is the hold time to analyze the leachate or extract.
16. Consumable media provided will be cleaned and leak-checked, when applicable. Shipment of media is billed at the client expense and is supplied contingent on availability. If specified, certified media is available (2-week lead time required) and will be subject to the analytical fees and TAT stipulated in the fee schedule. Blanks can be provided at client request and are billable at the per sample rate. Fees do not include specialized hardware. Contract specific discounts do not apply to consumable media.

5.0 SAMPLE CUSTODY

5.1 Sample Custody Objectives

The primary objective of STL Savannah's sample chain-of-custody procedures is to provide accurate, verifiable, and traceable records of sample possession and handling from sample container shipment through laboratory receipt and sample disposition.

Evidence of documentation of sample collection, shipment, laboratory receipt and custody is accomplished utilizing a chain-of-custody record (Figure 5.1). A sample is considered in custody if it is:

- in actual possession of the sampler or transferee
- in view after being in physical possession of the sampler or transferee
- sealed so that sample integrity will be maintained while in possession of the sampler or transferee
- in a secured area, restricted to authorized personnel.

5.2 Facility Security Policy

All external doors are either visually monitored by STL staff or kept locked. Visitors are required to sign in and wear a visitor's badge during their visit and are accompanied at all times by an STL staff member when in the laboratory. Secure refrigerators and storage cabinets are available for samples requiring this level of security.

5.3 Custody Record Maintenance

Field and laboratory records, including copies of the chain-of-custody forms and associated field documentation, are maintained in a secure area with other project records. All field and laboratory data are reported in bound notebooks and entries are made in waterproof ink. Field and laboratory data entry errors are deleted with a one-line strike through. The correction is initialed and dated by the sampling or analytical staff member making the change. Correction tape or other substances designed to obliterate documentation are strictly prohibited in the laboratory or custody areas. Field and laboratory information is documented on prepared forms. All forms for recording field and laboratory data include spaces for date and initials which must be completed by the data recorder. Field and laboratory documentation not recorded on prepared forms is also dated and initialed.

5.4 Laboratory and Field Sample Custody Procedures

All samples are received by the custody technician using custody procedures detailed in SOP CU01: *Receipt, Log Number Assignment, and Distribution of Field Samples*. The procedures for the preparation of sampling kits are described in SOP CU15: *Preparation of Sampling Containers*.

5.4.1 Selection and Preparation of Sample Containers Supplied to a Client or Sampling Team

Sample containers provided by STL are constructed from EPA-designated materials and contain EPA-prescribed preservatives. The recommended containers are listed in Section 4.0. If requested, an STL Savannah or client supplied identification label is affixed to the container. A 100-mL plastic container labeled "Container Temperature- For Laboratory Use Only" is pre-filled with tap water and supplied with each sample shipment to monitor sample temperature upon receipt.

Pre-cleaned sample containers are purchased by STL. Containers from each lot are pre-certified in-house prior to use in accordance with SOP CU35: *Procedure for Contaminant-Free Containers.*

A color-coded dot, affixed to the outside of the container, is used to identify preservatives. The color code scheme for the various preservatives used in STL Savannah's sample containers is described on the Sample Container Request Form (Figure 5.2) which is submitted to the client along with the sample containers.

5.4.2 Chain of Custody Documentation, Traceability, and Sample Integrity

Formal chain-of-custody procedures are initiated by a custody technician who is responsible for organization and relinquishment of sample containers to the client or field personnel.

All field information must be properly recorded on the chain-of-custody form. Proper completion of the form is the responsibility of the field sampling manager or client and is requested prior to the relinquishment of the samples. If the site location is different from the client address, the site location is recorded in the "Project Name" space on the chain-of-custody form or on the right hand side of the form if additional space is required. The sample identities assigned in the field are recorded in the "Sample Identification" column. Common carriers may identify themselves by signing the "Relinquished By" space on the chain-of-custody form.

For samples transported from the field to the laboratory by common carrier, chain of custody is maintained. Completed custody forms must accompany each sealed cooler, and are placed in a plastic bag and taped to the inside lid of the cooler. At the client's request, coolers are sealed in the field with the STL Savannah Custody Seal or custody tape by the field sampling team to ensure that tampering will be immediately evident. A unique identification number is recorded on the seal and accompanying chain-of-custody form with waterproof ink.

Custody personnel are responsible for the inspection of shipping containers upon laboratory receipt for overall integrity and to ensure that the contents have not been altered or tampered with during transit. If tampering is apparent, the custody personnel immediately contact the assigned project manager who is responsible for client notification. Any problems detected are documented on an Anomaly Report (Figure 5.3), which is initiated by the custody personnel. Any corrective action required by the client is also documented.

Upon arrival, shipping containers are opened immediately by the custody technician in the receiving area, and the chain-of-custody form and temperature container are removed for inspection. Container temperature upon receipt is documented on the Sample Internal Custody Form (Figure 5.6) and on the laboratory's copy of the COC, or, if requested by the client, documented on the client's chain-of-custody form.

5.4.3 Field Custody

When sample collection is performed by STL, the field sampling manager is responsible for ensuring that chain-of-custody procedures for all sampling events are properly documented. The custody forms and login procedures follow the protocol outlined in Section 5.3.

Prior to field sampling, it is preferable to place waterproof sample labels on each sample container and complete each sample label with as much information as possible in waterproof ink. Field sampling technicians are responsible for ensuring that labels are complete. Each sample is identified in the field by a unique alphanumeric designation on the label.

Adequate sample identification information included on each container label must be included on all field-generated records including: permanent field notebook, individual well log, groundwater elevation form, and chain-of-custody form. This field documentation demonstrates traceability of the containers and samples and links all ancillary records to specific sampling events.

Each sample is packed to ensure against leakage and breakage and to maintain individual sample integrity. All glass containers are secured individually with bubble wrap. All VOA sample vials are wrapped in bubble bags. Plastic bags are supplied by STL to hold ice necessary to maintain the samples at less than 6°C during transit. An attempt should be made by the field sampling team to pre-cool samples to 4°C prior to packing the sample cooler for shipment. Additional information regarding sample containers can be found in Section 4.0 and the appropriate SOP.

When applicable to the site, the following information is documented by the field technicians in the bound field notebook. This field documentation is reviewed, approved, and initialed by the field sampling manager prior to client submission.

Site location
Date/time of sampling
Sample identification (including specific location)
Sample sequence number
Site conditions Use of fuel powered units
Weather conditions
Description of QC samples collected
Names of personnel/visitors
Sampling/purging equipment used
Field analysis data
Field documentation techniques
Well casing composition and diameter
Drilling/boring method
Drilling well type/name
Water table and well depth

Purge volume calculations
Volume of water purged
Date/time of purging
Analytical data to monitor stabilization of well
Plumbing/tap material construction
Purging flow rate
Purging time
Flow rate at sampling collection
Depth samples taken
Beginning/ending time for composite sampling
Depth soil samples taken
Soil sampling technique used
Type/description of drums
Phases sampled in drums
Use of fuel powered units

5.4.4 Sample Documentation, Identification, and Login

A sequential identification number is assigned to the project and recorded on the chain-of-custody form, on each sample container submitted with the project, and in the bound Sample Registry (Figure 5.4). Accurate and complete sample documentation must be provided on the chain-of-custody form in order to log samples into the sample registry. The sample registry includes all information necessary to maintain chain of custody including laboratory ID, client (field) ID, and initials of the custody technician. Ancillary information such as sample collection date and requested analyses is transferred from the chain-of-custody form into the LIMS, and appears on the client project-specific acknowledgement.

The custody technician checks each sample against the chain-of-custody form for discrepancies between information on the sample label and information provided on the chain-of-custody form (Figure 5.1). The custody technician also inspects all samples for leakage or obvious seal tampering (if provided). All samples are unpacked in a well-ventilated sample receipt area. Face shields are available to each sample receipt staff member for use with any hazardous samples. Samples which appear to be accumulating or evolving gas are treated cautiously and inspected under a chemical hood.

A space labeled "custody intact" provided on the chain-of-custody form is used to describe the sample condition upon receipt. A "Y" indicates no custody problem was identified and an "N" indicates samples or container integrity was compromised and client notification and corrective action is required. At client request, a "Cooler Receipt Form" (Figure 5.5) can be completed to document custodial concerns at sample login.

Discrepancies noted by the custody staff are communicated to the project and sample manager and are resolved with the client prior to laboratory work assignment. Discrepancies are documented on the Anomaly Report. The project manager and the custody department staff should attempt to resolve custody discrepancies expeditiously to avoid compromising hold times. After a decision concerning a sample has been made, the project manager or sample manager makes an initialed note on the original custody form which states person notified, time, date, and resolution, if applicable. This information is also documented on the Anomaly Report. A faxed or hard copy of custodial resolutions or project order alterations should be secured from the client prior to work initiation. Copies of this documentation are mailed to the client and maintained in the client file.

A sample barcode label containing the project number and sample designation is affixed to each container. The barcode label contains the following information:

- STL Savannah project log number (e.g., S242450)
- COC designation for the different field samples (e.g., S242450-1, S242450-2, S242450-3, etc.)
- sample designation for each container for a particular field sample(e.g., S242450-1A, S242450-1B, S242450-2A, etc.)
- barcode relating this information to the LIMS login

The barcode allows laboratory personnel to track the disposition of the sample from receipt into the laboratory until disposal.

5.4.5 Sample Preservation Checks and Storage

After the sample containers are labeled, the samples are distributed to the appropriate laboratory section. Samples are relinquished to the laboratory section from the custody department. This transfer is documented on the Sample Internal Custody Log. The samples are then transferred to the storage area or, if required, checked for proper preservation as soon after receipt as possible and then placed in storage areas. The preservation is documented and, if necessary, adjusted. Discrepancies are documented on the Anomaly Report.

Samples are logged into the department storage areas using barcode readers. The barcode system is also used to track the disposition of the samples when the sample is removed from the storage area, the sample is returned from the storage area after use, the sample container is empty, and the sample is removed from the storage area for disposal. Bound sample storage temperature logs are maintained for all sample storage refrigerators to ensure proper temperature maintenance throughout the analytical process.

5.4.6 Sample Security, Accessibility, Distribution, and Tracking

Only authorized personnel are permitted within the laboratory areas where samples are stored. Sample storage areas are designed to segregate volatile and nonvolatile samples. Standards and extracts are also departmentally controlled and stored separately.

After sample registry login and verification, samples are relinquished from the receiving area to the appropriate sample analysis storage area. Transfer of samples from the sample receipt personnel to the department is documented on the Sample Internal Custody Log (Figure 5.6). Interdivisional sample custody is documented on the Remote Division Sample Internal Custody Log (Figure 5.7). Using LIMS-generated sample preparation worksheets for guidance, samples are extracted, digested, or distilled as appropriate. The extracts, digestates, or distillates are then transferred and relinquished to the appropriate analysis section, where analysis is performed.

For projects where in-laboratory custody records are required by the client, the project manager and custody department will coordinate the documentation of these records.

Sample holding times are tracked via the LIMS. Sample collection dates are entered into the LIMS with all sample logins. This information allows holding times specific to each department analysis to be tracked by department managers, supervisors, chemists, and analysts through the use of daily status sheets, reference sheets, and preparation worksheets. Date analyzed is recorded via instrument outputs or analysis forms/logs when applicable as an integral part of the raw data. For projects in which reporting the analysis or preparation date is appropriate, the dates are entered into the LIMS.

5.4.7 Interdivisional Custody

The laboratory manager monitors the sample load and turnaround time through LIMS-generated reports. If it appears that analysis demand will exceed capacity, samples may be transferred (provided client contracts or arrangements, project QA plans or certification limitations do not prohibit sample transfer) to another STL division to ensure that holding times and turnaround commitments are met. The procedures used by STL are described in SOP CU20: *Interlaboratory Sample Exchange* and are summarized below.

If samples are transferred to another division laboratory, full custody is maintained. A completed and signed fax of the Interdivisional Shipping Log is sent to the receiving division custody department. Special LIMS determination codes specific to each laboratory location are utilized to enable the project manager and laboratory director to track sample progress and maintain chain of custody. Copies of the original chain-of-custody form (executed for interdivisional sample submittal), computerized LIMS order information (LOI), and extract or digest preparation logs pertinent to the project order accompany the samples or sample preparations. The accompanying documentation also includes dates of sample preparation and requested analyses.

5.4.8 Sample Disposal

All waste disposal is carried out in accordance with SOP CA70: *Waste Management*. This document includes procedures for identification, storage, personnel training, tracking forms, report forms, safety, as well as details of the disposal.

After analysis completion, unused sample portions, extracts, or digests are transferred to a central secured storage area to await disposal. Unless a client requests the project manager to save unused samples, digests, or extracts, disposal from the central storage occurs as soon as holding times have expired or three weeks after results submission.

Requests for extended sample, digest, or extract storage must be provided by the client to the STL project manager in writing (or contract form) prior to sample receipt. Extended storage may result in additional fees to be negotiated by the STL project manager prior to sample receipt. STL is not responsible for evaporation or other deterioration of samples, extracts, or digests during extended storage periods.

Samples which are requested to be returned to the client may be picked up at the laboratory by the client, shipped by courier (at the client's expense for packaged shipping), or returned by any other legal means that is arranged by the client. Clients requesting the return of samples should provide detailed shipping instructions.

If a client by contract requires that samples be disposed of by a hazardous waste contractor, the client's name and EPA ID number are used on the manifest and the client is billed for all disposal related costs.

5.4.9 Sample Disposition Documentation

Upon completion of analytical work, sample custody of unused sample portions, extracts, or digests is relinquished to a central secured storage area. Here the samples, digests, or extracts await disposal, which is performed with the assistance of the LIMS. The LIMS stores clients' specific disposal instructions, compiles results from the analyses of composited samples, prepares sample disposal lists, invoices for disposal and sample return costs, and provides a disposal record for all excess samples.

FIGURE 5.1

Serial Number 04509

SEVERN TRENT STL

ANALYSIS REQUEST AND CHAIN OF CUSTODY RECORD

STL Savannah
5102 LaRoche Avenue
Savannah, GA 31404

Website: www.stl-inc.com
Phone: (912) 354-7858
Fax: (912) 352-0165

Alternate Laboratory Name/Location

Phone:
Fax:

PROJECT REFERENCE	PROJECT NO.	PROJECT LOCATION (STATE)	MATRIX TYPE
STL (LAB) PROJECT MANAGER	P.O. NUMBER	CONTRACT NO.	
CLIENT (SITE) PM	CLIENT PHONE	CLIENT FAX	
CLIENT NAME	CLIENT E-MAIL		
CLIENT ADDRESS			
COMPANY CONTRACTING THIS WORK (if applicable)			

REQUIRED ANALYSIS

PAGE OF

STANDARD REPORT DELIVERY ○

DATE DUE _____

EXPEDITED REPORT DELIVERY (SURCHARGE) ○

DATE DUE _____

NUMBER OF COOLERS SUBMITTED PER SHIPMENT:

SAMPLE DATE	SAMPLE TIME	SAMPLE IDENTIFICATION	COMPOSITE (C) OR GRAB (G) INDICATE	AQUEOUS (WATER)	SOLID OR SEMISOLID	AIR	NONAQUEOUS LIQUID (OIL, SOLVENT,...)	NUMBER OF CONTAINERS SUBMITTED	REMARKS

RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME	RELINQUISHED BY: (SIGNATURE)	DATE	TIME
RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME	RECEIVED BY: (SIGNATURE)	DATE	TIME

LABORATORY USE ONLY

RECEIVED FOR LABORATORY BY:	DATE	TIME	CUSTODY SEAL NO.	SITE MANAGER LOG NO.	LABORATORY REMARKS

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FIGURE 5.2

STL Savannah • 5102 LaRoche Avenue • Savannah, GA 31404 • Tel 912 354 7858 • Fax 912 351 3673 • www.stl-inc.com

Shipping Address: STL Savannah
5102 LaRoche Avenue
Savannah, GA 31404
Attn: Mr. Joe Smith

Phone No: (912)354-7858

Account No:

Date of Shipment: 01/30/03

Method of Shipment: UPS

Project Reference: EXAMPLE PROJECT

Project Site Location: GA

Ship Origin: Savannah

SAMPLE CONTAINER REQUEST FORM

AQUEOUS															NONAQUEOUS				
O	R	LB	LB												O	O	O	O	PRESERVATIVES
L n/m amber glass w/TFE	250 mL m/m naigene	125 mL m/m amber glass w/TFE	40 mL vial w/TFE												250 mL w/m plastic	250 mL w/m glass	125 mL w/m clear glass w/septa	EnCore Samplers 5g	Lab Sp. Rec. by: Date: Time: Lab Sp. Checked by: Quantity of Lab Pkg. Shipped: Proj Mgr. Steve White Coordinator: Comments:
2	1	1	3												1	1	1	3	NO. OF CONTAINERS SHIPPED
2	1	1	3												1	1	1	3	NO. OF CONTAINERS RECEIVED
1	1	1	1												1	1	1	1	NO. OF SAMPLES
																			STYLE OF TRIP BLANK USED
SVOC	METALS	TOC	VOC												METALS/CYANIDE	SVOC	VOC	ENCORE SAMPLERS	ANALYSIS

It is the shipper's responsibility to ensure samples are maintained at the appropriate temperature during transit.

PRESERVATION COLOR CODE KEY

RED(R)	HNO3	CAUTION! STRONG OXIDIZER! CONTAINS NITRIC ACID. Avoid skin and eye contact. If contact is made, FLUSH IMMEDIATELY with water.
ORANGE(O)	NONE	No preservatives added.
LT.BLUE(LB)	HCL	CAUTION! CONTAINS HYDROCHLORIC ACID. Avoid skin and eye contact. If contact is made, FLUSH IMMEDIATELY with water.

DO NOT inhale vapors that may be caused from a chemical reaction between the preservative and sample. Collect sample in a well-ventilated area or use appropriate breathing apparatus. NEVER RINSE sample containers. If skin contact with preservatives occurs, flush exposed areas IMMEDIATELY.

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FIGURE 5.3

ANOMALY REPORT

Date: _____ Log #: _____ Sample ID: _____ Client: _____

Dept: ___ EX ___ GE ___ LC ___ ME ___ RA
___ CU ___ SG ___ SM ___ VG ___ VM ___ AI

Analysis: _____ Reported by: _____

Anomaly:

☐ Sample matrix is different than indicated by log-in.

Logged in as	*Best described as*	
Water	*Water*	*Non-aqueous liquid*
Soil	*Soil*	*Sludge*
Oil	*Oil*	*Product*
	Other _____	

☐ Sample was received with inadequate preservation, and was preserved upon receipt.

☐ Sample received in an incompatible sample container. ___ *glass* ___ *plastic* ___ *other* _____

☐ MS/MSD failed while the LCS/LCSD passed criteria, for a drinking water parameter. Method indicates data qualification.

☐ Target analyte(s) detected in drinking water sample. (Describe below)

☐ Sample exhibits gross non-homogeneity. (Describe below)

☐ Insufficient sample received for analysis.

☐ Data qualifier needed. Discuss with DM/LM before reporting.

☐ Grand Mean exception was utilized for Initial Calibration (specify compounds). (SW-846 Only)

☐ Grand Mean exception was utilized for Continuing Calibration (specify compounds). (SW-846 Only)

Other _____

Custody: ***ALWAYS ATTACH A COPY OF COC WITH HIGHLIGHTED DEFICIENCY**

☐ Sample description discrepancy between COC & Container ☐ Custody seals broken

☐ Sample container breakage ☐ Incomplete COC

☐ Cooler temp >6°C or frozen ☐ Sample container partially filled

☐ Sample received not listed on COC ☐ Improperly preserved sample

Comments:

Client Notified: ☐Yes ☐No
Contact:

Date:

Resolution:

Route to:

Project Manager: _____

STL Facility: Savannah_____ Mobile_____ Tampa West_____ Tallahassee_____

FAN038:10.12.01:6

FIGURE 5.4

SAMPLE REGISTRY

LOG NO.	TIME RECEIVED	DATE RECEIVED	DELIVERED BY	CLIENT ID	NUMBER OF COOLERS RECEIVED	INITIATE ANOMALLY? Y/N	CONTAINER TEMPERATURE CORRECT	ADDITIONAL SAMPLE *INFORMATION*

FIGURE 5.5

COOLER RECEIPT FORM	
Client:	Project:
STL Log #:	Date Received:
Sample Custodian (Signature):	

Use other side of this form to note details concerning custodial discrepancies

		YES	NO
1	Did a shipping slip (air bill, etc.) accompany the cooler shipment?		
2	Were custody seals affixed to the outside of cooler? If YES, enter the following: Seal Identification (if provided):		
3	Were custody seals unbroken and intact at the date and time of arrival?		
4	Were custody papers completed properly (ink, signed, etc.)?		
5	Chain of custody associated with cooler receipt form.		
6	Was wet ice/blue ice used? (Circle which media)		
7	Cooler temperature upon receipt:		
8	Describe type of packing in cooler (vermiculite, bubble pack, etc.).		
9	Were sampling containers supplied by SL or client? (Circle which one)		
10	Did all bottles arrive intact and were labels in good condition?		
11	Did all bottle labels agree with custody papers?		
12	Were bubbles present in VOA samples?		
13	Was the project manager notified of any custody discrepancies or excursions?		
14	Was a custody excursion form completed and a copy provided to the project manager? If so, complete No. 15.		
15	Who was contacted? By whom: Date:		

FIGURE 5.6

SAMPLE INTERNAL CUSTODY LOG

STL LOG NO._____
CLIENT:_____ COURIER:_____
COOLERS/CLIENT:_____ TEMPERATURE_____

GENERAL CONTAINER TYPE	P	#	METALS CONTAINER TYPE	P	#	VOLATILE CONTAINER TYPE	P	#	EXTRACTION CONTAINER TYPE	P	#
LIQUID			LIQUID			LIQUID			LIQUID		
L N/M PLASTIC			500 M/M PLASTIC			40 ML VIAL			L N/M AMB GLASS		
250 AMB GLASS			250 M/M PLASTIC			SOIL			250 M/M AMB GLASS		
500 M/M PLASTIC			100 M/M PLASTIC			ENCORE SPLERS/25g			500 M/M AM GLASS		
500 M/M AMB GLASS			SOIL			ENCORE SPLERS/5g			500 M/M PLASTIC		
250 N/M PLASTIC			L W/M PLASTIC			125 AMB W/M W/SEPTA			250 M/M PLASTIC		
250 N/M PLASTIC			500 W/M PLASTIC			125 AMB W/M GLASS			SOIL		
250 M/M NALGENE			250 W/M PLASTIC			AIR			L W/M GLASS		
125 M/M AMB GLASS			OTHER			TEDLAR BAG			500 W/M GLASS		
100 M/M PLASTIC						SUMMA CANS			250 M/M GLASS		
DO BOTTLE						VACUUM CANS			OTHER		
SOIL						TUBES					
250 M/M NALGENE						OTHER					
OTHER											
						PLEASE VERIFY					
PLEASE VERIFY	4		PLEASE VERIFY	4		TOTAL CONTAINERS	4		PLEASE VERIFY	4	
TOTAL CONTAINERS			TOTAL CONTAINERS						TOTAL CONTAINERS		

RELINQUISHED INFORMATION:

CUSTODY INITIAL/DATE _____ CUSTODY INITIAL/DATE _____ CUSTODY INITIAL/DATE _____ CUSTODY INITIAL/DATE _____

GENERAL INITIAL/DATE _____ METALS INITIAL/DATE _____ VOLATILES INITIAL/DATE _____ EXTRACTION INITIAL/DATE _____

MISC. BOTTLES STORED IN REFRIGERATOR FOR SUBCONTRACT/REMOTE TRANSFER:
_____
_____

FIGURE 5.7

REMOTE DIVISION
SAMPLE INTERNAL CUSTODY LOG

STL DIVISION_____
COOLERS_____
TEMPERATURE(S)_____

LOG # FOR GENERAL LAB	#	LOG # FOR METALS LAB	#	LOG # FOR VOLATILES LAB	#	LOG # FOR EXTRACTION LAB	#
PLEASE VERIFY 4		PLEASE VERIFY 4		PLEASE VERIFY 4		PLEASE VERIFY 4	
TOTAL CONTAINERS		TOTAL CONTAINERS		TOTAL CONTAINERS		TOTAL CONTAINERS	

RELINQUISHED INFORMATION:

CUSTODY INITIAL/DATE _____ CUSTODY INITIAL/DATE _____ CUSTODY INITIAL/DATE _____ CUSTODY INITIAL/DATE _____

GENERAL INITIAL/DATE _____ METALS INITIAL/DATE _____ VOLATILES INITIAL/DATE _____ EXTRACTION INITIAL/DATE _____

6.0 ANALYTICAL PROCEDURES AND INSTRUMENTATION

The ultimate responsibility for selection of the analytical method lies with the client or regulatory agencies. Whenever possible, laboratory and field analysis of all samples is conducted in accordance with EPA-approved methodology or guidance. Interpretation of ambiguous or conflicting method requirements is accomplished by consulting with regulatory agencies and EPA technical and quality assurance personnel. When EPA approved methods do not exist or project data quality objectives require alternative methods or modifications of EPA methods (i.e., to achieve lower reporting limits), methods are modified on a project-by-project basis with the approval of the client or regulatory agency.

For Gas Chromatographic (GC) methods, which have long lists of targets, have peaks that co-elute, or are subject to matrix interferences (e.g.. Methods 8021, 604/8041), STL recommends the guidance in SW846, which states that gas chromatography/mass spectrometry (GC/MS) methods are preferred, provided project reporting detection limits are met and costs are not appreciably different. This practice will usually result in fewer false positive detects and more accurate and defensible results.

A detailed SOP has been prepared for each routine analytical method. If multiple versions of a reference method exist (e.g., 6010A, 6010B, etc.), the SOP will reflect the different requirements of each version or an SOP will be prepared for each version. Any modifications to the approved methodology are described in the SOP. Copies of the SOP are approved by laboratory management and issued under document control. A master copy of each SOP is retained by the laboratory's QA Department and are made available to each staff member involved in the procedure.

When new, routine analytes are added to an established procedure or when a new, routine method is developed, data for the analyte or method are generated, reviewed, and documented in accordance with SOP AN52: *Test Procedures for Method Development and Modification*. The main elements of SOP AN52 are:

-Preparation or modification of an SOP, if required (SOP AN01)
-Performance and evaluation of the Initial Demonstration of Capability (SOP CA92)
-Performance of an MDL Study (SOP CA90)

6.1 Laboratory Glassware

6.1.1 Volumetric Glassware

STL employs appropriate glassware for all preparatory and analytical operations. For critical measurements, such as standard preparation, Class A volumetric glassware is used when practical. Exceptions include the use of volumetric syringes for volatiles standards preparation and polypropylene volumetric flasks for metals standards.

6.1.2 Glassware Cleaning Procedures

Laboratory glassware washing procedures are adapted from SW-846, *40 CFR Part 136, Standard Methods*, and EPA 600/4-79-109. The procedures are given in SOP AN60: *Glassware Cleaning Procedures* and are summarized as follows:

Extractable Organics
Precleaned, certified, disposable glassware is routinely utilized for extraction and extract storage. If non-disposable vessels are used, the glassware is washed with hot water and a non-phosphate detergent. The glassware is scrubbed vigorously with a brush to remove all artifacts and rinsed three (3) times with tap water. The glassware is allowed to air dry whenever possible and stored inverted or with cap openings covered with aluminum foil or glass stoppers to exclude dust and other contaminants.

Volatile Organics
Precleaned, certified disposable glassware is routinely utilized. If non-disposable vessels are used, the glassware is washed with tap water and non-phosphate detergent, rinsed thoroughly with organic free water, and oven dried at 110°C-120°C for at least two hours. Class A volumetric glassware is air-dried. Caps and septa are washed in the same manner, but caps are air-dried. Highly contaminated glassware is allowed to soak in Nochromix solution overnight, then washed as above.

General Chemistry and Microbiology
Precleaned, certified disposable glassware is routinely utilized for the sample preparation. If non-disposable vessels are used, the glassware is washed with hot tap water and non-phosphate detergent, rinsed thoroughly with tap and deionized water, air dried, and stored inverted or with cap openings covered with foil. Tubes for TKN and total phosphorus sample digestions are washed with hot water and phosphate free detergent, and rinsed with tap water, Nochromix, and deionized water.

Bateriological laboratory glassware and collection bottles are autoclaved as described in analytical procedures or purchased presterlized (disposable).

Metals

Precleaned, certified disposable glassware is routinely utilized for digestion and digestate storage. If non-disposable vessels are used, the glassware, plastic, and Teflon items are washed in hot tap water and phosphate-free detergent. They are then rinsed with tap water, 1:1 nitric acid, tap water, and deionized water. For highly contaminated samples, it is recommended that Teflon beakers used for sample digestion are further decontaminated by adding 20mL nitric acid and 12mL hydrochloric acid, covered with a watch glass, and digested on a hot plate for two hours. Following this treatment, they are rinsed with 10% nitric acid and deionized water and allowed to air dry.

6.2 *Standard and Reagent Receipt and Traceability*

Standards are purchased from commercial sources in stock solutions or mixes designed for the specific methods or as neat analytes. Certificates of analysis are shipped with each standard material by the vendor. When possible, standards are certified to meet or exceed the criteria established by the US EPA or are traceable to NIST standards.

Standard traceability logbooks are maintained by all sections of the laboratory to track the receipt, preparation, and disposition of all standard materials. A lot number is assigned to each standard material and the lot number is documented in the standard traceability logbook along with date of preparation, initials of analyst, concentration, expiration date (if applicable), and solvent (if applicable). If required, a standard preparation narrative is also provided in this logbook to document the preparation steps for each stock standard.

6.2.1 Standard Sources and Preparation

STL maintains an inventory of standard materials necessary to calibrate and verify all analytical systems. Field instruments requiring calibration standards (conductivity meters and pH meters) use the same sources as laboratory instrumentation. Documentation of standard preparation is performed in accordance with SOP AN41: *Standard Material Traceability*. This SOP also provides guidance for extending the expiration date of standards.

6.2.2 Reagent Storage and Documentation

Reagents are stored with consideration for safety and maximum shelf life.

All acids, except those poured up in small marked containers for immediate use, are stored in the original containers in acid storage cabinets.

All bases, except those poured up in small containers for immediate use and those that are standardized for specific purposes, are stored in the original containers within designated areas or storage cabinets.

All flammable solvents, except those poured up for immediate use, are stored in original containers in approved vented flammable storage cabinets which are located indoors.

Dry reagents are stored in designated cabinets in cool, dry areas. Reactive chemicals, cyanides, and sulfides are labeled and isolated from other chemicals.

All acids used for metal sample digestions and solvents used for semivolatile sample extraction are tested prior to initial use. Specific acceptable chemical lots are reserved and stored by the vendor(s) and are requisitioned as needed by the laboratory. Lot numbers used for digestion or extraction are recorded in bound notebooks in the appropriate departments.

Reagent blanks are analyzed with each sample batch for all methods, validating the purity of all reagents. All reagent containers are dated when received and dated and initialed when opened (except high use items consumed in less than one week). Documentation is maintained to provide traceability of the reagents used with the analysis of any batch to specific reagent lot numbers in accordance with SOP AN44: *Reagent Traceability*.

6.2.3 Waste Disposal

STL Savannah operates as a small quantity generator of hazardous waste. All waste disposal is carried out in accordance with SOP CA70: *Waste Management*. This document includes procedures for identification, storage, personnel training, tracking forms, report forms, safety, as well as details of the disposal.

6.3 Instrument Calibration Procedures

STL Savannah's laboratories are equipped with state-of-the-art instrumentation to provide quality analytical data to clients. A list of the major instrumentation maintained by STL Savannah is found in Table 7.1. This list may change periodically. A current instrument list is available upon request.

The calibration procedures for various analytical methods are summarized below. CLP protocols are followed as written in the statement of work (SOW).

6.3.1 Metals

Metals are analyzed by the following protocols: 200-series are primarily for drinking water and for NPDES compliance, 6000 and 7000-series are primarily for RCRA testing, and CLP protocols are primarily for hazardous waste site monitoring. It should be noted that EPA has promulgated two versions of EPA method 200.7: one for drinking water and the other for NPDES compliance testing.

6.3.1.1 ICP (Inductively Coupled Plasma - Atomic Emission)

The inductively coupled plasma atomic emission spectrophotometer is standardized daily with a single concentration standard solution containing the metals of interest and a calibration blank. Multi-point calibrations with a minimum of three standards encompassing the concentration range of interest are analyzed annually and are on file for each ICP. The calibration curve demonstrates the linearity of each metal over the standardization range. Continuing calibration verification (CCV) standards are analyzed after every 10 samples and at the end of the sequence and must meet the acceptance criteria. A calibration blank (ICB or CCB) is analyzed immediately after the verification standards and must meet the acceptance criteria.

After the instrument is standardized, the following calibration verification checks are performed:

Calibration Check	6010	200.7 (NPDES)	200.7 (Drinking Water)
Re-analysis of Standards	+/-5% of true value	+/-5% of true value	+/-5% of true value
Initial Calibration Verification (ICV)	+/-10% of true value	+/-5% of true value	+/-5% of true value
Initial Calibration Blank(ICB)	<RL (<MDL)	<RL (<MDL)	<RL (<MDL)
RL Standard	Detected; +/-50% of true value	Detected; +/-50% of true value	Detected; +/-50% of true value
Interference Check Solutions A and AB	+/-20% of true value	+/-20% of true value	+/-20% of true value
Continuing Calibration Verification (CCV)	+/-10% of true value	+/-5% of true value	+/-10% of true value
Continuing Calibration Blank (CCB)	<RL (<MDL)	<RL (<MDL)	<RL (<MDL)

All sample results must be bracketed by acceptable calibration standards.

6.3.1.2 AA (Atomic absorption)

Atomic absorption spectrophotometers are calibrated daily with the specified number of calibration standards, including a calibration blank. The correlation coefficient of the regression curve must be greater than or equal to 0.995. An initial calibration verification (ICV) standard is analyzed immediately upon calibration and must meet acceptance criteria. Continuing calibration verification (CCV) standards are analyzed after every 10 samples and at the end of the sequence and must meet the acceptance criteria. A calibration blank (ICB or CCB) is analyzed immediately after the verification standards and must meet the acceptance criteria.

GFAA (Graphite furnace atomic absorption)

Calibration Check	7000-series	200-series	200.9
Minimum number of calibration points	4	4	4
Initial Calibration Verification (ICV)	+/-10% of true value	+/-10% of true value	+/-5% of true value
Initial Calibration Blank(ICB)	<RL (<MDL)	<RL (<MDL)	<RL (<MDL)
Continuing Calibration Verification (CCV)	+/-20% of true value	+/-10% of true value	+/-10% of true value
Continuing Calibration Blank (CCB)	<RL (<MDL)	<RL (<MDL)	<RL (<MDL)

All sample results must be bracketed by acceptable calibration standards.

CVAA (Cold vapor atomic absorption-Mercury)

Calibration Check	7000-series	200-series
Minimum number of calibration points	6	4
Initial Calibration Verification (ICV)	+/-10% of true value	+/-5% of true value
Initial Calibration Blank(ICB)	<RL (<MDL)	<RL (<MDL)
Continuing Calibration Verification (CCV)	+/-20% of true value	+/-10% of true value
Continuing Calibration Blank (CCB)	<RL (<MDL)	<RL (<MDL)

All sample results must be bracketed by acceptable calibration standards.

6.3.1.3 ICP-MS (Inductively Coupled Plasma-Mass Spectrometry)

The inductively coupled plasma mass spectrometer is calibrated with a minimum of three standards and a calibration blank. Continuing calibration verification (CCV) standards are analyzed after every 10 samples and at the end of the sequence and must meet the acceptance criteria. A calibration blank (ICB or CCB) is analyzed immediately after the verification standards and must meet the acceptance criteria.

Calibration Check	6020	200.8
Mass Calibration Verification -Resolution Check Verification	+/- 0.1amu <0.9amu full width at 10% peak height	+/- 0.1amu Approximately 0.75amu at 5% peak height
Initial Calibration Criterion	Correlation Coefficient >=0.995	Correlation Coefficient >=0.995
Initial Calibration Verification (ICV)	+/-10% of true value	+/-10% of true value
Initial Calibration Blank(ICB)	<RL (<MDL)	<RL (<MDL)
RL Standard	Detected; +/-50% of true value	Detected; +/-50% of true value
Linear range standard	+/-10% of true value	+/-10% of true value
Interference Check Solutions A and AB	+/-20% of true value (advisory limits)	+/-20% of true value (not required)
Continuing Calibration Verification (CCV)	+/-10% of true value	+/-10% of true value
Continuing Calibration Blank (CCB)	<RL (<MDL)	<RL (<MDL)

All sample results must be bracketed by acceptable calibration standards.

6.3.2 General Chemistry

6.3.2.1 Autoanalyzer

The autoanalyzer is calibrated with a minimum of five calibration standards at least every six months (some procedures/instruments may require daily calibration). The correlation coefficient of the curve must be greater than or equal to 0.995 using a regression fit. Calibration verification standards are analyzed immediately following the calibration standards (initial or continuing), after every 10 samples, and at the end of each run. Sample analyses must be bracketed by calibration verification standards that meet control criteria. The calibration curve is verified each day that analyses are performed by the analysis of a midpoint standard.

6.3.2.2 Ion Chromatography (IC)

Initial calibration is performed upon instrument startup and whenever the continuing calibration verification standard fails the acceptance criteria. A calibration curve is prepared for all target analytes with the lowest standard concentration at or below the reporting limit and the remaining standards defining the working range of the detector. Either linear regression or quadratic curve fitting is used, depending on the analyte. The regression correlation coefficient must be greater than or equal to 0.99 for any analyte to be used for quantitation. Calibration verification standards are analyzed immediately upon calibration, after every 10 samples, and at the end of each run. Sample analyses must be bracketed by calibration verification standards that meet the acceptance criteria.

6.3.2.3 Ultraviolet-Visible (UV-VIS) Spectrophotometer

The spectrophotometer is calibrated with a minimum of five standards at least every six months (some procedures/instruments may require daily calibration). The correlation coefficient of the curve must be greater than or equal to 0.995 using a regression fit. Independent calibration verification standards are analyzed immediately following the calibration standards (initial or continuing), after every 10 samples, and at the end of each run. Data must be bracketed by calibration verification standards that meet control criteria. The calibration curve is verified each day that analyses are performed by the analysis of a standard at the midpoint of the calibration curve and by the analysis of a standard at the reporting limit of the target analyte(s). The standard at the midpoint must be ±10% of the true value of the standard and the standard at the reporting limit must be detected.

6.3.2.4 Infrared (IR) Spectrophotometer

The infrared spectrophotometer is calibrated with a minimum of five standards at least every six months (some procedures/instruments may require daily calibration). The correlation coefficient of the curve must be greater than or equal to 0.995 using a regression fit. Independent calibration verification standards are analyzed immediately following the calibration standards (initial or continuing), after every 10 samples, and at the end of each run. Data must be bracketed by calibration verification standards that meet control criteria. The calibration curve is verified each day that analyses are performed by the analysis of a standard at the midpoint of the calibration curve and by the analysis of a standard at the reporting limit of the target analyte(s). The standard at the midpoint must be ±10% of the true value of the standard, and the standard at the reporting limit must be detected.

6.3.2.5 Turbidimeter

Initial calibration is performed upon instrument startup and whenever the continuing calibration verification standard fails the acceptance criteria. Gelex solid standards are calibrated against formazin standards initially and then quarterly. The instrument is calibrated daily with one Gelex standard for each range of interest. A mid-range calibration verification standard is analyzed for every 10 samples and must meet control criteria in order for bracketed data to be acceptable.

6.3.2.6 Conductivity Meter

The cell constant of each meter is determined annually, at a minimum, by the analysis of five KCl standards. To verify the cell constant, a verification standard is analyzed at the beginning of each working day, using a KCl standard in the expected range of the samples. For meters not having automatic temperature compensation, all samples are analyzed at 25 C ± 2 C.

6.3.2.7 pH Meter

The pH meter is calibrated daily with two standard buffers at pH 7.0 and either 4.0 or 10.0, and checked with a third buffer at 10.0 or 4.0, which must indicate ± 0.10 pH units of its given value. A calibration verification standard is analyzed immediately upon calibration and after every 10 samples. Acceptable calibration verification standards must bracket the sample analyses. Manual or automatic temperature compensation is performed, depending on the meter. Additional checks of the pH meter must be performed with buffers other than 4 or 10 if samples are outside the pH range of 4-10.

6.3.2.8 Total Organic Carbon (TOC)

The instrument is calibrated according to the manufacturer's recommendations, with a minimum of a single point calibration daily. A calibration verification standard is analyzed immediately upon calibration, after 10 samples, and at the end of each run. Sample analyses must be bracketed by acceptable calibration verification standards.

6.3.2.9 Ion Selective Electrode (ISE)

Ion selective electrodes are calibrated daily with a minimum of five standards. The calibration curve is established by linear regression applied to the log of the standard concentrations versus potential and must result in a correlation coefficient greater than or equal to 0.995. Calibration verification standards are analyzed immediately upon calibration, after every 10 samples, and at the end of each run. Data must be bracketed by calibration standards that meet control criteria to be acceptable.

6.3.2.10 Total Organic Halogens (TOX) /Absorbable Organic Halides (AOX)

Although the TOX/AOX instrument provides an "absolute" measurement of halogen, a six-point calibration curve (five point and a calibration blank) is analyzed to confirm the accuracy of the instrument readout. The coefficient of variation (percent relative deviation) must be less than or equal to 20% to confirm the validity of the calibration curve. The TOX/AOX calibration is verified by periodic analysis of a precision and recovery (PAR) standard, a mid-level calibration check standard.

6.3.2.11 Bomb Calorimeter

The energy equivalent of the bomb calorimeter is determined quarterly by bombing six standard benzoic acid tablets. A control standard is analyzed in duplicate for every batch of samples, and must meet control criteria in order for data to be acceptable.

6.3.2.12 Dissolved Oxygen (DO) Meter

DO meters are calibrated prior to use either by Winkler titration or the air calibration technique.

6.3.2.13 Temperature

Laboratory and field thermometers are calibrated annually by comparison with a NIST-certified thermometer. Digital thermometers are calibrated quarterly. Field meters with automated temperature compensation are checked before use with a calibrated thermometer.

6.3.3 Gas Chromatography (GC)

6.3.3.1 Volatiles by GC (VG)

Volatile organic compounds (VOC) are analyzed by the following protocols: 600-series are primarily for NPDES compliance; and 8000-series are primarily for RCRA testing. These analyses are generally performed using internal standard calibration and quantitation; therefore relative retention time, as defined in the respective SOPs, will be used to determine the identification of the target compounds and bracketing by CCV will not be required unless specified in the method or QAPP. If external standard calibration is used, the absolute retention time window is calculated as three times the standard deviation obtained from a 72-hour sequence or default windows of 0.05 to 0.10 minutes are used for compounds where the calculated window is too restrictive or zero. Bracketing by CCV will be required for external standard calibrations if specified in the method, SOP, or QAPP.

Initial calibration (ICAL) is performed upon instrument startup and whenever the continuing calibration verification standard fails the acceptance criteria. A calibration curve is prepared for all target compounds with the lowest standard concentration at or below the reporting limit and the remaining standards defining the working range of the detector. After the initial calibration standards are injected, a calibration curve is constructed using either internal standard or external standard methodology. The analyst inspects the curves before proceeding with sample analysis. The correlation coefficient or coefficient of determination of the calibration curve must be greater than or equal to 0.99. An alternative to quantitation from a calibration curve is quantitation from an average response factor. If the %RSD is less than or equal to the acceptance criteria, the average response factor can be used for quantitation.

A midpoint calibration verification standard (CCV) must be analyzed periodically as a check on the validity of the initial calibration. If the percent difference or percent drift is within the acceptance criteria, the curve

is acceptable for quantitation of samples.

The analysis of acidified samples causes acidification of the purge and trap instrument gas lines that results in loss of response for 2-chloroethyl vinyl ether. 2-Chloroethyl vinyl ether is also completely degraded by the acid (HCl) added to samples at the time of collection. No corrective action will be taken when 2-CEVE fails initial or continuing calibration criteria except when the compound is not detected in the calibration or calibration verification standards or the samples for the analysis of 2-CEVE are not preserved with acid.

Calibration Check	600-series	8000-series
Initial calibration -minimum calibration standards	3	5
%RSD criteria (1)	<=10%	<=20% (with exceptions noted below)
CCV criteria (%difference or %drift)	Within Q-table values	+/-15% (with exceptions noted below)
Frequency of CCV	Daily	Every 12 hours

8000-series ICAL grand mean exception:
If one or more compounds exceed the %RSD criteria, the average response factors can be used for quantitation if the average %RSD of ALL of the compounds (the grand mean) in the ICAL is less than or equal to 20% and no single compound exceeds 3X the initial calibration criteria.

8000-series CCV grand mean exception:
If one or more compounds exceed the %drift or %difference criteria, the average response factor from the initial calibration can be used for quantitation if the average %drift or %difference of ALL of the compounds (the grand mean) in the CCV is less than or equal to 15% and no single compound exceeds 3X the continuing calibration criteria.

External Standard CCV: Samples analyzed by external standard calibration require bracketing by CCV. If the CCV standard analyzed after the samples fails to meet the acceptance criteria and the response of the mid point standard is *above* the criteria (that is the response of the analytical system has increased), samples which have no target compounds detected above the RL may be reported as <RL, since the compounds would have been detected if present. (SW-846 Method 8000B).

6.3.3.2 Semivolatiles by GC (SG)

Semivolatile organic compounds (SVOC) are analyzed by the following protocols: 500-series are primarily for drinking water; 600-series are primarily for NPDES compliance; 8000-series are primarily for RCRA testing; and the CLP protocols are used for hazardous waste site monitoring. If internal standard calibration is used; relative retention time, as defined in the respective SOPs, will be used to determine the identification of the target compounds and bracketing by CCV will not be required unless specified in the method or QAPP. If external standard calibration is used, the absolute retention time window is calculated as three times the standard deviation obtained from a 72-hour sequence, or default windows of 0.05 to 0.10 minutes are used for compounds where the calculated window is too restrictive or zero. Bracketing by CCV will be required for external standard calibrations if specified in the method, SOP, or QAPP.

Initial calibration (ICAL) is performed upon instrument startup and whenever the continuing calibration verification standard fails the acceptance criteria. A calibration curve is prepared for all target compounds with the lowest standard concentration at or below the reporting limit and the remaining standards defining the working range of the detector. After the initial calibration standards are injected, a calibration curve is constructed using either internal standard or external standard methodology. The analyst inspects the curves before proceeding with sample analysis. The correlation coefficient or coefficient of determination of the calibration curve must be greater than or equal to 0.99. An alternative to quantitation from a calibration curve is quantitation from an average response factor. If the %RSD is less than or equal to the

acceptance criteria, the average response factor can be used for quantitation.
A midpoint calibration verification standard (CCV) must be analyzed periodically as a check on the validity of the initial calibration. If the percent difference or percent drift is within the acceptance criteria, the curve is acceptable for quantitation of samples.

Calibration Check	500-series	600-series	8000-series
Initial calibration -minimum calibration standards	3 (as the calibration range is extended, the number of points must be increased)(1)	3	5
%RSD criteria(2)	<=20%	<=10%	<=20% (with exceptions noted below)
CCV criteria (%difference or %drift)	+/- 20%	+/-15%	+/-15% (with exceptions noted below)
Frequency of CCV	Every 12 hours	Daily	Every 12 hours

(1) An alternate single point calibration can be performed if the standard response is within 20% of the sample response.
(2) Alternatively, a regression curve may be constructed. If the correlation coefficient of the regression curve is greater than or equal to 0.99, the curve may be used for quantitation of samples.

8000-series ICAL grand mean exception:
If one or more compounds exceed the %RSD criteria, the average response factors can be used for quantitation if the average %RSD of ALL of the compounds (the grand mean) in the ICAL is less than or equal to 20% and no single compound exceeds 3X the initial calibration criteria.

8000-series CCAL grand mean exception:
If one or more compounds exceed the %drift or %difference criteria, the average response factor from the initial calibration can be used for quantitation if the average %drift or %difference of ALL of the compounds (the grand mean) in the CCV is less than or equal to 15% and no single compound exceeds 3X the initial calibration criteria.

External Standard CCV: Samples analyzed by external standard calibration require bracketing by CCV. If the CCV standard analyzed after the samples fails to meet the acceptance criteria and the response of the mid point standard is *above* the criteria (that is the response of the analytical system has increased), samples which have no target compounds detected above the RL may be reported as <RL, since the compounds would have been detected if present. (SW-846 Method 8000B).

6.3.4 Gas Chromatography/Mass Spectrometry (GC/MS)

6.3.4.1 Volatiles by GC/MS (VM)

Volatile organic compounds (VOC) are analyzed by the following protocols: 500-series are primarily for drinking water; 600-series are primarily for NPDES compliance; 8000-series are primarily for RCRA testing; and the CLP protocols are used for hazard waste site monitoring.

Hardware tuning is performed on each GC/MS prior to calibration as specified in the applicable EPA methods. Ion abundance acceptance criteria for VOC tuning with BFB are given below. Mass calibration is performed as an integral part of tuning.

The tune check and calibration check must be performed in the following intervals:

624 - Daily
8260/CLP - every 12 hours
524.2 - every 8 hours

VOLATILE ORGANIC GC/MS TUNING AND MASS CALIBRATION BROMOFLUOROBENZENE (BFB)			
	Ion Abundance Criteria		
m/e	524.2	624	8260/OLMO4.0(1)
50	15-40% of mass 95	15-40% of mass 95	8.0-40.0% of mass 95
75	30-80% of mass 95	30-60% of mass 95	30.0-66.0% of mass 95
95	Base peak, 100% relative abundance	Base peak, 100% relative abundance	Base peak, 100% relative abundance
96	5-9% of mass 95	5-9% of mass 95	5.0-9.0% of mass 95
173	< 2% of mass 174	<2% of mass 174	< 2.0% of mass 174
174	> 50% of mass 95	> 50% of mass 95	50-120% of mass 95
175	5-9% of mass 174	5-9% of mass 174	4.0-9.0% of mass 174
176	> 95% but < 101% of mass 174	> 95% but < 101% of mass 174	93.0-101.0% of mass 174
177	5-9% of mass 176	5-9% of mass 176	5.0-9.0% of mass 176

(1) *8260 criteria taken from CLP OLMO4.0 (January 1998)

Initial calibration (ICAL) is performed upon instrument startup and whenever the continuing calibration verification standard fails the acceptance criteria. A calibration curve is prepared for all target compounds with the lowest standard concentration at or below the reporting limit and the remaining standards defining the working range of the detector.

After the initial calibration standards are injected, a calibration curve is constructed using internal standard methodology. The analyst inspects the curves before proceeding with sample analysis. The correlation coefficient or coefficient of determination of the calibration curve must be greater than or equal to 0.99. An alternative to quantitation from a calibration curve is quantitation from an average response factor. If the %RSD of the calibration curve is less than or equal to the acceptance criteria, the average response factor can be used for quantitation.

A midpoint calibration verification standard (CCV) must be analyzed at the required interval as a check on the validity of the initial calibration. If the percent difference or percent drift is within the acceptance criteria, the curve is acceptable for quantitation of samples.

The analysis of acidified samples causes acidification of the purge and trap instrument gas lines that results in loss of response for 2-chloroethyl vinyl ether. 2-Chloroethyl vinyl ether is also completely degraded by the acid (HCl) added to samples at the time of collection. No corrective action will be taken when 2-CEVE fails initial or continuing calibration criteria except when the compound is not detected in the initial calibration or calibration verification standards or the samples for the analysis of 2-CEVE are not preserved with acid.

Volatiles		
Method	**Initial Calibration Check Criteria**	**Continuing Calibration Check Criteria**
624	All targets <= 35% RSD, or alternatively, construct calibration curve	QC Check Sample (20 µg/L) meets limits specified in method –Table 5, Range for Q
8260	CCC <= 30% RSD	CCC <= 20% difference or drift from initial calibration
	SPCC (minimum RF) Chloromethane 1,1-Dichloroethane Bromoform Chlorobenzene 1,1,2,2-Tetrachloroethane	 0.10 0.10 >0.10 0.30 0.30 (0.10 for 25-mL purge) (1)
524.2	All targets <= 20% RSD, or alternatively, generate linear, 2nd or 3rd order calibration curve	All targets <= 30% difference from initial calibration, or alternatively, using analyst judgment, all targets must fall on the initial calibration curve

(1) The purging efficiency of 1,1,2,2-tetrachloroethane relative to the internal standard is such that the SPCC criteria cannot be met consistently for a 25mL purge. The response factor is generally in the 0.1 to 0.3 range. The alternate criteria is adopted from the EPA CLP Low Level Statement of Work, a protocol similar in scope and application to SW-846 Method 8260.

SW-846 Method 8260: After the CCC and SPCC are evaluated, all target compounds are evaluated for linearity. If the %RSD is less than or equal to 15%, the average response factor can be used for quantitation. If the %RSD exceeds 15%, a regression curve (linear, quadratic, etc.) may be used for quantitation if the correlation coefficient or coefficient of determination is greater than 0.99.

8000-series ICAL grand mean exception:
If one or more compounds exceed the %RSD criteria, the average response factors can be used for quantitation if the average %RSD of ALL of the compounds (the grand mean) in the ICAL is less than or equal to 15%.

6.3.4.2 Semivolatile GC/MS (SM)

Semivolatile organic compounds (SVOC) are analyzed by the following protocols: 500-series are primarily for drinking water; 600-series are primarily for NPDES compliance; 8000-series are primarily for RCRA testing; and the CLP protocols are followed for pesticides for hazardous waste site monitoring.

Hardware tuning is performed on each GC/MS prior to calibration as specified in the applicable EPA methods. Ion abundance acceptance criteria for SVOC tuning with DFTPP are given below. Mass calibration is performed as an integral part of tuning. The tune check and calibration check must be performed in the following intervals:

625 - Daily
8270/CLP - every 12 hours
525.2 - every 8 hours

SEMIVOLATILE ORGANIC GC/MS TUNING AND MASS CALIBRATION (DFTPP)			
	Ion Abundance Criteria		
m/e	525.2	625	8270/OLMO4.0 (1)
51	10-80% of mass 442	30-60% of mass 198	30-80% of mass 198
68	Less than 2% of mass 69	Less than 2% of mass 69	Less than 2.0% of mass 69
69	(reference only)	(reference only)	Present
70	Less than 2% of mass 69	Less than 2% of mass 69	Less than 2.0% of mass 69
127	10-80% of mass 198	40-60% of mass 198	25-75% of mass 198
197	Less than 2% of mass 198	Less than 1% of mass 198	Less than 1% of mass 198
198	Greater than 50% of mass 442	Base peak, 100% relative abundance	Base peak, 100% relative abundance
199	5-9% of mass 198	5-9% of mass 198	5.0-9.0% of mass 198
275	10-60% of mass 442	10-30% of mass 198	10-30% of mass 198
365	Greater than 1% of mass 442	Greater than 1% of mass 198	Greater than 0.75% of mass 198
441	0-100% of mass 443	Present but less than mass 443	Present but less than mass 443
442	Base peak, 100% relative abundance	>40% of mass 198	40-110% of mass 198
443	15-24% of mass 442	17-23% of mass 442	15.0-24.0% of mass 442

(1) *8270 criteria taken from CLP OLMO4.0 (January 1998)

Initial calibration is performed upon instrument startup and whenever the continuing calibration verification standard fails the acceptance criteria. A calibration curve is prepared for all target compounds with the lowest standard concentration at or below the reporting limit and the remaining standards defining the working range of the detector.

After the initial calibration standards are injected, a calibration curve is constructed using either internal standard or external standard methodology. The analyst inspects the curves before proceeding with sample analysis. The correlation coefficient or coefficient of determination of the calibration curve must be greater than or equal to 0.99. An alternative to quantitation from a calibration curve is quantitation from an average response factor. If the %RSD of the calibration curve is less than or equal to the acceptance criteria, the average response factor can be used for quantitation.

A midpoint calibration verification standard must be analyzed daily as a check on the validity of the initial calibration. If the percent difference or percent drift is within the acceptance criteria, the curve is acceptable for quantitation of samples.

Semivolatiles - GC/MS		
Method	**Initial Calibration Check Criteria**	**Continuing Calibration Check Criteria**
625	All targets <= 35% RSD, or alternatively, construct calibration curve	All targets <=20% difference from initial calibration
8270	CCC <= 30% RSD SPCC >= 0.050	CCC <= 20% difference from initial calibration SPCC >= 0.050
525	All targets <= 30% RSD, or alternatively, generate linear, 2nd order, or 3rd order calibration curve.	All targets <= 30% difference from initial calibration, or alternatively, using analyst judgment, all analytes must fall on the initial calibration curve

SW-846 Method 8270: After the CCC and SPCC are evaluated, all target compounds are evaluated for linearity. If the %RSD is less than or equal to 15%, the average response factor can be used for quantitation. If the %RSD exceeds 15%, the "grand mean" exception can be applied to the ICAL. Alternatively, a regression curve (linear, quadratic, etc.) may be used for quantitation if the correlation coefficient or coefficient of determination is greater than 0.99.

8000-series ICAL grand mean exception:
If one or more compounds exceed the %RSD criteria, the average response factors can be used for quantitation if the average %RSD of ALL of the compounds (the grand mean) in the ICAL is less than or equal to 15% and no single compound exceeds 3X the initial calibration criteria.

6.3.5 High Performance Liquid Chromatography (LC)

Semivolatile organic compounds (SVOC) are analyzed by three protocols: 500-series are primarily for drinking water; 600-series are primarily for NPDES compliance; and 8000-series are primarily for RCRA testing. If internal standard calibration is used; relative retention time, as defined in the respective SOPs, will be used to determine the identification of the target compounds and bracketing by CCV will not be required unless specified in the method or QAPP. If external standard calibration is used, the absolute retention time window is calculated as three times the standard deviation obtained from a 72-hour sequence or default windows of 0.1 to 0.5 minutes are used for compounds where the calculated window is too restrictive or zero. Bracketing by CCV will be required for external standard calibrations if specified in the method, SOP, or QAPP.

Initial calibration is performed upon instrument startup and whenever the continuing calibration verification standard fails the acceptance criteria. A calibration curve is prepared for all target compounds with the lowest standard concentration at or below the reporting limit and the remaining standards defining the working range of the detector. After the initial calibration standards are injected, a calibration curve is constructed using either internal standard or external standard methodology. The analyst inspects the curves before proceeding with sample analysis. The correlation coefficient or coefficient of determination of the calibration curve must be greater than or equal to 0.99. An alternative to quantitation from a calibration curve is quantitation from an average response factor. If the %RSD of the calibration curve is less than or equal to the acceptance criteria, the average response factor can be used for quantitation. A midpoint calibration verification standard must be analyzed daily as a check on the validity of the initial calibration. If the percent difference or percent drift is within the acceptance criteria, the curve is acceptable for quantitation of samples.

Calibration Check	500-series	600-series	8000-series
Initial calibration -minimum calibration standards	3 (as the calibration range is extended, the number of points must be increased)(2)	3	5
%RSD criteria(1)	<=20%	<=10%	<=20% (with exceptions noted below)
CCV criteria (%difference or %drift)	+/- 20%	+/-10%	+/-15% (with exceptions noted below)
Frequency of CCV	Every 8 hours	Daily	Every 12 hours

(1) Alternatively, a regression curve (linear, quadratic, etc.) may be constructed. If the correlation coefficient of the regression curve is greater than or equal to 0.99, the curve may be used for quantitation of samples.
(2) An alternate single point calibration can be performed if the standard response is within 20% of the sample response.

8000-series ICAL grand mean exception:
If one or more compounds exceed the %RSD criteria, the average response factors can be used for quantitation if the average %RSD of ALL of the compounds (the grand mean) in the ICAL is less than or equal to 20% and no single compound exceeds 3X the initial calibration criteria.

8000-series CCAL grand mean exception:
If one or more compounds exceed the %drift or %difference criteria, the average response factor from the initial calibration can be used for quantitation if the average %drift or %difference of ALL of the compounds (the grand mean) in the CCV is less than or equal to 15% and no single compound exceeds 3X the continuing calibration criteria.

External Standard CCV: Samples analyzed by external standard calibration require bracketing by CCV. If the CCV standard analyzed after the samples fails to meet the acceptance criteria and the response of the mid point standard is *above* the criteria (that is the response of the analytical system has increased), samples which have no target compounds detected above the RL may be reported as <RL, since the compounds would have been detected if present. (SW-846 Method 8000B).

6.4 Calibration Documentation

All calibration records including raw data, response factors, standard concentrations, curves, reduced data, and instrument settings or conditions are stored and archived as hard or electronic copy according to laboratory standard operating procedures. Current chromatograms, curves, and results transcribed onto forms are kept at the analysts' workstations and periodically archived into a data storage area. Initial and continuing calibrations are stored by date for ease of location. STL SOP CA83: *Analytical Records Maintained by STL* describes the policies and procedures for the archival of raw data and associated QC data.

6.5 Low Level Calibration Check

An additional optional continuing calibration check standard at or below the RL (usually lowest level standard) may be analyzed daily. This check standard is used to demonstrate that the RL can be achieved and may also be used in conjunction with the calibration check standard for reporting data. If the mid point CCV standard fails acceptance criteria and a standard at the reporting limit (RL) is analyzed within the same analytical clock, samples which have no target compounds detected above the RL may be reported as <RL, if

1) all targets in the RL standard are detected at the established retention time
2) the surrogate recovery, if applicable, is within acceptance limits
3) the internal standard area(s), if applicable, is within acceptance limits

6.6 Balance Calibration

Electronic analytical balances are calibrated daily with internal mechanisms, if available. The calibration of the balance must be checked daily by the analysis of two Class S weight that bracket the approximate weight of material that is being determined. The balance must be checked weekly by the analysis of the weights in Table 6.2 that the lab routinely determines. The daily and weekly calibration checks must be documented in a bound logbook kept with the balance in accordance with SOP AN10: *Balance Calibration and Use.*

6.7 Thermometer Calibration and Temperature Checks

Equipment such as refrigerators, ovens, waterbaths, hot plates, and incubators are periodically checked with calibrated thermometers. Refrigerators and waterbaths are checked daily and the temperatures documented in a notebook. The temperature of microbiological incubators must be checked and recorded twice daily. Sample storage refrigerators should be set to 4 C. Refrigerators must maintain a temperature less than 6C and must not freeze aqueous samples. All thermometers are calibrated annually against an NIST-certified thermometer.

6.8 Method Modifications and Clarifications

6.8.1 Soil Sample Preparations

In the absence of an approved soil method, water methods are adapted for soil matrices. The following soil preparation procedures are applied to parameters in Appendix B.

Common Anions:
Fluoride (extractable): Method 340.2/300.0
Chloride (extractable): Method 9251/325.2/300.0
Sulfate (extractable): Method 9038/375.4/300.0
Orthophosphate (extractable): Method 365.1

Approximately 5 g of sample is weighed out and placed in a screw-cap bottle. One hundred milliliters of reagent water is added to the sample, the bottle is capped, placed in a rotating extractor, and rotated for 2 hours. Upon removal, the sample is allowed to settle, the supernatant decanted, and the leachate is analyzed in the same manner as a liquid sample.

Silica by ICP
Silica is prepared for analysis by the "shake water" procedure. Approximately 5g of homogenized sample is placed in a plastic container and 100mL of reagent water is added. The sample/water mixture is tumbled. The solids and liquid are separated. The leachate is filtered and analyzed for silica by ICP.

Oil and Grease and Petroleum Hydrocarbons
HEM (hexane extractable materials-oil and grease) and HEM-SGT (hexane extractable materials-silica gel treated-petroleum hydrocarbons) are extracted using SW-846 Method 3550, sonication.

A modified method for determining oil and grease and petroleum hydrocarbons by infra red detection (IR) is described in SOP GE150: *Oil and Grease and Petroleum Hydrocarbons by IR*. This procedure is based on the guidance in SW-846 and EPA Methods 413.2 and 418.1 with reduced sample volume and weights and reduced volumes of Freon-113 for extraction.

Cyanide Amenable to Chlorination in Soils
If cyanide amenable to chlorination is requested for a soil sample, the sample is extracted with a sodium hydroxide solution. A portion of the leachate is distilled and reported as the "extractable" cyanide, and a portion of the leachate is treated with chlorine and distilled. The leaching procedure is required because the direct chlorination of the sample may solubilize metal cyanides that will not be recovered by the direct distillation of the soil.

6.8.2 Aqueous Sample Preparations

Arsenic in Water by Method 7060 (3020)
Water samples are prepared using the procedures in Section 7 of Method 3020. Arsenic is then determined using the analytical procedures described in Method 7060.

Selenium in Water by Method 7740 (3020)
Water samples are prepared using the procedures described in Section 7 of Method 3020. Selenium is then determined using the analytical procedures described in Method 7740.

6.8.3 Clarifications and Modifications of Referenced Analytical Methods

Except for the instances described below, parameters in Appendices A and B have been determined by the methods referenced with no significant modifications to those methods, other than the use of additional standards for parameters not included in the referenced method lists.

Internal Standards and Bracketing of Calibration Standards (SW-846 Organics Methods)
If internal standard calibration is used for quantification of target compounds using any organics method (volatiles and semivolatiles), bracketing or capping of the sequence (analyzing a CCV at the end of the sequence) with an acceptable CCV standard is not performed unless required by the client or agency and documented in a project quality assurance plan or statement of work.

6.9 Field Instrument Calibration

Calibration of field instrumentation (conductivity/salinity meters, pH meters, DO meters, and turbidimeters) is performed in the field prior to use, in accordance with the manufacturers and method specifications. All calibration data are documented in a bound field notebook.

6.10 Preventive Maintenance

STL Savannah is equipped with up-to-date computerized instrumentation. In order to gain maximum performance and minimize downtime, regular inspection, maintenance, cleaning, and servicing of all laboratory and field equipment is performed according to the manufacturers' recommendations. A maintenance log is kept for each piece of laboratory and field instrumentation, detailing all maintenance performed on the instrument. Routine repairs and maintenance are performed and documented by the analyst responsible for the particular instrument. Non-routine maintenance is signed and dated by the analyst or repair technician. Routine maintenance procedures for laboratory instrumentation are given in SOP AN53: *Maintenance Procedures for Laboratory Instrumentation.* Maintenance contracts are carried for most instrumentation, and close contact is maintained with service personnel to provide optimum instrument functioning.

An extensive spare parts inventory is maintained for routine repairs at the facilities, consisting of GC detectors, AA lamps, fuses, printer heads, flow cells, tubing, certain circuit boards and other common instrumentation components. Since instrumentation is standardized throughout the laboratory network, spare parts and components can be exchanged among the labs.

In general, each facility has at least one backup unit for each critical unit. In the event of instrument failure, portions of the sample load may be diverted to duplicate instrumentation within each facility, the analytical technique switched to an alternate approved technique (such as manual colorimetric determination as opposed to automated colorimetric determination), or samples shipped to another properly certified or approved STL location (where identical SOPs, QA procedures and instruments are utilized). When shipping samples to another facility, interdivisional chain-of-custody procedures are followed as given in Section 5.

Number of Units	Table 6.1 Major Instrumentation
1	**Atomic Absorption Furnace/Flame**
6	**GC/MS Semivolatiles with Autosamplers**
6	**GC/MS Volatiles**
	4 with Purge and Trap Liquid Autosamplers
	2 with Low Level Soil Archon Purge and Trap Autosamplers
11	**GC Semivolatiles**
	9 GC Semivolatiles with Autosamplers
	2 GC Semivolatiles with Autosamplers/EZ Flash
8	**GC Volatiles**
	3 with Purge and Trap Liquid Autosamplers
	1 with Low Level Soil Archon Purge and Trap Autosampler
	1 with Headspace Analyzer
	2 Direct Aqueous Injection (DAI)
	1 Dissolved Gases (TCD/FID)
3	**HPLC Units with Autosamplers**
3	**Ion Chromatographs**
2	**IR Spectrophotometer**
1	**Mercury Cold Vapor Unit**
3	**Nutrient Autoanalyzer**
4	**Sample Extract Concentrators**
2	**TOC Analyzer**
2	**TOX/AOX Absorption Unit**
2	**TOX/AOX Analyzer**
2	**Trace ICP Units with Autosamplers**
1	**ICP/MS with Autosamplers**
1	**Turbidimeter**
3	**UV-VIS Spectrophotometer**

TABLE 6.2
BALANCE CALIBRATION CHECKS

Analytical Balance	
Class S Weight	**Tolerance**
0.01 g	± 0.0002 g
0.1 g	± 0.0002 g
0.5 g	± 0.0004 g
1 g	± 0.0004 g
10 g	± 0.0005 g
50 g	± 0.0010 g
Top-Loading Balance	
Class S Weight	**Tolerance**
0.1 g	± 0.02 g
0.5 g	± 0.02 g
1 g	± 0.04 g
5 g	± 0.04 g
10 g	± 0.05 g
50 g	± 0.20 g
100 g	± 0.20 g
300 g	± 0.50 g

7.0 LABORATORY QUALITY ASSURANCE (QA) AND QUALITY CONTROL (QC)

The key to a successful QA/QC program is strict adherence to the program during all phases of the project, including pre-sampling discussions, sample collection, preservation, storage and analysis, and validation and reporting of results. Field and laboratory quality control checks described in this manual, meet or exceed all routine agency requirements. If project-specific quality assurance plan (QAPP) quality control requirements are more stringent than the general procedures given in this manual, QAPP requirements are followed.

When state certification or agency accreditation requirements are non-routine or more stringent than those procedures described in this manual, the requirements are identified according to State/Agency Requirement Summaries. These documents outline non-routine analytical quality control practices unique to each program and are derived from administrative codes, regulations, or other similar publications. The State/Agency Requirement Summaries are located within each section of the laboratory and are document controlled by the QA Department. Analysts are notified to use the program-specific requirements prior to sample preparation and analysis via status worksheets designated by the Project Manager during project initiation. The State/Agency Requirement Summaries are updated when requirements change.

Field QC checks are described in Section 5 of this manual.

7.1 Laboratory QC Checks

STL Savannah employs control samples to assess the validity of the analytical results. Determination of the validity of sample results is based on the acceptance criteria being met by the control samples. The acceptance criteria for each type of control sample are defined or referenced in the appropriate SOP. These acceptance criteria are based on method requirements or calculated from historical data.

An analytical batch is defined as a group of field samples which are processed as a unit. If the number of field samples in the group is greater than 20, each group of 20 samples or less is handled as a separate batch. The minimum QC items are a method or reagent blank and a lab control standard. Matrix spikes and matrix spike duplicates are prepared and analyzed at the frequency defined by the analytical method. Clients are requested to provide sufficient sample for matrix spikes and are invoiced for matrix spikes. Matrix spike/duplicate analysis will be conducted on replicate samples provided by the client. In all other cases, matrix spikes will be on a batch-specific basis (not client-, project- or sample-specific basis). When possible, aliquots for matrix spikes are taken from the same container as the field sample. In some cases with liquid samples, this is not possible, i.e., semivolatile extractables, oil and grease, TPH, etc.

If QAPP or agency QC requirements are more stringent than the general procedures given below, QAPP or agency QC requirements are followed.

7.1.1 Organics- Volatiles and Semivolatiles

Method Blanks: A method blank will be analyzed for each batch of samples.

Lab Control Standards: A blank spike or lab control standard (LCS) will be processed and analyzed (per method requirement) with each batch of samples (except for CLP protocols and other methods which do not require an LCS). For drinking water samples, analyte spike concentrations will be at or near reporting limits as specified for lab-fortified blanks in the 500 series methods. A lab control standard duplicate (LCSD) will be prepared and analyzed if sufficient sample is not supplied for the MS/MSD or duplicate.

Surrogates: Appropriate surrogate(s) will be added to all samples, standards and blanks.

Matrix Spikes: Matrix spikes will be analyzed at a frequency of 5% of samples. If a method does not specify matrix-spiking compounds, the SW-846 or CLP subset matrix spiking compounds will be used. Appropriate matrix spikes will be used for other chromatographic methods in which matrix spikes are not defined..

Matrix Spike Duplicates/Sample Duplicates: Duplicate samples or matrix spike duplicates will be analyzed at a frequency of 5% of samples. In cases where duplicate matrix spikes are used, precision data are obtained on only the matrix spiking compounds.

NOTE: Unless requested by the client, matrix spikes are not routinely performed on TCLP, SPLP, EPTOX., or waste dilutions.

Full List Spikes: For projects that require spiking a laboratory control sample (LCS) or matrix spike (MS) with all target compounds, re-extraction and/or re-analysis of the samples in the batch will not be performed if :

1) The recoveries of no more than one (1) compound when 5 to 10 compounds are spiked, two (2) compounds when 11 to 20 compounds are spiked, three (3) compounds when 21-30 compounds are spiked, or five (5) compounds when more than 30 compounds are spiked are determined to be outside the control limits, and recoveries for all spiked compounds are positive. When <5 compounds are spiked, all compounds should be within control limits.

2) The recovery of a spike exceeds the upper control limit (UCL) and the compound is not detected in any sample in the analytical batch.

As indicated in Methods 8260 and 8270, the following compounds have erratic recoveries under the routine conditions of the preparation and analytical procedures and will not be evaluated for corrective action nor included in the count (1) above if included in the LCS or MS:

VOC:

Acrolein	Carbon disulfide
2-chloroethyl vinyl ether	Pentachloroethane

SVOC:

Aniline	Kepone
Benzidine	Alpha, alpha-Dimethylphenethylamine
Benzoic acid	Methapyrilene
Hexachlorocyclopentadiene	4,4-Methylbis(2-chloroaniline)
Hexachlorophene	p-Phenylenediamine

The above guidance is used as the default for evaluation of full target spikes in organic analyses unless other corrective actions are defined in a project-specific quality assurance plan or in an STL Savannah pre-project plan.

7.1.2 Inorganics-Metals and General Chemistry

Calibration Blanks: Calibration blanks are non-digested blanks, which are analyzed at a frequency of 10% of samples.

Method Blanks: Method blanks should be processed and analyzed with each batch of samples of the same matrix.

Lab Control Standards: A blank spike or lab control standard will be processed and analyzed with each batch of samples (except for CLP protocols and other methods which do not require an LCS). A lab control standard duplicate (LCSD) will be prepared and analyzed if sufficient sample is not supplied for the MS/MSD or duplicate.

Matrix Spikes: Matrix spikes will be analyzed at a frequency of 5% of samples.

Matrix Spike Duplicates/Sample Duplicates: Duplicate samples or duplicate matrix spikes will be analyzed at a frequency of 5% of samples.

NOTE: Unless requested by the client, matrix spikes are not routinely performed on TCLP, SPLP, EPTOX, or waste dilutions.

7.1.3 Microbiology

Quality control checks are routinely performed for all microbiological analyses. Strict requirements for the lab-generated deionized water must be met before it can be used in any testing.

PARAMETER(s)	FREQUENCY	CRITERIA
Residual chlorine	Monthly	< 1.0mg/L
Total Cd, Cr, Cu, Ni, Pb, Zn	Annually	Total metals < 1.0mg/L Individual metals < 0.05mg/L
Conductivity	Daily	<2.0umho/cm
Heterotrophic plate count	Monthly	< 500 CFU/mL
Inhibitory residue	Annually	Less than 15% between groups
Suitability	Annually	Ratio between 0.8 and 3.0

Other laboratory QC practices are utilized to provide accurate microbiological results. Positive and negative microbiological controls are run with each new lot of medium. Autoclave tape is used to ensure proper sterilization of sample containers, media, etc. Incubators are maintained at 35 ± 0.5 C and water baths at 44.5 ± 0.2 C. Thermometers used for these monitoring purposes are calibrated annually against an NIST-certified thermometer. Other equipment, such as the dissecting microscope and colony counter, is maintained in clean operating condition at all times.

Microbiological samples are analyzed in duplicate at a rate of 10% of positive samples. A positive control sample is analyzed with each batch of coliform samples. A negative control is analyzed at least monthly. Additionally, all drinking water samples positive for total coliform must be confirmed. For environmental samples, 10% of samples positive for total coliform must be confirmed. A completed test for MPN analysis must be performed on 10% of all confirmed samples or at least quarterly.

Blanks are routinely analyzed with microbiological samples. For membrane filter analyses, a sterile dilution water blank is run initially, after every 10 samples, and at the end of each analytical run. For MPN analysis, sterile dilution water is added to a lauryl tryptose broth tube for a blank for each analytical run.

7.2 Routine Methods Used to Assess Precision and Accuracy

A system for assessing precision and accuracy through tabulation (manual or electronic) is initiated for each parameter upon method validation. Control calculations are based on procedures in *The Handbook for Analytical Quality Control in Water and Wastewater Laboratories* (EPA, 1979) and contain both "warning limits" (± 2 standard deviations) control charts and "control limits" (± 3 standard deviations). Control limits are updated periodically for all parameters, with a minimum frequency of every two years. A minimum of ten data points is used to update these limits. Formulas used for calculations of precision and accuracy are given below.

Precision
Relative percent difference is used to express precision between two replicate values. In routine analyses, the values for most parameters are usually below quantitation limits; therefore, precision data are derived from duplicate or matrix spike duplicate results. Precision is used to evaluate matrix bias and is not used for method control, except where required in a client quality assurance project plan or agency program.

The relative percent difference (RPD) is calculated as:

$$\%RPD = \left| \frac{V1 - V2}{\left(\frac{V1 + V2}{2}\right)} \right| \otimes 100$$

V1, V2 = The two concentrations obtained by analyzing the duplicate samples, matrix spike and matrix duplicate, or lab control standard and lab control standard duplicate.

Accuracy
Accuracy control limits are produced from environmental matrix spike data. Percent recovery (%R) is used to express accuracy. The percent recovery (%R) is calculated as below:

$$\%REC = \frac{SPV - SAV}{SA} \otimes 100$$

SPV = Value obtained by analyzing the sample with the spike added
SAV = The background value, value obtained by analyzing the unspiked sample
SA = Concentration of the spike added to the sample

7.3 Method Detection Limits and Reporting Limits

7.3.1 Definitions

Reporting Limit (RL)
The level to which data is reported for a specific test method and/or sample. The RL is generally the lowest standard or the sample equivalent of the lowest standard in the calibration curve. At a minimum, the RL must be at or above the MDL and is generally related to the Quantitation Limit (QL). The quantitation limit is defined as the minimum amount of a substance that can be quantitatively measured with a specified degree of confidence and within the accuracy and precision guidelines of a specific measurement system. The QL can be based on the MDL, and is generally calculated as 3-5 times the MDL, however, there are analytical techniques and methods where this relationship is not applicable. Also referred to as Practical Quantitation Level (PQL), Estimated Quantitation Level (EQL).

Method Detection Limit (MDL)
Method Detection Limit (MDL): the minimum amount of a substance that can be measured with a specified degree of confidence that the amount is greater than zero using a specific measurement system. The MDL is a statistical estimation at a specified confidence interval of the concentration at which the relative uncertainty is ±100%. The MDL represents a range where qualitative detection occurs using a specific method. Quantitative results are not produced in this range.

7.3.2 Laboratory Procedures and Policies

Method detection limits (MDLs) are determined annually in accordance with the procedures are described in SOP CA90: *Procedures for the Determination of Method Detection Limits (MDL)*, which is based on the guidance in Appendix B of 40 CFR Part 136. The procedure includes preparing (extraction, digestion, etc.) and analyzing seven or more spikes in reagent water or blank matrix at levels 3-5 times the estimated detection limit. The standard deviation of the replicate measurements is calculated and the MDL is computed by multiplying by the appropriate Student's t value (n-1 degrees of freedom) for the appropriate 99% confidence level (for seven replicates, t = 3.14).

The MDL calculated by the procedure described above is defined as the minimum concentration of a substance that can be measured in a clean matrix and reported with a given confidence that the analyte concentration is greater than zero. STL makes no claim that the MDLs determined by this statistical procedure are obtainable in environmental samples.

Since MDLs are based on the analyses of standards in a clean matrix (reagent water, blank soil, etc.), they may not be useful in reporting data for environmental samples; therefore, reporting limits (RL) are typically used for reporting a non-detected parameter. Reporting limits are defined as the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions and are determined to be the lowest concentration standard or the sample equivalent of the lowest concentration standard in the initial calibration.

The method detection limits (MDL) and reporting limits (RL) are evaluated and updated periodically, with a minimum frequency of every two years, by Laboratory and QA management and published in the Laboratory Quality Manual. If the statistically determined MDL is deemed to low to be qualitatively identified, the MDL may be elevated.

7.4 Non-Conformance and Corrective Action Procedures

A nonconformance is defined as any occurrence that prevents the lab from delivering data that are compliant with the control criteria published or incorporated by reference in an applicable quality assurance plan. The non-conformance report (NCR) form (Figure 7.1) is used to document nonconformance conditions and to specify the necessary action(s) taken to correct the specific problem. The corrective action report (CAR) form (Figure 7.2) is used in situations where a recurring problem or breakdown in systems is observed and warrants a more thorough investigation than a single event NCR. CARs may be initiated from:

- a specified NCR
- an observed trend or frequency of events that warrant corrective action
- audit finding

STL will abide by all reasonable corrective actions generated from documented findings by agency audits.

Some situations that develop and require formal documentation may not be appropriate for an NCR or CAR. Some of these anomalous situations are detailed on the Anomaly Report (Figure 7.3).

The status of all NCRs and CARs are tracked in registries located in various departments or centrally located in the lab. Summaries of the NCRs and CARs are provided to the Lab Director and management periodically so that overall trends in nonconformances and corrective actions can be evaluated. The procedures for preparation, tracking and disposition of NCRs, CARs, and Anomaly Reports are given in SOP CA85: *Nonconformance and Corrective Action Procedures.*

Table 7.1 summarizes the checks, the acceptance criteria, and the recommended corrective action for various QC activities. This table and SOP AN02: *Analytical Batching* provide guidance to the analysts to evaluate sample and batch QC.

FIGURE 7.1
Nonconformance Report (NCR)

Initiated by:_____ Date initiated:_____ Client:_____ NCR #:_____

Issuing department/(division): _____ Project manager/(division) :_____ Method:_____

Project/SDG#: Sample(s) affected: Batch ID:

1	Nonconformance condition: Indicate and describe details (if necessary) Describe reason problem occurred (root cause):	☐ Holding time ☐ Catastrophic Failure ☐ LCS/MS ☐ Method blank ☐ Calibration ☐ Internal standards ☐ Surrogates ☐ Other
2	Action taken (add details if necessary): PM Initials/date: TM/DM/PS Initials/date:	☐ Proceed with analysis ☐ Reprep/reanalyze ☐ Do not analyze ☐ Case narrative (discuss in Sect. 4) ☐ No action taken (justify)
3	Result of action taken in 2, above (add details if necessary):	☐ Reprep/reanalysis acceptable ☐ Reprep/reanalysis agrees w/ original ☐ Other
4	Case Narrative Comments (if necessary) Initials/date:	
5	Close-out: Additional corrective action required to prevent recurrence? ☐ YES ☐ NO If YES, initiate corrective action report (CAR): CAR Initiated #: _____ Closed by:_____ Date:_____	
6	Original to TM/DM; Copy to PM; Copy to RP (QC level III/IV only)	

FIGURE 7.2
Corrective Action Report (CAR)

CAR #:_____ Initiated by/date:_____

Lab Director attn. requested? ☐ Yes ☐ No (*if yes, copy LD after completing section 1, below*)

1	Responsible TM/DM - summarize non-conformance incident and comments:
2	State root cause Initials: Date:
3	CORRECTIVE ACTION Assigned To:_____Target completion date:_____ Corrective action has been completed on (date):_____ By (initials):
4	QA Department Comments By (initials): Date:
5	Follow-up dates / comments (if no comments, indicate as "none") Initial 2 week 2 month ☐ Add to internal systems checklist?

FIGURE 7.3

ANOMALY REPORT

Date: _____ Log #: _____ Sample ID: _____ Client: _____

Dept: ____ EX ____ GE ____ LC ____ ME ____RA

____CU ____ SG ____ SM ____ VG ____ VM ____AI

Analysis: _____ Reported by: _____

Anomaly:

☐ Sample matrix is different than indicated by log-in.

Logged in as	*Best described as*	
Water	*Water*	*Non-aqueous liquid*
Soil	*Soil*	*Sludge*
Oil	*Oil*	*Product*
	Other _____	

☐ Sample was received with inadequate preservation, and was preserved upon receipt.

☐ Sample received in an incompatible sample container. ____ glass ____ plastic ____ other _____

☐ MS/MSD failed while the LCS/LCSD passed criteria, for a drinking water parameter. Method indicates data qualification.

☐ Target analyte(s) detected in drinking water sample. (Describe below)

☐ Sample exhibits gross non-homogeneity. (Describe below)

☐ Insufficient sample received for analysis.

☐ Data qualifier needed. Discuss with DM/LM before reporting.

☐ Grand Mean exception was utilized for Initial Calibration (specify compounds). (SW-846 Only)

☐ Grand Mean exception was utilized for Continuing Calibration (specify compounds). (SW-846 Only)

Other _____

Custody: ***ALWAYS ATTACH A COPY OF COC WITH HIGHLIGHTED DEFICIENCY**

☐ Sample description discrepancy between COC & Container ☐ Custody seals broken

☐ Sample container breakage ☐ Incomplete COC

☐ Cooler temp >6°C or frozen ☐ Sample container partially filled

☐ Sample received not listed on COC ☐ Improperly preserved sample

Comments:

Client Notified: ☐Yes ☐No
Contact:
Date:
Resolution:

Route to:

Project Manager: _____

STL Facility: Savannah_____ Mobile_____ Tampa West_____ Tallahassee_____

TABLE 7.1 CORRECTIVE ACTION SUMMARY TABLE		
QC Activity	**Acceptance Criteria**	**Recommended Corrective Action**
GC/MS tuning	Section 6.0	Do not analyze samples unless criteria are met.
Initial calibration standards	Section 6.0	Reanalyze standards. If still unacceptable, remake standards or instrument corrections.
Continuing calibration standard	Section 6.0	Reanalyze standard. If still unacceptable, remake standards, or recalibrate.
Calibration blanks	< Reporting Limit (RL)L or QAPP/Method-defined criteria (for CLP procedures, use SOW guidelines)	Reanalyze calibration blank. If problem, determine source of contamination and reanalyze. Re-calibration may be required.
Method blank	< RL or QAPP/ Method-defined criteria (for CLP procedures, use SOW guidelines)	Reanalyze method blank. If problem, determine source of contamination. If necessary or possible, re-prep and re-analyze. Do not re-prep and re-analyze if no sample in batch or report contains the analyte(s) detected in the method blank. For SW-846 analyses, do not reanalyze if the method blank level is less than 5% of the regulatory limit or less than 5% of the lowest sample concentration.
Surrogate recovery (GC/MS semivolatiles)	LQM Appendices, or program/ project specific.	Follow method guidelines. Check calculations, check for possible matrix interferences, and if necessary or possible, extract sample and reanalyze
Surrogate recovery (GC/MS volatiles)	LQM Appendices, or program/project specific	Follow method guidelines. Check calculations, check for possible matrix interferences, and if possible, reanalyze sample.
Surrogate recovery GC or LC	LQM Appendices, or program/project specific	Check for possible matrix interferences or other causes and follow method guidelines.
Matrix spike recoveries	LQM Appendices, or program/project specific	Check for possible matrix interferences or other causes. If still out, evaluate LCS.(1)
Lab control standard (LCS) recoveries	LQM Appendices, or program/project specific	Check calculations, reanalyze standards, and if necessary or possible, redigest or extract batch and reanalyze.(1)
Precision of MS/MSD or sample duplicate	LQM Appendices, or QAPP Specific (used for evaluation but not control unless specified by the method)	Check calculation. Check for possible matrix interference or other causes.
Internal standards (organics)	Method or protocol-required limits	Follow method or protocol guidelines.
Trip blanks	< RL	Check related method blank for contamination.
Field Blanks	< RL	Check related method blank for contamination.
Equipment blanks	< RL	Check related method blank for contamination.
Field duplicates	Follow project/program requirements	Follow project/program requirements.
Microbiology + and – controls for media	Should be + and -, respectively	Reject medium.
Microbiology duplicates	RPD with established limits	Follow agency requirements.

(1) See Section 8.1 for guidance on full list spikes and unstable compounds

TABLE 7.1 CORRECTIVE ACTION SUMMARY TABLE		
QC Activity	**Acceptance Criteria**	**Recommended Corrective Action**
Sample results	Calibration	If the calibration fails for a target and the corresponding target is not detected, the results may be reported as < RL if the RL standard is analyzed and detected.
	Spike criteria limits	If a limited list MS or LCS is high biased and no targets are detected above the RL, results are reported as < RL. When a full compound spike is utilized, and the MS or LCS result is high biased, and the corresponding target is not detected, the result for the corresponding target is reported as <RL, regardless of the other targets.
	Surrogate criteria limits	If surrogate recovery is high biased and no target is detected, the results are reported as <RL.
External Quality control check samples	Defined by the program or project.	Defined by the program or project.

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8.0 DATA REDUCTION, REVIEW, REPORTING, AND ARCHIVAL

In order to provide the highest quality data possible, an extensive system for data reduction, review, and reporting has been implemented.

8.1 Initiation of Sample Analyses

The key to the sample flow, analysis, data/QA review, archiving, and reporting system is the single Laboratory Information Management System (LIMS) network which controls the day to day production of the laboratories. This system, which is summarized in the figure entitled *Data Tracking and Submittal* (Figure 8.1), provides project managers, QA personnel, and all analysts with immediate information on the status of any sample. The system schedules and prioritizes all work, provides a mechanism for sample tracking, review of sample results and QC data, generation of reports and invoices, and archival of all reports and associated QC data. The policies and procedures for the LIMS and other computer systems are described in the current revision of the *Software Quality Assurance Plan* prepared by and for STL Savannah.

Upon receipt of custody forms, the project manager instructs data management personnel to log the sample analysis request and identification into the LIMS, enabling the project manager, section manager, QA Manager, laboratory director, or analyst with authority to access and check the status of all projects.

If special handling or data packaging is required, the QA department and the laboratory receive copies of the custody forms and computer acknowledgments or a pre-project plan. A sample delivery group (SDG) sheet is established and distributed to all affected departments including the various laboratory analysts, project managers, and section managers. After the sample analysis request is logged into the LIMS and approved, the LIMS generates worksheets, which are accessed via a LIMS terminal or printed and distributed.

8.2 Sample Preparation and Analysis

The analyst is prompted by the LIMS worksheets to prepare and analyze the samples according to approved methodology. The analyses supported by STL Savannah are listed in the tables in the Appendices to this document. Calibrations are performed in accordance with the methods (see Section 6 for the routine calibration procedures), and quality control samples are analyzed at the frequency specified in the method and summarized in Section 7 of this document. For many organic analytes, samples are screened prior to analysis to determine the proper dilution

8.3 Data Reduction

8.3.1 Laboratory Data

Most sample concentration results are read directly from instrumentation without further reduction or calculations. In some cases, manual calculations may be necessary. Sample parameters (sample volume or weight, final volume of the extract or digest, dilution factor, percent solids, etc.) are entered into the data system and in most cases, the results are calculated automatically. Samples above the calibration range of the instrumentation are diluted and the appropriate dilution factor applied to the calculations. Soils and solid waste concentrations for all laboratory sections are routinely calculated on a dry weight basis.

Data obtained by the following method/instrument are directly reportable: GC, GC/MS, metals, general chemistry automated colorimetry, TOC, DO, turbidity, and pH. Data from methods requiring reduction prior to reporting include titrimetric methods, BOD, COD, conductivity, manual UV/VIS/IR, residue, and AOX/TOX. The equations used in computer-controlled instrumentation for data reduction as well as equations used for the manual calculation of reportable concentration results are given in the analyte-specific standard operating procedure (SOP).

8.3.1.1 Policy for Reporting Chromatographic Data from Dual Columns or Detectors

When data are reported from dual columns (e.g., gas chromatography) or detectors (e.g., liquid chromatography), the default procedure of STL is to report the highest result between the primary and confirmation columns or detectors if the relative percent difference (%RPD) is <40%. If the %RPD exceeds 40%, the analyst evaluates the data for the presence of matrix interferences and reports the result that is most appropriate for that sample and flags the result to note the discrepancy. The default procedure is to report the lowest result between the two columns or detectors if the %RPD exceeds 40%.

8.3.1.2 Policy for Manual Integrations of Chromatographic Data

Manual integrations of calibration standards and QC analytes require management approval. If the manual integration involves a calibration standard, signed approval must be obtained from laboratory management (laboratory manager, laboratory director, or QA Manager). If the manual integration is performed on a sample constituent that has associated criteria, such as a surrogate compound, internal standard, or spike compound, the integration must be approved by the department technical manager or supervisor.

Management approval is not required for total area integrations (DRO, GRO, etc.), assigning peaks to account for coelutions, and selected ion monitoring (SIM) analyses. These manual integrations must be reviewed periodically and approved by the department technical manager or supervisor.

8.3.1.3 Policy for Reporting Samples that Require Dilution

Unless otherwise specified by a client QAPP, results from a single analysis are reported as long as the largest target analyte (when multiple analytes are present) is in the upper half of the calibration range. When reporting results from dilutions, appropriate data flags are used or qualification is included in a case narrative provided to the client. For TCLP analyses, every reasonable effort is made to achieve the regulatory level without instrument overload.

For clients who require we provide lower detection limits, the laboratory's default guidance is to report the dilution detailed above and one additional run at a dilution factor 1/10 less dilute (10X more concentrated) than the analysis with the highest target in the upper half of the calibration curve. For example, if a sample analyzed at a 1/50 dilution resulted in a target in the upper half of the calibration curve, the sample would also be analyzed at a dilution factor of 1/5 to provide lower RLs.

8.3.1.4 Data File Identification

It is the policy of STL to unambiguously identify the data generated by the laboratory and to associate the instrument raw data to the field and QC samples. Chromatograms and data files are given a unique alphanumeric identification by the chemists initiating the analyses in each section where appropriate. These file identification numbers reflect either the date the sequence was initiated (GC sections), the order in which the samples were analyzed (GC/MS sections), and/or the sample identification and log numbers given by the client and listed on the LIMS.

8.3.2 Field Data

All pH and conductivity meters must be temperature compensated. Cell constants for field conductivity meters are determined by laboratory personnel annually. All other field data are read directly from instrumentation. Bound field notebooks are used for documentation of required data reduction. Calculations are recorded in waterproof ink.

8.4 Data Review

Laboratory analytical results are reviewed by a second analyst or a section supervisor. Prior to being entered into the LIMS, laboratory raw data have been reviewed to ensure that all of the method specifications have been met. This includes checking the extraction, digestion, distillation, and other preparation logs, as well as ensuring that all precision and accuracy requirements are addressed, and all steps of the analyses have been completed. If any problems arise during the analysis of the sample batch, it is the responsibility of the analyst and the section supervisor to bring this to the attention of the project manager and QA Manager through a written non-conformance report.

The field/sampling manager is responsible for data review of all field-generated data. This includes verifying that all field descriptive data are recorded, that all field calibration requirements are met, that all field QC data meet met criteria, and that field data are entered accurately on worksheets.

Data flags are used on reports as needed to inform the project manager and the client of any additional information that might aid in the interpretation of the data. The data flagging system incorporates data qualifiers which are similar to flags specified in the Contract Laboratory Program protocols, as well as additional flags used to help explain batch specific events.

When data acquisition and reporting have been completed, the project manager reviews and prepares the final report. Because the project managers have extensive experience in evaluating analytical data, they have developed both objective and subjective techniques for data review. Each value reported is reviewed in the context of the respective environmental matrix and all available QC/QA data. Outliers or other abnormal values are carefully scrutinized, and samples are reanalyzed if the abnormalities cannot be explained. Where there are cases in which the results from spiked samples suggest interferences, attempts are made to remove the interferences, or alternate analytical procedures are used. If the interference problem cannot be resolved, the data are flagged and/or a narrative is included with the report.

If special handling and/or data packages are requested by the client, QA personnel also review the project report and the raw data. This includes checking that holding time requirements are met, checking calibrations, reviewing all quality control data and/or control charts, and initiating any corrective action or reanalyses that might be appropriate.

8.5 Data Transfer to LIMS

After review of the data, the analytical results are entered manually on the department worksheets or by direct electronic transfer from the instrument data system.

8.6 Reporting

The final report is printed and signed by the project manager after all review has been completed. The data flags that may appear in a project report are defined on the signature page, and any additional comments are also footnoted on this page.

If requested by the client or a project specific QA Plan, custom reports or CLP-like data packages with diskette deliverables can be provided. If data packaging is requested, a paginated data package is provided in addition to the project report. The format of the project report and/or data package can be adjusted to meet the needs of the client. All LIMS reports can be downloaded onto diskettes or to most clients' computers.

8.6.1 STL Savannah Routine Reporting Formats

STL Savannah offers several options for reporting data. The STL Savannah LIMS generated summary report and standard data package options are listed below:

DELIVERABLE	LEVEL I	Level II	Level III	Level IV
LIMS Report	x	x	Optional	Optional
Data Package			x	X
Raw Data				X
EDD	Optional	Optional	Optional	Optional

The STL Savannah LIMS generated summary report is the primary data-reporting tool. The standard elements of the report are given for Level I and Level II. Optional Level III and Level IV reports can be customized to include other data results to meet project specific data quality objectives.

REPORT ITEM	LEVEL I	LEVEL II
Target Analyte/Compound Result	x	x
Method Reference	x	x
Sample Collection Date	x	x
Sample Received Date	x	x
Sample Preparation Date		x
Sample Analysis Date		x
Chain-of Custody	x	x
Method Blank Results	x	x
LCS Results and Control Limits	x	x
Surrogates (organics)		x

8.6.2 Data Flags

STL Savannah uses data flags to qualify, explain, or clarify analytical results. Analytical results below the level of quantitation are routinely reported as "< value". The following routine data flags may be applied to analytical results:

Organic Parameters

FLAG	DEFINITION
U	Undetected. Result is less than the project quantitation limit or, if estimated results (J Flags) are to be reported, less than the MDL.
J	Estimated. Result is below the project quantitation limit but greater than or equal to the MDL.
B	Target compound present in the method blank.
E	Concentration of the target compound exceeds the concentration of the highest standard in the calibration curve (used only when multiple dilutions are reported as separate samples).
D	Results are reported from a dilution (used only when multiple dilutions are reported as separate samples).
P	Relative percent difference between primary and confirmation columns (GC or LC) or detectors (LC) exceed 40%. The lowest concentration has been reported. The P-flag criterion is <=25% difference for CLP SOW.

Inorganic Parameters

FLAG	DEFINITION
U	Undetected. Result is less than the project quantitation limit or, if estimated results (J flags) are to be reported, less than the MDL.
B	Estimated. Result is below the project quantitation limit but greater than or equal to the MDL or IDL
E	Serial dilution exceeded ±10% criteria. Also denotes matrix interference for post digestion spike for GFAA.
M	%RSD criteria exceeded for replicate analysis. Analysis repeated and results confirmed.
N	MS/MSD exceed acceptance criteria.
S	Method of standard addition was used to quantify the sample.
W	(GFAA) Post digestion spike recovery outside acceptance limits.
*	Sample duplicate %RPD exceeded acceptance limits.

STL Savannah uses other data qualifiers to explain or to clarify analytical results or to address sample matrix concerns. These flags are usually denoted as *F# on the report and are defined at the end of the report.

8.6.3 Electronic Download Deliverables

Electronic data deliverables are available in a number of standard STL Savannah formats, including record-by-record downloads, single and multiple-project spreadsheets, and standard database formats. These reports may include a full results summary in report or spreadsheet format, a positive results or "hits only" summary, a results plus standard QC summary, or a full QC including all fields used in routine electronic data validations. STL Savannah's standard downloading formats are compatible with many standard software formats including spreadsheets (such as Lotus, Excel, or Quattro Pro), databases (such as dBase, Paradox, FoxPro, or Access), ASCII, Delimited ASCII, Text, and Fixed Field Length. The report page image files are available in Adobe Acrobat PDF format and can be emailed or provided on a compact disk (CD) and viewed as an exact reproduction of the printed hardcopy report.

STL Savannah also provides special program formats such as: GIS/Key, EQuIS for Windows, EDSolution97 and program-required deliverables such as AFCEE/ERPIMS, USACE/IRDMIS, DOE/EMIS, EPA Format A, and EPA Agency Standard. Client-specific download formats can be developed to meet specific information requirements.

8.7 Data Storage

The procedures and policies for raw data retention are described in SOP CA82: *Analytical Records Maintained by STL* and summarized briefly as follows. After the projects are completed, the data are transferred to a secured area, filed chronologically by laboratory section in boxes, and maintained for five years or the term specified in a client contract. In cases where data are reviewed on a computer screen and a tape back-up system is available, electronic files of data are stored on tape in lieu of paper data for a period of five years. If the data are to be purged to the client or need to be separated from the general raw data files, the data can be boxed, labeled, and stored in a separate secured area. Keys to the data storage areas are retained by the QA Manager.

All in-lab data generated by computer systems are stored to tape or on hard disk, when the capability exists. The tapes are labeled and stored at the individual workstations or maintained by a data systems manager and serve as the lab's raw data files.

Hard copies of all LIMS reports are maintained for five years in client files. All LIMS reports and associated QC data are kept for a minimum of three years on the LIMS hard diskettes and/or magnetic tape. All data on the LIMS are backed up daily on magnetic tape.

8.7.1 Documents and Records

All documentation and records are maintained in accordance with the following standard operating procedures: AN45: *Laboratory Notebooks*, CA02:*Document Control and Distribution*, and CA80:*Data Generation, Entry, Review, Approval, and Reporting.*

8.7.2 Data Retention Policy

The following table outlines STL Savannah's standard record retention time. For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QC, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Section 8.7.3 have lengthier retention requirements and are subject to the requirements listed in the table in Section 8.7.3.

STL Record Retention

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

8.7.3 Programs with Longer Retention Requirements

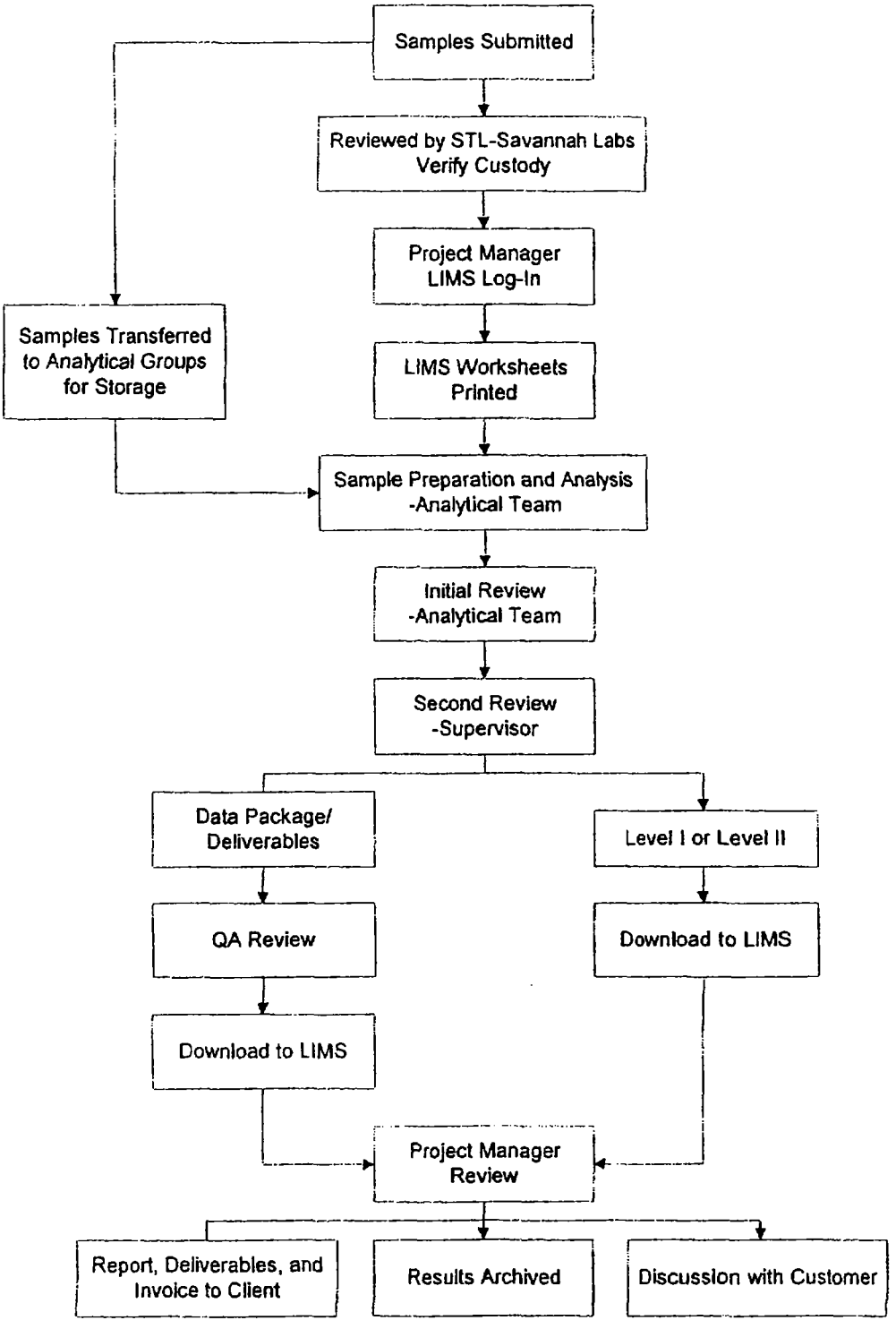
Some regulatory programs have longer record retention requirements than the STL standard record retention time. These are detailed in the following table with their retention requirements. In these cases, the longer retention requirement must be implemented and noted in the archive. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Special Record Retention Requirements

Program	Retention Requirements
Colorado – Drinking Water	10 years
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
FIFRA – 40 CFR Part 160	Retain for life of research or marketing permit for pesticides regulated by EPA
Housing and Urban Development (HUD) Environmental Lead Testing	10 years
Louisiana – All	10 years
Michigan Department of Environmental Quality – all environmental data	10 years
Minnesota – Drinking Water	10 years
Navy Facilities Engineering Service Center (NFESC)	10 years
NY Potable Water NYCRR Part 55-2	10 years
OSHA - 40 CFR Part 1910	30 years
Pennsylvania – Drinking Water	10 years
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement

FIGURE 8.1

SAMPLE TRACKING and DATA SUBMITTAL



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SEVERN TRENT STL

Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Metals						
Aluminum (ICP)	200.7(NPDES)	2	75-125	<=20	17	200
Aluminum (ICP)	6010(3005/3030C)	1/4	75-125	<=20	17	200
Aluminum (ICP)	6010(3010)	1	75-125	<=20	14	200
Aluminum (ICP/MS)	200.8	33	70-130	<=20	3.6	50
Aluminum (ICP/MS)	6020(3005)	1	75-125	<=20	3.6	50
Aluminum (ICP/MS)	6020(3010)	1	75-125	<=20	1.8	50
Antimony (ICP)	200.7(NPDES)	2	75-125	<=20	3.7	20
Antimony (ICP)	6010(3005/3030C)	1/4	75-125	<=20	3.7	20
Antimony (ICP)	6010(3010)	1	75-125	<=20	4.3	20
Antimony(ICP/MS)	200.8	33	70-130	<=20	0.16	2.5
Antimony(ICP/MS)	6020(3005)	1	75-125	<=20	0.16	2.5
Antimony(ICP/MS)	6020(3010)	1	75-125	<=20	0.10	2.5
Antimony (GFAA)	200.9	5	80-120	<=20	0.98	5.0
Antimony (GFAA)	204.2	2	80-120	<=20	3.0	10
Antimony (GFAA)	7041(3020)	1	80-120	<=20	3.0	10
Arsenic (ICP)	200.7(NPDES)	2	75-125	<=20	5.0	10
Arsenic (ICP)	6010(3005/3030C)	1/4	75-125	<=20	5.0	10
Arsenic (ICP)	6010(3010)	1	75-125	<=20	6.9	10
Arsenic (ICP/MS)	200.8	33	70-130	<=20	1.4	5.0
Arsenic (ICP/MS)	6020(3005)	1	75-125	<=20	1.4	5.0
Arsenic (ICP/MS)	6020(3010)	1	75-125	<=20	1.5	5.0
Arsenic (GFAA)	200.9	5	80-120	<=20	1.0	5.0
Arsenic (GFAA)	206.2	2	80-120	<=20	1.2	10
Arsenic (GFAA)	7060(3020)	1	80-120	<=20	1.2	10
Barium (ICP)	200.7(NPDES)	2	75-125	<=20	1.0	10
Barium (ICP)	6010(3005/3030C)	1/4	75-125	<=20	1.0	10
Barium (ICP)	6010(3010)	1	75-125	<=20	1.0	10
Barium (ICP/MS)	200.8	33	70-130	<=20	0.20	5.0
Barium (ICP/MS)	6020(3005)	1	75-125	<=20	0.20	5.0
Barium (ICP/MS)	6020(3010)	1	75-125	<=20	0.17	5.0
Beryllium (ICP)	200.7(NPDES)	2	75-125	<=20	0.40	4.0
Beryllium (ICP)	6010(3005/3030C)	1/4	75-125	<=20	0.40	4.0
Beryllium (ICP)	6010(3010)	1	75-125	<=20	0.40	4.0
Beryllium (ICP/MS)	200.8	33	70-130	<=20	0.062	0.50
Beryllium (ICP/MS)	6020(3005)	1	75-125	<=20	0.062	0.50
Beryllium (ICP/MS)	6020(3010)	1	75-125	<=20	0.052	0.50
Boron (ICP)	200.7(NPDES)	3	75-125	<=20	6.5	50
Boron (ICP)	6010(3005)	1	75-125	<=20	6.5	50
Boron (ICP)	6010(3010)	1	75-125	<=20	7.5	50
Boron (ICP/MS)	200.8	33	70-130	<=20	4.9	25
Boron (ICP/MS)	6020(3005)	1	75-125	<=20	4.9	25
Boron (ICP/MS)	6020(3010)	1	75-125	<=20	1.0	25

SEVERN TRENT STL

Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Cadmium (ICP)	200.7(NPDES)	2	75-125	<=20	0.86	5.0
Cadmium (ICP)	6010(3005/3030C)	1/4	75-125	<=20	0.86	5.0
Cadmium (ICP)	6010(3010)	1	75-125	<=20	0.55	5
Cadmium (ICP/MS)	200.8	33	70-130	<=20	0.13	2.5
Cadmium (ICP/MS)	6020(3005)	1	75-125	<=20	0.13	2.5
Cadmium (ICP/MS)	6020(3010)	1	75-125	<=20	0.090	2.5
Cadmium (GFAA)	213.2	2	80-120	<=20	0.21	1.0
Cadmium (GFAA)	7131(3020)	1	80-120	<=20	0.21	1.0
Calcium (ICP)	200.7(NPDES)	2	75-125	<=20	50	500
Calcium (ICP)	6010(3005/3030C)	1/4	75-125	<=20	50	500
Calcium (ICP)	6010(3010)	1	75-125	<=20	50	500
Calcium (ICP/MS)	200.8	33	70-130	<=20	7.8	250
Calcium (ICP/MS)	6020(3005)	1	75-125	<=20	7.8	250
Calcium (ICP/MS)	6020(3010)	1	75-125	<=20	7.6	250
Chromium (ICP)	200.7(NPDES)	2	75-125	<=20	1.1	10
Chromium (ICP)	6010(3005/3030C)	1/4	75-125	<=20	1.1	10
Chromium (ICP)	6010(3010)	1	75-125	<=20	0.66	10
Chromium (ICP/MS)	200.8	33	70-130	<=20	0.71	5.0
Chromium (ICP/MS)	6020(3005)	1	75-125	<=20	0.71	5.0
Chromium (ICP/MS)	6020(3010)	1	75-125	<=20	0.16	5.0
Chromium (GFAA)	218.2	2	80-120	<=20	1.8	10
Chromium (GFAA)	7191(3020)	1	80-120	<=20	1.8	10
Chromium, hexavalent (colorimetric)	7196/3500-Cr-D	1/4	85-115	<=20	2.0	10
Cobalt (ICP)	200.7(NPDES)	2	75-125	<=20	1.4	10
Cobalt (ICP)	6010(3005/3030C)	1/4	75-125	<=20	1.4	10
Cobalt (ICP)	6010(3010)	1	75-125	<=20	1.1	10
Cobalt (ICP/MS)	200.8	33	70-130	<=20	0.024	5.0
Cobalt (ICP/MS)	6020(3005)	1	75-125	<=20	0.024	5.0
Cobalt (ICP/MS)	6020(3010)	1	75-125	<=20	0.0078	5.0
Copper (ICP)	200.7(NPDES)	2	75-125	<=20	2.7	20
Copper (ICP)	6010(3005)	1	75-125	<=20	2.7	20
Copper (ICP)	6010(3010)	1	75-125	<=20	2.7	20
Copper (ICP/MS)	200.8	33	70-130	<=20	0.24	5.0
Copper (ICP/MS)	6020(3005)	1	75-125	<=20	0.24	5.0
Copper (ICP/MS)	6020(3010)	1	75-125	<=20	0.27	5.0
Copper (GFAA)	220.2	2	80-120	<=20	0.67	10
Copper (GFAA)	7211(3020)	1	80-120	<=20	0.67	10
Iron (ICP)	200.7(NPDES)	2	75-125	<=20	22	50
Iron (ICP)	6010(3005/3030C)	1/4	75-125	<=20	22	50
Iron (ICP)	6010(3010)	1	75-125	<=20	24	50
Iron (ICP/MS)	200.8	33	70-130	<=20	1.2	25
Iron (ICP/MS)	6020(3005)	1	75-125	<=20	1.2	25
Iron (ICP/MS)	6020(3010)	1	75-125	<=20	5.9	25
Iron (ferrous)	3500-Fe-D (colorimetric)	4	80-120	<=20	50	100

SEVERN TRENT STL

Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Lead (ICP)	200.7(NPDES)	2	75-125	<=20	2.5	5.0
Lead (ICP)	6010(3005/3030C)	1/4	75-125	<=20	2.5	5.0
Lead (ICP)	6010(3010)	1	75-125	<=20	1.1	5.0
Lead (ICP/MS)	200.8	33	70-130	<=20	0.068	1.5
Lead (ICP/MS)	6020(3005)	1	75-125	<=20	0.068	1.5
Lead (ICP/MS)	6020(3010)	1	75-125	<=20	0.043	1.5
Lead (GFAA)	200.9	5	80-120	<=20	0.58	2.0
Lead (GFAA)	239.2	2	80-120	<=20	0.68	5.0
Lead (GFAA)	7421(3020)	1	80-120	<=20	0.68	5.0
Magnesium (ICP)	200.7(NPDES)	2	75-125	<=20	50	500
Magnesium (ICP)	6010(3005/3030C)	1/4	75-125	<=20	50	500
Magnesium (ICP)	6010(3010)	1	75-125	<=20	50	500
Magnesium (ICP/MS)	200.8	33	70-130	<=20	0.44	250
Magnesium (ICP/MS)	6020(3005)	1	75-125	<=20	0.44	250
Magnesium (ICP/MS)	6020(3010)	1	75-125	<=20	0.56	250
Manganese (ICP)	200.7(NPDES)	2	75-125	<=20	1.0	10
Manganese (ICP)	6010(3005/3030C)	1/4	75-125	<=20	1.0	10
Manganese (ICP)	6010(3010)	1	75-125	<=20	1.0	10
Manganese (ICP/MS)	200.8	33	70-130	<=20	0.10	5.0
Manganese (ICP/MS)	6020(3005)	1	75-125	<=20	0.10	5.0
Manganese (ICP/MS)	6020(3010)	1	75-125	<=20	0.10	5.0
Mercury (CVAA)	245.1	2	85-115	<=20	0.037	0.20
Mercury (CVAA)	7470	1	80-120	<=20	0.078	0.20
Molybdenum (ICP)	200.7(NPDES)	2	75-125	<=20	1.7	10
Molybdenum (ICP)	6010(3005/3030C)	1/4	75-125	<=20	1.7	10
Molybdenum (ICP)	6010(3010)	1	75-125	<=20	5.7	10
Molybdenum (ICP/MS)	200.8	33	70-130	<=20	0.16	5.0
Molybdenum (ICP/MS)	6020(3005)	1	75-125	<=20	0.16	5.0
Molybdenum (ICP/MS)	6020(3010)	1	75-125	<=20	0.11	5.0
Nickel (ICP)	200.7(NPDES)	2	75-125	<=20	2.2	40
Nickel (ICP)	6010(3005/3030C)	1/4	75-125	<=20	2.2	40
Nickel (ICP)	6010(3010)	1	75-125	<=20	4.0	40
Nickel (ICP/MS)	200.8	33	70-130	<=20	0.064	5.0
Nickel (ICP/MS)	6020(3005)	1	75-125	<=20	0.064	5.0
Nickel (ICP/MS)	6020(3010)	1	75-125	<=20	0.070	5.0
Potassium (ICP)	200.7(NPDES)	2	75-125	<=20	100	1000
Potassium (ICP)	6010(3005/3030C)	1/4	75-125	<=20	100	1000
Potassium (ICP)	6010(3010)	1	75-125	<=20	100	1000
Potassium (ICP/MS)	200.8	33	70-130	<=20	12	250
Potassium (ICP/MS)	6020(3005)	1	75-125	<=20	12	250
Potassium (ICP/MS)	6020(3010)	1	75-125	<=20	25	250

SEVERN TRENT STL

Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Selenium (ICP)	200.7(NPDES)	2	75-125	<=20	5.3	10
Selenium (ICP)	6010(3005/3030C)	1/4	75-125	<=20	5.3	10
Selenium (ICP)	6010(3010)	1	75-125	<=20	5.8	10
Selenium (ICP/MS)	200.8	33	70-130	<=20	0.14	2.5
Selenium (ICP/MS)	6020(3005)	1	75-125	<=20	0.14	2.5
Selenium (ICP/MS)	6020(3010)	1	75-125	<=20	0.13	2.5
Selenium (GFAA)	200.9	5	80-120	<=20	0.91	10
Selenium (GFAA)	270.2	2	80-120	<=20	1.3	10
Selenium (GFAA)	7740(3020)	1	80-120	<=20	1.3	10
Silica, dissolved (ICP)	200.7(NPDES)	6	75-125	<=20	100	500
Silica, dissolved (ICP)	6010	6	75-125	<=20	100	500
Silver (ICP)	200.7(NPDES)	2	75-125	<=20	2.0	10
Silver (ICP)	6010(3005/3030C)	1/4	75-125	<=20	2.0	10
Silver (ICP)	6010(3010)	1	75-125	<=20	2.0	10
Silver (ICP/MS)	200.8	33	70-130	<=20	0.059	5.0
Silver (ICP/MS)	6020(3005)	1	75-125	<=20	0.059	5.0
Silver (ICP/MS)	6020(3010)	1	75-125	<=20	0.046	5.0
Silver(GFAA)	272.2	2	80-120	<=20	0.52	1.0
Silver(GFAA)	7761(3020)	1	80-120	<=20	0.52	1.0
Sodium (ICP)	200.7(NPDES)	2	75-125	<=20	180	500
Sodium (ICP)	6010(3005/3030C)	1/4	75-125	<=20	180	500
Sodium (ICP)	6010(3010)	1	75-125	<=20	180	500
Sodium (ICP/MS)	200.8	33	70-130	<=20	15	250
Sodium (ICP/MS)	6020(3005)	1	75-125	<=20	15	250
Sodium (ICP/MS)	6020(3010)	1	75-125	<=20	24	250
Strontium (ICP)	200.7(NPDES)	2	75-125	<=20	1.0	10
Strontium (ICP)	6010(3005/3030C)	1/4	75-125	<=20	1.0	10
Strontium (ICP)	6010(3010)	1	75-125	<=20	1.0	10
Strontium (ICP/MS)	200.8	33	70-130	<=20	0.040	5.0
Strontium (ICP/MS)	6020(3005)	1	75-125	<=20	0.040	5.0
Strontium (ICP/MS)	6020(3010)	1	75-125	<=20	0.074	5.0
Thallium (ICP)	200.7(NPDES)	2	75-125	<=20	5.7	10
Thallium (ICP)	6010(3005/3030C)	1/4	75-125	<=20	5.7	10
Thallium (ICP)	6010(3010)	1	75-125	<=20	6.5	10
Thallium (ICP/MS)	200.8	33	70-130	<=20	0.16	1.0
Thallium (ICP/MS)	6020(3005)	1	75-125	<=20	0.16	1.0
Thallium (ICP/MS)	6020(3010)	1	75-125	<=20	0.33	1.0
Thallium (GFAA)	200.9	5	80-120	<=20	1.2	2.0
Thallium (GFAA)	279.2	2	80-120	<=20	0.70	10
Thallium (GFAA)	7841(3020)	1	80-120	<=20	0.70	10

SEVERN TRENT STL

Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Tin (ICP)	200.7(NPDES)	2	75-125	<=20	7.0	50
Tin (ICP)	6010(3005/3030C)	1/4	75-125	<=20	7.0	50
Tin (ICP)	6010(3010)	1	75-125	<=20	11	50
Tin (ICP/MS)	200.8	33	70-130	<=20	0.15	5.0
Tin (ICP/MS)	6020(3005)	1	75-125	<=20	0.15	5.0
Tin (ICP/MS)	6020(3010)	1	75-125	<=20	0.40	5.0
Titanium (ICP)	200.7(NPDES)	2	75-125	<=20	1.0	10
Titanium (ICP)	6010(3005/3030C)	1/4	75-125	<=20	1.0	10
Titanium (ICP)	6010(3010)	1	75-125	<=20	1.0	10
Titanium (ICP/MS)	200.8	33	70-130	<=20	2.1	5.0
Titanium (ICP/MS)	6020(3005)	1	75-125	<=20	2.1	5.0
Titanium (ICP/MS)	6020(3010)	1	75-125	<=20	1.5	5.0
Vanadium (ICP)	200.7(NPDES)	2	75-125	<=20	0.70	10
Vanadium (ICP)	6010(3005/3030C)	1/4	75-125	<=20	0.70	10
Vanadium (ICP)	6010(3010)	1	75-125	<=20	0.99	10
Vanadium (ICP/MS)	200.8	33	70-130	<=20	1.5	5.0
Vanadium (ICP/MS)	6020(3005)	1	75-125	<=20	1.5	5.0
Vanadium (ICP/MS)	6020(3010)	1	75-125	<=20	0.74	5.0
Zinc (ICP)	200.7(NPDES)	2	75-125	<=20	1.3	20
Zinc (ICP)	6010(3005/3030C)	1/4	75-125	<=20	1.3	20
Zinc (ICP)	6010(3010)	1	75-125	<=20	2.0	20
Zinc (ICP/MS)	200.8	33	70-130	<=20	3.7	10
Zinc (ICP/MS)	6020(3005)	1	75-125	<=20	3.7	10
Zinc (ICP/MS)	6020(3010)	1	75-125	<=20	6.5	10

SEVERN TRENT STL

Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/L)	RL (mg/L)
General Chemistry						
Acidity	305.1/2310B	2/4	80-120	<=30	10	10
Alkalinity, total, as CaCO3	310.1/2320B	2/4	80-120	<=30	1.0	1.0
Ammonia (as N)	350.1/4500-NH3-H	2/4	85-115	<=30	0.020	0.03
Ammonia, un-ionized	FL-DER	8	NA	NA	NA	Calculated based on pH & temperature
Bicarbonate, as CaCO3	4500-CO2 D	4	NA	NA	NA	1.0
Biochemical Oxygen Demand (BOD-5)	405.1/5210B	2/4	85-115	<=30	NA	2.0
Bromide	300.0/9056	2/1	90-110	<=30	0.12	1.0
Carbon, total organic	415.1/9060/5310-B	2/1/4	80-120	<=25	0.50	1.0
Carbonate, as CaCO3	4500-CO2 D	4	NA	NA	NA	1.0
Carbonaceous Biochemical Oxygen Demand (CBOD)	5210-B	4	81-119	<=30	NA	2.0
Chloride (ion chromatography)	300.0/9056	2/1	90-110	<=30	0.50	1.0
Chloride (colorimetric)	325.2/9251/4500-Cl-E	2/1/4	85-115	<=30	0.50	1.0
Chlorine, residual	330.3/4500-CL-B	2	NA	<=30	NA	1.0
Chemical Oxygen Demand (COD) (titrimetric)	410.1/5220C	2/4	80-120	<=30	16	20
Chemical Oxygen Demand (COD) (colorimetric)	410.4/5220D	2/4	90-110	<=30	12	20
Color	110.2/2120B	2/4	NA	<=40	NA	5 PCU
Corrosivity-Saturation Index	2330B	4	NA	NA	NA	NA
Corrosivity-pH	9040/9041	1	63-158	<=40	NA	NA
Cyanide, amenable to chlorination	335.1/9012/ 4500-CN-G	2/1/4	NA	NA	NA	0.010
Cyanide, reactive	SW-846 Chapter 7, Section 7.3.3.2/9014	1	NA	<=50	NA	100 mg HCN/ kg waste
Cyanide, total	335.3/9012	2/4	85-115	<=20	0.0050	0.010
Cyanide, weak acid dissociable (WAD)	4500-CN -I	4	85-115	<=30	0.0050	0.010
Fluoride (ion chromatography)	300.0/9056	2/1	90-110	<=30	0.063	0.20
Fluoride (ion-specific electrode)	340.2/4500-F--C (undistilled)	2/4	85-115	<=30	0.040	0.20
Halogens, total organic (TOX)	450.1/9020B	2/1	60-140	<=40	0.0041	0.010
Halogens, total absorbable (AOX)	1650	10	71-116	<=40	0.0052	0.020
Hardness, total,as CaCO3 (calculation)	2340B	4	NA	NA	NA	3.3
Hardness, total, as as CaCO3 (titrimetric)	2340C/130.2	4/2	75-125	<=30	10	10
Hydrazine	ASTM 1385	11	75-125	<=25	0.0050	0.010
Hydrogen ion (pH)	150.1/9040	2/1	63-158	<=40	NA	NA
Nitrate (as N) (ion chromatography)	300.0/9056	2/1	90-110	<=30	0.023	0.10
Nitrate (as N) (colorimetric)	353.2 /4500-NO3-F	2/4	80-120	<=30	0.025	0.050
Nitrate + Nitrite (as N)	353.2 /4500-NO3-F	2/4	80-120	<=30	0.025	0.050
Nitrite (as N) (ion chromatography)	300.0/9056	2/1	90-110	<=30	0.030	0.10
Nitrite (as N) (colorimetric)	353.2 /354.1/ 4500-NO3-F	2/4	80-120	<=30	0.025	0.050

SEVERN TRENT STL

Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/L)	RL (mg/L)
Nitrogen, total Kjeldahl (TKN)	351.2	2	75-125	<=40	0.072	0.20
Nitrogen, organic	EPA-CE: 3-205 (TKN-NH3(N))	12/13	NA	NA	NA	0.20
Nitrogen, total	TKN + NO2/NO3(N)	13	NA	NA	NA	0.25
Odor	140.1/2150B	2/4	NA	NA	NA	1 TON
Oil & Grease (gravimetric)	1664 (HEM)/9071	14/2	78-114	<=18	0.85	5.0
Oil & Grease (infra-red)	413.2	2/4	60-140	<=30	0.13	1.0
Oxidation-Reduction potential (ORP)	D1498-76	16	90-110	<=20	NA	NA
Oxygen, dissolved (electrode)	360.1 /4500 O-G	2/4	NA	<=30	NA	0.10
Oxygen, dissolved (colorimetric)	360.2 /4500 O-C	2/4	NA	<=30	NA	0.10
Perchlorate	314.0	15	85-115	<=15	0.00043	0.0020
Petroleum hydrocarbons (gravimetric)	1664 (SGT-HEM)	14	64-132	<=34	0.51	5.0
Petroleum hydrocarbons (infra-red)	418.1	2	60-140	<=30	0.13	1.0
Phenolics, total recoverable	420.1/ 9065	2/1	75-125	<=30	0.032	0.050
Phosphorus,Orthophosphate (as P)	365.2/4500-P-E	2	90-110	<=30	0.025	0.050
Phosphorus, total (as P)	365.4 /4500P-F	2/4	60-140	<=40	0.050	0.10
Residue, dissolved (Total Dissolved Solids-TDS)	160.1/2540C	2/4	80-120	<=25	NA	5.0
Residue, settable (settleable matter)	160.5/2540F	2/4	NA	NA	NA	0.20 mL
Residue, suspended (Total Suspended Solids-TSS)	160.2 / 2540D	2/4	80-120	<=25	NA	5.0
Residue, total(Total Solids)	160.3 / 2540B	2/4	80-120	<=25	NA	5.0
Residue, volatile(Volatile Solids)	160.4/2540E	2/4	NA	<=25	NA	5.0
Salinity	2520B	4	NA	NA	NA	2 parts per thousand
Specific conductance	120.1/9050/2510B	2/1/4	90-110	<=10	NA	5.0 uS/cm
Specific gravity	2710F	4	NA	<=20	NA	NA
Sulfate (ion chromatography)	300.0/9056	2/1	90-110	<=30	0.36	1.0
Sulfate (turbidimetric/colorimetric)	375.4/9038/ 4500-SO4-E	2/1/4	75-125	<=30	2.5	5.0
Sulfide (titrimetric)	376.1 (undistilled)	2	75-125	<=30	1.0	1.0
Sulfide (colorimetric)	376.2 /4500-S2-D (undistilled)	2/4	80-120	<=25	0.019	0.10
Sulfide (distillation/titrimetric)	9034/4500-S2-E(9030-distilled)	1/4	50-150	<=50	1.0	1.0
Sulfide, reactive	SW-846 Chapter 7, Section 7.3.3.2/9014	1	NA	<=50	NA	50 mg H2S/kg waste
Sulfite	377.1/4500-S02-B	2/4	70-130	<=30	2.0	5.0
Surfactants (Methylene Blue Activated Substances-MBAS)	425.1/5540C	2/4	70-130	<=30	0.050	0.10
Turbidity	180.1/2130B	2/4	90-110	<=30	0.10 NTU	0.10 NTU

SEVERN TRENT STL

Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/L)	RL (mg/L)
Non-Routine Analytes						
Acetate (ion chromatography)	Modified EPA 300	7	75-125	<=30	0.50	1.0
Cyanide, free	ASTM D4282-83	9	75-125	<=25	0.0050	0.010
Iodide (ion chromatography)	Modified EPA 300	7	75-125	<=30	2.5	5.0
Phenolics, total recoverable	420.1/ 9065 (chloroform extraction)	2/1	75-125	<=30	0.0050	0.010
Phosphorus, acid hydrolyzable(as P)	365.2	2	60-140	<=40	0.025	0.050
Phosphorus, organic (as P)-(total minus acid hydrolyzable)	365.4	2	NA	NA	NA	0.10
Tannins and Lignins	5550B	4	80-120	<=20	0.10	0.10
Thiocyanate	4500-CN-M	4	80-120	<=25	0.10	0.10
Microbiological Parameters						
Chlorophyll	10200H	4	NA	<=30	NA	0.0001
Coliform, fecal, MPN	9221E, C	4	NA	<=200	NA	2 MPN/100 mL
Coliform, fecal, MF	9222D	4	NA	<=200	NA	1 col/100 mL
Coliform, total, MPN	9131	4	NA	<=200	NA	2 MPN/100 mL
	9221B, C	4	NA	<=200	NA	2 MPN/100 mL
Coliform, total MF	9132	4	NA	<=200	NA	1 col/100 mL
	9222B	4	NA	<=200	NA	1 col/100 mL
Plate count, heterotrophic	9215B	4	NA	NA	NA	1000 CFU/L

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Volatiles (Halogenated) in Water and Wastewater by GC/HECD						
Bromodichloromethane	601	18	42-172	<=30	0.17	1.0
Bromoform	601	18	13-159	<=30	5.0	5.0
Bromomethane	601	18	D-144	<=50	0.25	1.0
Carbon tetrachloride	601	18	43-143	<=30	0.25	1.0
Chlorobenzene	601	18	38-150	<=30	0.43	1.0
Chloroethane	601	18	46-137	<=50	0.37	1.0
2-Chloroethylvinyl ether	601	18	14-186	<=100	10	10
Chloroform	601	18	49-133	<=30	0.12	1.0
Chloromethane	601	18	D-193	<=50	0.41	1.0
Dibromochloromethane	601	18	24-191	<=30	0.15	1.0
1,2-Dichlorobenzene	601	18	D-208	<=30	0.38	1.0
1,3-Dichlorobenzene	601	18	7-187	<=30	0.28	1.0
1,4-Dichlorobenzene	601	18	42-143	<=30	0.25	1.0
Dichlorodifluoromethane	601	18	50-130	<=50	0.25	1.0
1,1-Dichloroethane	601	18	47-132	<=30	0.19	1.0
1,2-Dichloroethane	601	18	51-147	<=30	0.15	1.0
1,1-Dichloroethene	601	18	28-167	<=30	0.23	1.0
cis-1,2-Dichloroethene	601	18	38-155	<=30	0.26	1.0
Trans-1,2-Dichloroethene	601	18	38-155	<=30	0.15	1.0
1,2-Dichloropropane	601	18	44-156	<=30	0.38	1.0
cis-1,3-Dichloropropene	601	18	22-178	<=30	0 20	1.0
trans-1,3-Dichloropropene	601	18	22-178	<=30	0.23	1.0
Methylene chloride	601	18	25-162	<=50	0.10	5.0
1,1,2,2-Tetrachloroethane	601	18	8-184	<=30	0.48	1.0
Tetrachloroethene	601	18	26-162	<=30	0.17	1.0
1,1,1-Trichloroethane	601	18	41-138	<=30	0.24	1.0
1,1,2-Trichloroethane	601	18	39-136	<=30	0.20	1.0
Trichloroethene	601	18	35-146	<=30	0.14	1.0
Trichlorofluoromethane	601	18	21-156	<=30	0.39	1.0
Vinyl chloride	601	18	28-163	<=50	0.30	1.0
Surrogates-						
Bromochloromethane	601	18	61-125	NA	NA	NA
Volatiles (Aromatics) in Water and Wastewater by GC/PID or GC/FID						
Benzene	602	18	39-150	<=30	0.14	1.0
Chlorobenzene	602	18	55-135	<=30	0.15	1.0
1,2-Dichlorobenzene	602	18	37-154	<=30	0.35	1.0
1,3-Dichlorobenzene	602	18	50-141	<=30	0.28	1.0
1,4-Dichlorobenzene	602	18	42-143	<=30	0.25	1.0
Ethylbenzene	602	18	32-160	<=30	0.15	1.0
Methyl Tert-Butyl Ether (MTBE)	602	18	40-140	<=30	0.28	10
Toluene	602	18	46-148	<=30	0.15	1.0
Xylenes, m- and p-	602	18	54-125	<=30	0.31	1.0
Xylene, o-	602	18	54-128	<=30	0.13	1.0
Xylenes, total	602	18	54-125	<=30	0.44	2.0
Surrogates-						
a,a,a-Trifluorotoluene	602	18	69-124	NA	NA	NA
Non-Routine Analyte						
Isopropyl ether	602	18	70-130	<=30	0.44	10

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Chlorinated Pesticides and PCBs as Aroclors in Water and Wastewater by GC/EC						
Aldrin	608	18	42-122	<=40	0.0076	0.050
alpha BHC	608	18	37-134	<=40	0.0035	0.050
beta BHC	608	18	17-147	<=40	0.0026	0.050
delta BHC	608	18	19-140	<=40	0.0099	0.050
gamma BHC (Lindane)	608	18	32-127	<=40	0.0035	0.050
technical Chlordane	608	18	45-119	<=40	0.060	0.50
4,4'-DDD	608	18	31-141	<=40	0.014	0.10
4,4'-DDE	608	18	30-145	<=40	0.010	0.10
4,4'-DDT	608	18	25-160	<=40	0.032	0.10
Dieldrin	608	18	36-146	<=40	0.0086	0.10
Endosulfan I	608	18	45-153	<=40	0.0034	0.050
Endosulfan II	608	18	D-202	<=40	0.017	0.10
Endosulfan sulfate	608	18	26-144	<=40	0.0085	0.10
Endrin	608	18	30-147	<=40	0.0096	0.10
Endrin aldehyde	608	18	49-169	<=40	0.014	0.10
Heptachlor	608	18	34-111	<=40	0.0097	0.050
Heptachlor epoxide	608	18	37-142	<=40	0.022	0.050
Methoxychlor	608	18	28-167	<=40	0.017	0.50
Toxaphene	608	18	41-126	<=40	0.81	5.0
PCB 1016	608	18	50-114	<=40	0.12	1.0
PCB 1221	608	18	15-178	<=40	0.50	2.0
PCB 1232	608	18	10-215	<=40	0.18	1.0
PCB 1242	608	18	39-150	<=40	0.14	1.0
PCB 1248	608	18	38-158	<=40	0.17	1.0
PCB 1254	608	18	29-131	<=40	0.18	1.0
PCB 1260	608	18	8-127	<=40	0.20	1.0
Surrogates						
Decachlorobiphenyl	608	18	30-150	NA	NA	NA
2,4,5,6-Tetrachloro-m-xylene	608	18	30-150	NA	NA	NA
PAHs in Water and Wastewater by HPLC (UV and Fluroresence)						
Acenaphthene	610	18	D-124	<=40	0.14	0.50
Acenaphthylene	610	18	D-139	<=40	0.12	0.50
Anthracene	610	18	D-126	<=40	0.031	0.10
Benzo(a)anthracene	610	18	12-135	<=40	0.024	0.10
Benzo(b)fluoranthene	610	18	6-150	<=40	0.022	0.10
Benzo(k)fluoranthene	610	18	6-150	<=40	0.026	0.10
Benzo(g,h,i)perylene	610	18	D-116	<=40	0.060	0.25
Benzo(a)pyrene	610	18	D-128	<=40	0.040	0.10
Chrysene	610	18	12-135	<=40	0.024	0.10
Dibenzo(a,h)anthracene	610	18	D-116	<=40	0.070	0.25
Fluoranthene	610	18	14-123	<=40	0.14	0.25
Fluorene (MS)	610	18	D-142	<=40	0.074	0.25
Indeno(1,2,3-cd)pyrene	610	18	D-116	<=40	0.040	0.10
Naphthalene	610	18	D-122	<=40	0.11	0.50
Phenanthrene	610	18	D-126	<=40	0.045	0.10
Pyrene	610	18	D-140	<=40	0.078	0.25
Surrogate						
Terphenyl-d14	610	18	18-136	NA	NA	NA

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
2,3,7,8-TCDD in Water and Wastewater by GC/MS (SIM)						
2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) (MS)	613	18	63-137	<=40	0.00018	0.0050
Internal Standard - 13C12-2,3,7,8-TCDD	613	18	>50%	NA	NA	NA
Phosphous-Containing Pesticides and Herbicides in Water and Wastewater by GC/NPD-FPD						
Azinphos methyl (Guthion)	614/622	19/21	30-130	<=40	0.13	1
Bolstar	622	21	30-130	<=40	0.12	1
Chlorpyrifos	622	21	30-130	<=40	0.16	1
Coumaphos	622	21	30-130	<=40	0.15	1
Demeton-o	614	19	30-130	<=40	0.056	2.5
Demeton-s	614	19	30-130	<=40	0.25	2.5
Diazinon (MS)	614/622	19/21	30-130	<=40	0.094	1
Dichlorvos	622	21	30-130	<=40	0.15	2
Disulfoton	614/622	19/21	30-130	<=40	0.082	2
EPN	614.1	20	30-130	<=40	0.14	1
Ethoprop	622	21	30-130	<=40	0.12	0.5
Famphur	622.1	22	30-130	<=40	0.17	2
Fensulfothion	622	21	30-130	<=40	0.077	5
Fenthion	622	21	30-130	<=40	0.17	1
Malathion	614	19	30-130	<=40	0.13	1
Merphos/Merphos oxone	622	21	30-130	<=40	0.14	1
Mevinphos	622	21	30-130	<=40	0.056	2
Naled	622	21	30-130	<=40	0.087	5
Parathion, ethyl (MS)	614	19	30-130	<=40	0.12	1
Parathion, methyl (MS)	614/622	19/21	30-130	<=40	0.12	0.5
Phorate	622	21	30-130	<=40	0.061	1
Ronnel (MS)	622	21	30-130	<=40	0.064	1
Stirophos (Tetrachlorvinphos)	622	21	30-130	<=40	0.16	1
Thionazin (MS)	622.1	22	30-130	<=40	0.10	1
Tokuthion (Prothiofos)	622	21	30-130	<=40	0.13	1
Trichloronate	622	21	30-130	<=40	0.15	1
Surrogate						
Triphenylphosphate	614/622.1/622/622.1	19/20/21/22	28-152	NA	NA	NA
Chorinated Herbicides in Water and Wastewater by GC/EC						
2,4-D	615	23	33-156	<=40	0.13	0.50
2,4-DB	615	23	38-180	<=40	0.22	0.50
2,4,5-T	615	23	43-149	<=40	0.057	0.50
2,4,5-TP(Silvex)	615	23	48-135	<=40	0.054	0.50
Dalapon	615	23	20-164	<=40	0.24	120
Dicamba	615	23	55-152	<=40	0.054	1.2
Dichlorprop	615	23	22-116	<=40	0.059	6.0
Dinoseb	615	23	10-123	<=40	0.44	6.0
MCPA	615	23	27-150	<=40	7.1	120
MCPP	615	23	27-150	<=40	6.6	120
Surrogates						
2,4-Dichlorophenylacetic acid	615	23	35-134	NA	NA	NA

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Volatiles in Water and Wastewater by GC/MS						
Acrolein	624	18	54-145	<=50	3.1	100
Acrolein	624 (low level)	18	54-145	<=50	3.1	20
Acrylonitrile	624	18	10-183	<=50	4.2	100
Acrylonitrile	624 (low level)	18	10-183	<=50	4.2	20
Benzene	624	18	37-151	<=30	0.11	5.0
Benzene	624(low level)	18	37-151	<=30	0.11	1.0
Bromodichloromethane	624	18	35-155	<=30	0.097	5.0
Bromodichloromethane	624(low level)	18	35-155	<=30	0.097	1.0
Bromoform	624	18	45-169	<=30	0.084	5.0
Bromoform	624(low level)	18	45-169	<=30	0.084	1.0
Bromomethane	624	18	D-242	<=100	0.37	5.0
Bromomethane	624(low level)	18	D-242	<=100	0.37	1.0
Carbon tetrachloride	624	18	70-140	<=30	0.096	5.0
Carbon tetrachloride	624(low level)	18	70-140	<=30	0.096	1.0
Chlorobenzene	624	18	37-160	<=30	0.072	5.0
Chlorobenzene	624(low level)	18	37-160	<=30	0.072	1.0
Chloroethane	624	18	14-230	<=50	0.23	5.0
Chloroethane	624(low level)	18	14-230	<=50	0.23	1.0
2-Chloroethyl vinyl ether	624	18	D-305	<=100	10	50
2-Chloroethyl vinyl ether	624(low level)	18	D-305	<=100	10	10
Chloroform	624	18	51-138	<=30	0.12	5.0
Chloroform	624(low level)	18	51-138	<=30	0.12	1.0
Chloromethane	624	18	D-273	<=50	0.47	5.0
Chloromethane	624(low level)	18	D-273	<=50	0.47	1.0
Dibromochloromethane	624	18	53-149	<=30	0.10	5.0
Dibromochloromethane	624(low level)	18	53-149	<=30	0.10	1.0
1,2-Dichlorobenzene	624	18	18-190	<=30	0.15	5.0
1,2-Dichlorobenzene	624(low level)	18	18-190	<=30	0.15	1.0
1,3-Dichlorobenzene	624	18	59-156	<=30	0.11	5.0
1,3-Dichlorobenzene	624(low level)	18	59-156	<=30	0.11	1.0
1,4-Dichlorobenzene	624	18	18-190	<=30	0.10	5.0
1,4-Dichlorobenzene	624(low level)	18	18-190	<=30	0.10	1.0
1,1-Dichloroethane	624	18	59-155	<=30	0.16	5.0
1,1-Dichloroethane	624(low level)	18	59-155	<=30	0.16	1.0
1,2-Dichloroethane	624	18	49-155	<=30	0.12	5.0
1,2-Dichloroethane	624(low level)	18	49-155	<=30	0.12	1.0
1,1-Dichloroethene	624	18	D-234	<=30	0.19	5.0
1,1-Dichloroethene	624(low level)	18	D-234	<=30	0.19	1.0
cis-1,2-Dichloroethene	624	18	60-131	<=30	0.16	5.0
cis-1,2-Dichloroethene	624(low level)	18	60-131	<=30	0.16	1.0
trans-1,2-Dichloroethene	624	18	54-156	<=30	0.10	5.0
trans-1,2-Dichloroethene	624(low level)	18	54-156	<=30	0.10	1.0
1,2-Dichloroethenes, Total (sum of cis- and trans- isomers)	624	18	60-131	<=30	0.31	10
1,2-Dichloroethenes, Total (sum of cis- and trans- isomers)	624(low level)	18	60-131	<=30	0.31	2.0
1,2-Dichloropropane	624	18	D-210	<=30	0.074	5.0
1,2-Dichloropropane	624(low level)	18	D-210	<=30	0.074	1.0

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
cis-1,3-Dichloropropene	624	18	D-227	<=30	0.082	5.0
cis-1,3-Dichloropropene	624(low level)	18	D-227	<=30	0.082	1.0
trans-1,3-Dichloropropene	624	18	17-183	<=30	0.080	5.0
trans-1,3-Dichloropropene	624(low level)	18	17-183	<=30	0.080	1.0
1,3-Dichloropropenes, Total (sum of cis- and trans- isomers)	624	18	17-183	<=30	0.16	10
1,3-Dichloropropenes, Total (sum of cis- and trans- isomers)	624(low level)	18	17-183	<=30	0.16	2.0
Ethylbenzene	624	18	37-162	<=30	0.10	5.0
Ethylbenzene	624(low level)	18	37-162	<=30	0.10	1.0
Methylene chloride	624	18	D-221	<=30	0.20	5.0
Methylene chloride	624(low level)	18	D-221	<=30	0.20	5.0
1,1,2,2-Tetrachloroethane	624	18	46-157	<=30	0.17	5.0
1,1,2,2-Tetrachloroethane	624(low level)	18	46-157	<=30	0.17	1.0
Tetrachloroethene	624	18	64-148	<=30	0.17	5.0
Tetrachloroethene	624(low level)	18	64-148	<=30	0.17	1.0
Toluene	624	18	47-150	<=30	0.19	5.0
Toluene	624(low level)	18	47-150	<=30	0.19	1.0
1,1,1-Trichloroethane	624	18	52-162	<=30	0.090	5.0
1,1,1-Trichloroethane	624(low level)	18	52-162	<=30	0.090	1.0
1,1,2-Trichloroethane	624	18	52-150	<=30	0.14	5.0
1,1,2-Trichloroethane	624(low level)	18	52-150	<=30	0.14	1.0
Trichloroethene	624	18	71-157	<=30	0.18	5.0
Trichloroethene	624(low level)	18	71-157	<=30	0.18	1.0
Trichlorofluoromethane	624	18	17-181	<=30	0.17	5.0
Trichlorofluoromethane	624(low level)	18	17-181	<=30	0.17	1.0
Vinyl chloride	624	18	D-251	<=50	0.14	5.0
Vinyl chloride	624(low level)	18	D-251	<=50	0.14	1.0
Xylenes (total)	624	18	78-119	<=30	0.28	10
Xylenes (total)	624(low level)	18	78-119	<=30	0.28	2.0
Surrogates						
p-Bromofluorobenzene	624	18	71-121	NA	NA	NA
p-Bromofluorobenzene	624(low level)	18	71-121	NA	NA	NA
Dibromofluoromethane	624	18	77-129	NA	NA	NA
Dibromofluoromethane	624(low level)	18	77-129	NA	NA	NA
Toluene-d8	624	18	79-119	NA	NA	NA
Toluene-d8	624(low level)	18	79-119	NA	NA	NA

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Semivolatile Compounds in Water and Wastewater by GC/MS						
Acenaphthene	625	18	47-145	<=40	1.0	10
Acenaphthylene	625	18	33-145	<=40	1.0	10
Anthracene	625	18	27-133	<=40	1.0	10
Benzidine	625	18	D-200	<=100	4.4	80
Benzo(a)anthracene	625	18	33-143	<=40	1.0	10
Benzo(b)fluoranthene	625	18	24-159	<=40	1.3	10
Benzo(k)fluoranthene	625	18	11-162	<=40	1.5	10
Benzo(g,h,i)perylene	625	18	D-219	<=40	0.56	10
Benzo(a)pyrene	625	18	17-163	<=40	1.0	10
Bis(2-chloroethoxy) methane	625	18	33-184	<=40	1.0	10
Bis(2-chloroethyl) ether	625	18	12-158	<=40	1.6	10
Bis(2-chloroisopropyl) ether (2,2-oxybis(1-chloropropane))	625	18	36-166	<=40	1.0	10
Bis(2-ethylhexyl) phthalate	625	18	8-158	<=40	3.2	10
4-Bromophenyl phenyl ether	625	18	53-127	<=40	0.78	10
Butyl benzyl phthalate	625	18	D-152	<=40	1.0	10
4-Chloro-3-methylphenol	625	18	22-147	<=40	1.0	10
2-Chloronaphthalene	625	18	60-118	<=40	1.0	10
2-Chlorophenol	625	18	23-134	<=40	0.89	10
4-Chlorophenylphenyl ether	625	18	25-158	<=40	1.0	10
Chrysene	625	18	17-168	<=40	1.0	10
Dibenz(a,h)anthracene	625	18	D-227	<=40	0.74	10
Di-n-butyl phthalate	625	18	1-118	<=40	0.6	10
1,2-Dichlorobenzene	625	18	32-129	<=40	1.0	10
1,3-Dichlorobenzene	625	18	D-172	<=40	1.0	10
1,4-Dichlorobenzene	625	18	20-124	<=40	1.0	10
3,3'-Dichlorobenzidine	625	18	D-262	<=100	1.0	20
2,4-Dichlorophenol	625	18	39-135	<=40	0.82	10
Diethyl phthalate	625	18	D-114	<=40	1.0	10
2,4-Dimethylphenol	625	18	32-119	<=40	0.92	10
Dimethylphthalate	625	18	D-112	<=40	1.0	10
4,6-Dinitro-2-methylphenol	625	18	D-181	<=40	10	50
2,4-Dinitrophenol	625	18	D-191	<=40	10	50
2,4-Dinitrotoluene	625	18	39-139	<=40	1.0	10
2,6-Dinitrotoluene	625	18	50-158	<=40	0.57	10
Di-n-octyl phthalate	625	18	4-146	<=40	0.83	10
1,2-Diphenylhydrazine	625	18	30-130	<=40	1.0	10
Fluoranthene	625	18	26-137	<=40	1.0	10
Fluorene	625	18	59-121	<=40	1.0	10
Hexachlorobenzene	625	18	D-152	<=40	0.51	10
Hexachlorobutadiene	625	18	24-116	<=40	1.0	10
Hexachlorocyclopentadiene	625	18	D-200	<=100	1.0	10
Hexachloroethane	625	18	40-113	<=40	0.77	10
Indeno(1,2,3-cd)pyrene	625	18	D-171	<=40	0.76	10
Isophorone	625	18	21-196	<=40	1.0	10

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Naphthalene	625	18	21-133	<=40	1.0	10
Nitrobenzene	625	18	35-180	<=40	1.0	10
2-Nitrophenol	625	18	29-182	<=40	0.57	10
4-Nitrophenol	625	18	D-132	<=40	5	50
N-Nitrosodimethylamine	625	18	10-150	<=40	1.1	10
N-Nitrosodiphenylamine	625	18	10-150	<=40	0.60	10
N-Nitrosodi-n-propylamine	625	18	D-230	<=40	1.0	10
Pentachlorophenol	625	18	14-176	<=40	2.0	50
Phenanthrene	625	18	54-120	<=40	1.0	10
Phenol	625	18	5-112	<=40	0.54	10
Pyrene	625	18	52-115	<=40	0.58	10
1,2,4-Trichlorobenzene	625	18	44-142	<=40	0.53	10
2,4,6-Trichlorophenol	625	18	37-144	<=40	0.69	10
Surrogates						
2-Fluorobiphenyl	625	18	58-116	NA	NA	NA
2-Fluorophenol	625	18	36-124	NA	NA	NA
Nitrobenzene-d5	625	18	57-112	NA	NA	NA
Phenol-d5	625	18	44-112	NA	NA	NA
Terphenyl-d14	625	18	29-125	NA	NA	NA
2,4,6-Tribromophenol	625	18	51-132	NA	NA	NA

SEVERN TRENT STL

Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
PCB Homologs by GC/MS (SIM)						
Monochlorobiphenyls	680	24	18-97	<=40	0.0077	0.10
Dichlorobiphenyls	680	24	18-97	<=40	0.0070	0.10
Trichlorobiphenyls	680	24	23-98	<=40	0.011	0.10
Tetrachlorobiphenyls	680	24	25-100	<=40	0.022	0.20
Pentachlorobiphenyls	680	24	39-100	<=40	0.023	0.20
Hexachlorobiphenyls	680	24	33-110	<=40	0.020	0.20
Heptachlorobiphenyls	680	24	43-102	<=40	0.042	0.30
Octachlorobiphenyls	680	24	44-104	<=40	0.030	0.30
Nonachlorobiphenyls	680	24	44-104	<=40	0.050	0.50
Decachlorobiphenyl	680	24	44-104	<=40	0.050	0.50
Surrogate						
Decachlorobiphenyl-13C12	680	24	44-104	NA	NA	NA
Volatiles in Pulp and Paper Samples by GC/MS						
Chloroform	1624	18	40-150	<=30	0.46	10
Internal Standard- Chloroform-13C	1624	18	18-172	NA	NA	NA
Chloroform	624	18	51-138	<=30	0.12	5.0
Surrogates						
p-Bromofluorobenzene	624	18	71-121	NA	NA	NA
Dibromofluoromethane	624	18	D-130(1)	NA	NA	NA
Toluene-d8	624	18	79-119	NA	NA	NA
(1) D = detected. This surrogate shows very low bias in alkali samples.						
Chlorinated Phenols in Pulp and Paper Samples by GC/MS						
2,4,6-Trichlorophenol	1653	25	72-146	<=37	0.18	2.5
2,4,5-trichlorophenol	1653	25	82-128	<=33	0.15	2.5
2,3,4,6-Tetrachlorophenol	1653	25	82-132	<=26	0.25	2.5
3,4,6-Trichloroguaicol	1653	25	74-140	<=33	0.25	2.5
3,4,5-Trichloroguaicol	1653	25	80-134	<=27	0.47	2.5
4,5,6-Trichloroguaicol	1653	25	88-116	<=25	0.12	2.5
3,4,6-Trichlorocatechol	1653	25	64-149	<=43	1.2	5.0
Pentachlorophenol	1653	25	84-120	<=25	0.36	5.0
3,4,5-Trichlorocatechol	1653	25	72-128	<=28	1.0	5.0
Tetrachloroguaicol	1653	25	81-126	<=25	0.34	5.0
Trichlorosyringol	1653	25	66-174	<=27	0.58	2.5
Tetrachlorocatechol	1653	25	81-132	<=32	0.34	5.0
Internal Standards						
3,4,5-Trichlorophenol	1653	25	56-116 (1)	NA	NA	NA
3,4,5-Trichlorophenol	1653	25	24-167 (2)	NA	NA	NA
4,5,6-Trichloroguaalacol-13C6	1653	25	48-131 (1)	NA	NA	NA
4,5,6-Trichloroguaalacol-13C6	1653	25	51-139 (2)	NA	NA	NA
Pentachlorophenol-13C6	1653	25	8-143 (1)	NA	NA	NA
Pentachlorophenol-13C6	1653	25	27-167 (2)	NA	NA	NA
Tetrachloroguaiacol-13C6	1653	25	35-120 (1)	NA	NA	NA
Tetrachloroguaiacol-13C6	1653	25	27-161 (2)	NA	NA	NA
Tetrachlorocatechol-13C6	1653	25	14-118 (1)	NA	NA	NA
Tetrachlorocatechol-13C6	1653	25	0-184 (2)	NA	NA	NA
(1) Recovery limits for the internal standards with ascorbic acid						
(2) Recovery limits for the internal standards without ascorbic acid.						

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Microextractables in Groundwater by GC/EC						
1,2-Dibromoethane (EDB)	8011	1	70-130	<=30	0.0031	0.020
1,2-Dibromo 3-chloropropane(DBCP)	8011	1	70-130	<=30	0.0025	0.020
Volatile Petroleum Hydrocarbons in Groundwater by GC/PID-FID						
Gasoline Range organics (GRO)	TENNESSEE GRO	26	50-100	<=20	0.0036mg/L	0.036mg/L
Gasoline Range organics (GRO)	8015(5030)	1	50-150	<=30	0.0056mg/L	0.050mg/L
Surrogates						
a,a,a-Trifluorotoluene	TENNESSEE GRO	26	50-150	NA	NA	NA
a,a,a-Trifluorotoluene	8015 (5030)	1	50-150	NA	NA	NA
Non-routine Volatiles and Volatile Petroleum Hydrocarbons in Groundwater by GC/PID-FID						
Acetone (MS)	8015(5030)	1	70-130	<=30	7.6	25
2-Butanone (MEK) (MS)	8015(5030)	1	70-130	<=30	7.2	25
Heptane	8015(5030)	1	70-130	<=30	0.17	1.0
Hexane	8015(5030)	1	70-130	<=30	0.18	1.0
2-Hexanone	8015(5030)	1	70-130	<=30	21	25
4-Methyl-2-pentanone (MIBK) (MS)	8015(5030)	1	70-130	<=30	15	25
Methyl t-butyl ether (MTBE)	8015(5030)	1	70-130	<=30	0.88	10
Surrogates						
a,a,a-Trifluorotoluene	8015 (5030)	1	71-124	NA	NA	NA
Non-Routine Analytes (GC Fingerprint)						
Gasoline	8015(5030)	1	50-150	<=30	0.050mg/L	0.050mg/L
Lacolene	8015(5030)	1	40-140	<=30	0.050mg/L	0.050mg/L
Surrogates						
2,5-Dibromotoluene (surrogate for Lacolene)	8015(5030)	1	70-130	NA	NA	NA
a,a,a-Trifluorotoluene	8015 (5030)	1	71-124	NA	NA	NA

SEVERN TRENT STL

Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Extractable Petroleum Hydrocarbons in Groundwater by GC/FID						
Diesel range organics (DRO)	8015 (3520)	1	40-140	<=40	50	100
California LUFT (CALUFT)	8015 (3520)	34	40-140	<=40	50	100
Petroleum Range Organics	FL-PRO	27	41-101	<=20	150	300
Tennessee Extractable Petroleum Hydrocarbons (Tenn EPH)	Tenn EPH	28	50-130	<=40	50	100
Texas Total Petroleum Hydrocarbons (Tx TPH)	Tx TPH	29	70-130	<=20	2.5 mg/L	5.0mg/L
Texas Total Petroleum Hydrocarbons (Tx TPH)	C6-C12 Hydrocarbons	29	70-130	<=20	2.5 mg/L	5.0mg/L
Texas Total Petroleum Hydrocarbons (Tx TPH)	>C12-C28 Hydrocarbons	29	70-130	<=20	2.5 mg/L	5.0mg/L
Texas Total Petroleum Hydrocarbons (Tx TPH)	>C28-C35 Hydrocarbons	29	70-130	<=20	2.5 mg/L	5.0mg/L
Surrogates						
1-Chlorooctane	Texas TPH	29	70-130	NA	NA	NA
Nonatricontane (C39)	FL-PRO	27	24-137	NA	NA	NA
o-Terphenyl	8015 (3520)/CALUFT	1/34	38-156	NA	NA	NA
o-Terphenyl	FL-PRO	27	38-156	NA	NA	NA
o-Terphenyl	Tenn EPH	28	38-156	NA	NA	NA
o-Terphenyl	Texas TPH	29	70-130	NA	NA	NA
Non-Routine Analytes (GC Fingerprint)						
Diesel	8015 (3520)	1	40-140	<=40	300	300
Motor Oil (Heavy oil)	8015 (3520)	1	40-140	<=40	300	300
Kerosene	8015 (3520)	1	40-140	<=40	300	300
Mineral Spirits	8015 (3520)	1	40-140	<=40	300	300
Surrogates						
o-Terphenyl	8015 (3520)	1	38-156	NA	NA	NA

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Acetates						
n-Butyl acetate	8015 (DAI)	1	50-150	<=50	0.78 mg/L	5.0 mg/L
sec-Butyl acetate	8015 (DAI)	1	50-150	<=50	0.65 mg/L	5.0 mg/L
Cellosolve acetate	8015 (DAI)	1	50-150	<=50	1.2 mg/L	5.0 mg/L
Ethyl acetate (MS)	8015 (DAI)	1	50-150	<=50	0.76 mg/L	5.0 mg/L
Isoamyl acetate	8015 (DAI)	1	50-150	<=50	0.74 mg/L	5.0 mg/L
Isobutyl acetate	8015 (DAI)	1	50-150	<=50	0.80 mg/L	5.0 mg/L
Methyl acetate	8015 (DAI)	1	50-150	<=50	0.68 mg/L	5.0 mg/L
Isopropyl acetate	8015 (DAI)	1	50-150	<=50	0.74 mg/L	5.0 mg/L
n-Propyl acetate (MS)	8015 (DAI)	1	50-150	<=50	1.1 mg/L	5.0 mg/L
Alcohols						
Tert-Amyl alcohol	8015 (DAI)	1	50-150	<=50	0.26 mg/L	1.0 mg/L
Isobutanol	8015 (DAI)	1	50-150	<=50	0.15 mg/L	1.0 mg/L
n-Butanol	8015 (DAI)	1	50-150	<=50	0.16 mg/L	1.0 mg/L
Sec-Butanol	8015 (DAI)	1	50-150	<=50	0.21 mg/L	1.0 mg/L
Tert-Butanol	8015 (DAI)	1	50-150	<=50	0.18 mg/L	1.0 mg/L
Ethanol (MS)	8015 (DAI)	1	50-150	<=50	0.25 mg/L	1.0 mg/L
Methanol (MS)	8015 (DAI)	1	50-150	<=50	0.25 mg/L	1.0 mg/L
n-Propanol	8015 (DAI)	1	50-150	<=50	0.25 mg/L	1.0 mg/L
Isopropanol (MS)	8015 (DAI)	1	50-150	<=50	0.28 mg/L	1.0 mg/L
Cellosolves						
Butyl cellosolve	8015 (DAI)	1	50-150	<=50	1.6 mg/L	5.0 mg/L
Ethyl cellosolve (2-Ethoxyethanol)	8015 (DAI)	1	50-150	<=50	5.4 mg/L	20 mg/L
Glycols						
Diethylene glycol	8015 (DAI)	1	50-150	<=50	1.7 mg/L	5.0 mg/L
Ethylene glycol (MS)	8015 (DAI)	1	50-150	<=50	0.78 mg/L	5.0 mg/L
Propylene glycol (MS)	8015 (DAI)	1	50-150	<=50	0.90 mg/L	5.0 mg/L
Tetraethylene glycol	8015 (DAI)	1	50-150	<=50	1.6 mg/L	10 mg/L
Triethylene glycol	8015 (DAI)	1	50-150	<=50	1.0 mg/L	5.0 mg/L
Miscellaneous Solvents						
Cyclohexanone	8015 (DAI)	1	50-150	<=50	1.5 mg/L	5.0 mg/L
1,4-Dioxane	8015 (DAI)	1	50-150	<=50	0.78 mg/L	5.0 mg/L
2-Nitropropane	8015 (DAI)	1	50-150	<=50	1.0 mg/L	5.0 mg/L
Tetrahydrofuran (MS)	8015 (DAI)	1	50-150	<=50	0.84 mg/L	5.0 mg/L
Non-routine Solvents						
Allyl alcohol	8015 (DAI)	1	50-150	<=50	0.38 mg/L	1.0 mg/L
Diacetone alcohol	8015 (DAI)	1	50-150	<=50	0.51 mg/L	5.0 mg/L
2-Pentanone	8015 (DAI)	1	50-150	<=50	0.36 mg/L	1.0 mg/L
□ DAI = Direct Aqueous Injection						
HAPs by Direct Aqueous Injection GC/FID						
Acetaldehyde	NCASI 99.01	30	70-130	<=30	0.26 mg/L	1.0 mg/L
Methanol	NCASI 99.01	30	70-130	<=30	2.5 mg/L	50 mg/L
Methanol	NCASI 94.03	31	70-130	<=30	0.082 mg/L	0.50 mg/L
Propionaldehyde	NCASI 99.01	30	70-130	<=30	0.14 mg/L	1.0 mg/L
Methyl ethyl ketone (MEK)	NCASI 99.01	30	70-130	<=30	0.14 mg/L	1.0 mg/L
□ DAI = Direct Aqueous Injection						

SEVERN TRENT STL

Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Volatiles in Groundwater by GC/HECD and PID or FID						
Benzene (MS)	8021(5030)	1	79-123	<=30	0.14	1.0
Bromodichloromethane	8021(5030)	1	70-130	<=30	0.17	1.0
Bromoform	8021(5030)	1	70-130	<=30	5.0	5.0
Bromomethane	8021(5030)	1	50-150	<=50	0.25	1.0
Carbon tetrachloride	8021(5030)	1	70-130	<=30	0.25	1.0
Chlorobenzene (MS)	8021(5030)	1	80-123	<=30	0.43	1.0
Chloroethane	8021(5030)	1	50-150	<=50	0.37	1.0
2-Chloroethyl vinyl ether	8021(5030)	1	D-130	<=100	10	10
Chloroform	8021(5030)	1	70-130	<=30	0.12	1.0
Chloromethane	8021(5030)	1	50-150	<=50	0.41	1.0
Dibromochloromethane	8021(5030)	1	70-130	<=30	0.15	1.0
1,2-Dichlorobenzene	8021(5030)	1	70-130	<=30	0.38	1.0
1,3-Dichlorobenzene	8021(5030)	1	70-130	<=30	0.28	1.0
1,4-Dichlorobenzene	8021(5030)	1	70-130	<=30	0.25	1.0
Dichlorodifluoromethane	8021(5030)	1	50-150	<=50	0.25	1.0
1,1-Dichloroethane	8021(5030)	1	70-130	<=30	0.19	1.0
1,2-Dichloroethane	8021(5030)	1	70-130	<=30	0.15	1.0
1,1-Dichloroethene (MS)	8021(5030)	1	73-128	<=30	0.23	1.0
cis-1,2-Dichloroethene	8021(5030)	1	70-130	<=30	0.26	1.0
trans-1,2-Dichloroethene	8021(5030)	1	70-130	<=30	0.15	1.0
1,2-Dichloropropane	8021(5030)	1	70-130	<=30	0.38	1.0
cis-1,3-Dichloropropene	*8021(5030)*	*1*	*70-130*	*<=30*	*0.20*	*1.0*
trans-1,3-Dichloropropene	8021(5030)	1	70-130	<=30	0.23	1.0
Ethylbenzene	8021(5030)	1	70-130	<=30	0.15	1.0
Methylene chloride	8021(5030)	1	70-130	<=30	0.10	5.0
Methyl t-butyl ether (MTBE)	8021(5030)	1	70-130	<=30	0.28	10
Styrene	8021(5030)	1	70-130	<=30	0.13	1.0
1,1,2,2-Tetrachloroethane	8021(5030)	1	70-130	<=30	0.48	1.0
Tetrachloroethene	8021(5030)	1	70-130	<=30	0.17	1.0
Toluene (MS)	8021(5030)	1	78-123	<=30	0.15	1.0
1,1,1-Trichloroethane	8021(5030)	1	70-130	<=30	0.24	1.0
1,1,2-Trichloroethane	8021(5030)	1	70-130	<=30	0.20	1.0
Trichloroethene (MS)	8021(5030)	1	70-130	<=30	0.14	1.0
Trichlorofluoromethane	8021(5030)	1	50-150	<=50	0.39	1.0
Vinyl Chloride	8021(5030)	1	50-150	<=50	0.30	1.0
o-Xylene	8021(5030)	1	70-130	<=30	0.13	1.0
m&p-Xylene	8021(5030)	1	70-130	<=30	0.31	1.0
Total Xylenes	8021(5030)	1	70-130	<=30	0.44	2.0
Surrogates						
Bromochloromethane	8021(5030)	1	57-127	NA	NA	NA
a,a,a-Trifluorotoluene	8021(5030)	1	71-124	NA	NA	NA
Non-Routine Analyte						
Isopropyl ether	8021(5030)	1	40-140	<=50	0.44	10

SEVERN TRENT STL

Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Chlorinated Pesticides in Groundwater by GC/EC						
Aldrin (MS)	8081(3520)	1	20-99	<=40	0.0086	0.050
alpha BHC	8081(3520)	1	15-116	<=40	0.0035	0.050
beta BHC	8081(3520)	1	34-141	<=40	0.0035	0.050
delta BHC	8081(3520)	1	33-124	<=40	0.0090	0.050
gamma BHC (Lindane) (MS)	8081(3520)	1	26-119	<=40	0.0030	0.050
alpha Chlordane	8081(3520)	1	45-118	<=40	0.0084	0.050
gamma Chlordane	8081(3520)	1	47-115	<=40	0.0070	0.050
Technical Chlordane	8081(3520)	1	38-141	<=40	0.090	0.50
Chlorobenzilate	8081(3520)	1	35-155	<=40	0.19	0.50
4,4'-DDD	8081(3520)	1	55-124	<=40	0.016	0.10
4,4'-DDE	8081(3520)	1	39-114	<=40	0.010	0.10
4,4'-DDT (MS)	8081(3520)	1	41-145	<=40	0.014	0.10
Dieldrin (MS)	8081(3520)	1	46-124	<=40	0.0060	0.10
Endosulfan I	8081(3520)	1	40-114	<=40	0.0099	0.050
Endosulfan II	8081(3520)	1	58-116	<=40	0.0084	0.10
Endosulfan sulfate	8081(3520)	1	67-139	<=40	0.0085	0.10
Endrin (MS)	8081(3520)	1	37-128	<=40	0.0097	0.10
Endrin aldehyde	8081(3520)	1	55-142	<=40	0.014	0.10
Endrin ketone	8081(3520)	1	61-140	<=40	0.0072	0.10
Heptachlor (MS)	8081(3520)	1	21-114	<=40	0.014	0.050
Heptachlor epoxide	8081(3520)	1	43-118	<=40	0.0026	0.050
Isodrin	8081(3520)	1	24-214	<=40	0.0082	0.050
Kepone	8081(3520)	1	D-105	<=100	0.12	1.0
Methoxychlor	8081(3520)	1	30-163	<=40	0.0070	0.50
Toxaphene	8081(3520)	1	39-137	<=40	0.77	5.0
Surrogates						
Decachlorobiphenyl	8081(3520)	1	30-150	NA	NA	NA
2,4,5,6-Tetrachloro-m-xylene	8081(3520)	1	30-150	NA	NA	NA
Polychlorinated Biphenyls as Aroclors in Groundwater by GC/EC						
PCB 1016(MS)	8082(3520)	1	32-109	<=40	0.11	1.0
PCB 1221	8082(3520)	1	30-110	<=40	0.50	2.0
PCB 1232	8082(3520)	1	30-110	<=40	0.18	1.0
PCB 1242	8082(3520)	1	30-110	<=40	0.14	1.0
PCB 1248	8082(3520)	1	30-110	<=40	0.11	1.0
PCB 1254	8082(3520)	1	40-130	<=40	0.20	1.0
PCB 1260(MS)	8082(3520)	1	39-132	<=40	0.11	1.0
PCB 1268	8082(3520)	1	40-130	<=40	0.074	1.0
Surrogates						
Decachlorobiphenyl	8082(3520)	1	30-150	NA	NA	NA
2,4,5,6-Tetrachloro-m-xylene	8082(3520)	1	30-150	NA	NA	NA

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Phosphorus-containing Pesticides and Herbicides by GC/NPD-FPD						
Azinphos methyl	8141(3520)	1	30-150	<=40	0.13	1.0
Bolstar (Sulprofos)	8141(3520)	1	30-150	<=40	0.12	1.0
Chlorpyrifos	8141(3520)	1	30-150	<=40	0.16	1.0
Coumaphos	8141(3520)	1	30-150	<=40	0.15	1.0
Demeton-o	8141(3520)	1	30-150	<=40	0.056	2.5
Demeton-s	8141(3520)	1	30-150	<=40	0.25	2.5
Diazinon (MS)	8141(3520)	1	30-150	<=40	0.094	1.0
Dichlorvos	8141(3520)	1	30-150	<=40	0.15	2.0
Dimethoate	8141(3520)	1	30-150	<=40	0.13	2.0
Disulfoton	8141(3520)	1	30-150	<=40	0.082	2.0
EPN	8141(3520)	1	30-150	<=40	0.14	1.0
Ethoprop	8141(3520)	1	30-150	<=40	0.12	0.50
Famphur	8141(3520)	1	30-150	<=40	0.17	2.0
Fensulfothion	8141(3520)	1	30-150	<=40	0.077	5.0
Fenthion	8141(3520)	1	30-150	<=40	0.17	1.0
Malathion	8141(3520)	1	30-150	<=40	0.13	1.0
Merphos/Merphos oxone	8141(3520)	1	30-150	<=40	0.14	1.5
Mevinphos	8141(3520)	1	30-150	<=40	0.056	2.0
Monocrotophos	8141(3520)	1	30-150	<=40	8.8	10
Naled	8141(3520)	1	30-150	<=40	0.087	5.0
Parathion, ethyl (MS)	8141(3520)	1	30-150	<=40	0.12	1.0
Parathion, methyl (MS)	8141(3520)	1	30-150	<=40	0.12	0.50
Phorate	8141(3520)	1	30-150	<=40	0.061	1.0
Ronnel	8141(3520)	1	30-150	<=40	0.064	1.0
Stirophos (Tetrachlorvinphos)	8141(3520)	1	30-150	<=40	0.16	1.0
Sulfotepp	8141(3520)	1	30-150	<=40	0.16	0.50
Thionazin (MS)	8141(3520)	1	30-150	<=40	0.10	1.0
Tokuthion (Prothiofos)	8141(3520)	1	30-150	<=40	0.13	1.0
Trichloronate	8141(3520)	1	30-150	<=40	0.15	1.0
Surrogate						
Triphenylphosphate	8141(3520)	1	29-152	NA	NA	NA
Chlorinated Herbicides by GC/EC						
2,4-D (MS)	8151	1	33-156	<=40	0.13	0.50
2,4-DB	8151	1	38-180	<=40	0.22	0.50
2,4,5-T (MS)	8151	1	43-149	<=40	0.057	0.50
2,4,5-TP (Silvex) (MS)	8151	1	48-135	<=40	0.054	0.50
Dalapon	8151	1	20-164	<=40	0.24	120
Dicamba	8151	1	55-152	<=40	0.054	1.2
Dichlorprop	8151	1	22-116	<=40	0.059	6.0
Dinoseb	8151	1	10-123	<=40	0.44	6.0
MCPA	8151	1	27-150	<=40	7.1	120
MCPP	8151	1	27-150	<=40	6.6	120
Pentachlorophenol	8151	1	30-174	<=40	0.10	1.0
Surrogate						
2,4-Dichlorophenylacetic acid (DCAA)	8151	1	35-134	NA	NA	NA
Non-routine Compounds						
Picloram	8151	1	30-150	<=40	0.096	0.50

SEVERN TRENT STL

Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Volatiles in Groundwater by GC/MS						
Acetone	8260(5030)	1	32-164	<=50	2.3	50
Acetone	8260(5030)(low level)	1	32-164	<=50	2.3	25
Acetonitrile	8260(5030)	1	71-158	<=30	8.3	200
Acetonitrile	8260(5030)(low level)	1	71-158	<=30	8.3	40
Acrolein	8260(5030)	1	40-91	<=30	6.6	100
Acrolein	8260(5030) (low level)	1	40-91	<=30	6.6	20
Acrylonitrile	8260(5030)	1	46-144	<=30	3.9	100
Acrylonitrile	8260(5030) (low level)	1	46-144	<=30	3.9	20
Benzene (MS)	8260(5030)	1	69-128	<=30	0.096	5.0
Benzene (MS)	8260(5030)(low level)	1	69-128	<=30	0.096	1.0
Bromobenzene	8260(5030)	1	55-131	<=30	0.083	5.0
Bromobenzene	8260(5030)(low level)	1	55-131	<=30	0.083	1.0
Bromochloromethane	8260(5030)	1	50-154	<=30	0.16	5.0
Bromochloromethane	8260(5030)(low level)	1	50-154	<=30	0.16	1.0
Bromodichloromethane	8260(5030)	1	69-134	<=30	0.18	5.0
Bromodichloromethane	8260(5030)(low level)	1	69-134	<=30	0.18	1.0
Bromoform	8260(5030)	1	69-138	<=30	0.19	5.0
Bromoform	8260(5030)(low level)	1	69-138	<=30	0.19	1.0
Bromomethane	8260(5030)	1	22-184	<=50	0.49	5.0
Bromomethane	8260(5030)(low level)	1	22-184	<=50	0.49	1.0
2-Butanone (methyl ethyl ketone-MEK)	8260(5030)	1	38-153	<=30	0.48	25
2-Butanone (methyl ethyl ketone-MEK)	8260(5030)(low level)	1	38-153	<=30	0.48	10
n-Butylbenzene	8260(5030)	1	47-130	<=30	0.062	5.0
n-Butylbenzene	8260(5030)(low level)	1	47-130	<=30	0.062	1.0
sec-Butylbenzene	8260(5030)	1	53-125	<=30	0.063	5.0
sec-Butylbenzene	8260(5030)(low level)	1	53-125	<=30	0.063	1.0
tert-Butylbenzene	8260(5030)	1	51-134	<=30	0.14	5.0
tert-Butylbenzene	8260(5030)(low level)	1	51-134	<=30	0.14	1.0
Carbon disulfide	8260(5030)	1	55-140	<=30	0.72	5.0
Carbon disulfide	8260(5030)(low level)	1	55-140	<=30	0.72	1.0
Carbon tetrachloride	8260(5030)	1	67-136	<=30	0.15	5.0
Carbon tetrachloride	8260(5030)(low level)	1	67-136	<=30	0.15	1.0
Chlorobenzene (MS)	8260(5030)	1	72-126	<=30	0.10	5.0
Chlorobenzene (MS)	8260(5030)(low level)	1	72-126	<=30	0.10	1.0
2-Chloro-1,3-butadiene (Chloroprene)	8260(5030)	1	66-115	<=30	0.13	5.0
2-Chloro-1,3-butadiene (Chloroprene)	8260(5030)(low level)	1	66-115	<=30	0.13	1.0
Chloroethane	8260(5030)	1	40-158	<=50	0.86	5.0
Chloroethane	8260(5030)(low level)	1	40-158	<=50	0.86	1.0
2-Chloroethyl vinyl ether	8260(5030)	1	D-200	<=100	1.5	50
2-Chloroethyl vinyl ether	8260(5030)(low level)	1	D-200	<=100	1.5	10
Chloroform	8260(5030)	1	72-124	<=30	0.12	5.0
Chloroform	8260(5030)(low level)	1	72-124	<=30	0.12	1.0
Chloromethane	8260(5030)	1	40-123	<=50	0.40	5.0
Chloromethane	8260(5030)(low level)	1	40-123	<=50	0.40	1.0

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
3-Chloropropene (Allyl chloride)	8260(5030)	1	D-200	<=100	0.39	5.0
3-Chloropropene (Allyl chloride)	8260(5030)(low level)	1	D-200	<=100	0.39	1.0
2-Chlorotoluene	8260(5030)	1	53-133	<=30	0.14	5.0
2-Chlorotoluene	8260(5030)(low level)	1	53-133	<=30	0.14	1.0
4-Chlorotoluene	8260(5030)	1	47-132	<=30	0.14	5.0
4-Chlorotoluene	8260(5030)(low level)	1	47-132	<=30	0.14	1.0
Dibromochloromethane	8260(5030)	1	72-132	<=30	0.078	5.0
Dibromochloromethane	8260(5030)(low level)	1	72-132	<=30	0.078	1.0
1,2-Dibromo-3-chloropropane	8260(5030)	1	14-147	<=50	0.22	5.0
1,2-Dibromo-3-chloropropane	8260(5030)(low level)	1	14-147	<=50	0.22	1.0
1,2-Dibromoethane	8260(5030)	1	60-118	<=30	0.083	5.0
1,2-Dibromoethane	8260(5030)(low level)	1	60-118	<=30	0.083	1.0
Dibromomethane	8260(5030)	1	54-123	<=30	0 21	5.0
Dibromomethane	8260(5030)(low level)	1	54-123	<=30	0.21	1.0
1,2-Dichlorobenzene	8260(5030)	1	68-127	<=30	0.21	5.0
1,2-Dichlorobenzene	8260(5030)(low level)	1	68-127	<=30	0.21	1.0
1,3-Dichlorobenzene	8260(5030)	1	70-125	<=30	0.12	5.0
1,3-Dichlorobenzene	8260(5030)(low level)	1	70-125	<=30	0.12	1.0
1,4-Dichlorobenzene	8260(5030)	1	68-126	<=30	0.11	5.0
1,4-Dichlorobenzene	8260(5030)(low level)	1	68-126	<=30	0.11	1.0
trans-1,4-Dichloro-2-butene	8260(5030)	1	26-131	<=50	0.77	10
trans-1,4-Dichloro-2-butene	8260(5030)(low level)	1	26-131	<=50	0.77	2.0
Dichlorodifluoromethane	8260(5030)	1	54-162	<=50	0.31	5.0
Dichlorodifluoromethane	8260(5030)(low level)	1	54-162	<=50	0.31	1.0
1,1-Dichloroethane	8260(5030)	1	41-158	<=30	0.12	5.0
1,1-Dichloroethane	8260(5030)(low level)	1	41-158	<=30	0.12	1.0
1,2-Dichloroethane	8260(5030)	1	61-143	<=30	0.18	5.0
1,2-Dichloroethane	8260(5030)(low level)	1	61-143	<=30	0.18	1.0
1,2-Dichloroethenes, Total (sum of cis- and trans- isomers)	8260(5030)	1	48-148	<=30	0.31	10
1,2-Dichloroethenes, Total (sum of cis- and trans- isomers)	8260(5030)(low level)	1	48-148	<=30	0.31	2.0
cis-1,2-Dichloroethene	8260(5030)	1	57-132	<=30	0.16	5.0
cis-1,2-Dichloroethene	8260(5030)(low level)	1	57-132	<=30	0.16	1.0
trans-1,2-Dichloroethene	8260	1	48-148	<=30	0.36	5.0
trans-1,2-Dichloroethene	8260(5030)(low level)	1	48-148	<=30	0.36	1.0
1,1-Dichloroethene (MS)	8260(5030)	1	53-144	<=30	0.31	5.0
1,1-Dichloroethene (MS)	8260(5030)(low level)	1	53-144	<=30	0.31	1.0
1,2-Dichloropropane	8260(5030)	1	74-122	<=30	0.17	5.0
1,2-Dichloropropane	8260(5030)(low level)	1	74-122	<=30	0.17	1.0
1,3-Dichloropropane	8260(5030)	1	60-125	<=30	0.12	5.0
1,3-Dichloropropane	8260(5030)(low level)	1	60-125	<=30	0.12	1.0
2,2-Dichloropropane	8260(5030)	1	42-155	<=30	0.092	5.0
2,2-Dichloropropane	8260(5030)(low level)	1	42-155	<=30	0.092	1.0
1,1-Dichloropropene	8260(5030)	1	70-130	<=30	0.097	5.0
1,1-Dichloropropene	8260(5030)(low level)	1	70-130	<=30	0.097	1.0

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
cis-1,3-Dichloropropene	8260(5030)	1	77-127	<=30	0.12	5.0
cis-1,3-Dichloropropene	8260(5030)(low level)	1	77-127	<=30	0.12	1.0
trans-1,3-Dichloropropene	8260(5030)	1	73-133	<=30	0.15	5.0
trans-1,3-Dichloropropene	8260(5030)(low level)	1	73-133	<=30	0.15	1.0
Ethylbenzene	8260(5030)	1	76-120	<=30	0.11	5.0
Ethylbenzene	8260(5030)(low level)	1	76-120	<=30	0.11	1.0
Ethyl methacrylate	8260(5030)	1	58-101	<=30	0.076	5.0
Ethyl methacrylate	8260(5030)(low level)	1	58-101	<=30	0.076	1.0
Hexachlorobutadiene	8260(5030)	1	58-133	<=30	0.12	5.0
Hexachlorobutadiene	8260(5030)(low level)	1	58-133	<=30	0.12	1.0
2-Hexanone	8260(5030)	1	43-158	<=30	0.29	25
2-Hexanone	8260(5030)(low level)	1	43-158	<=30	0.29	10
Iodomethane	8260(5030)	1	34-116	<=30	0.085	5.0
Iodomethane	8260(5030)(low level)	1	34-116	<=30	0.085	1.0
Isobutyl alcohol	8260(5030)	1	39-132	<=30	8.8	200
Isobutyl alcohol	8260(5030)(low level)	1	39-132	<=30	8.8	40
Isopropylbenzene	8260(5030)	1	62-122	<=30	0.076	5.0
Isopropylbenzene	8260(5030)(low level)	1	62-122	<=30	0.076	1.0
p-Isopropyltoluene	8260(5030)	1	58-123	<=30	0.065	5.0
p-Isopropyltoluene	8260(5030)(low level)	1	58-123	<=30	0.065	1.0
Methacrylonitrile	8260(5030)	1	65-110	<=30	1.7	100
Methacrylonitrile	8260(5030)(low level)	1	65-110	<=30	1.7	20
Methylene chloride	8260(5030)	1	63-133	<=30	0.61	5.0
Methylene chloride	8260(5030)(low level)	1	63-133	<=30	0.61	5.0
Methylmethacrylate	8260(5030)	1	57-120	<=30	0.20	5.0
Methylmethacrylate	8260(5030)(low level)	1	57-120	<=30	0.20	1.0
4-Methyl-2-pentanone (MIBK)	8260(5030)	1	46-156	<=30	0.27	25
4-Methyl-2-pentanone (MIBK)	8260(5030)(low level)	1	46-156	<=30	0.27	10
Methyl t-butyl ether (MTBE)	8260(5030)	1	70-130	<=30	0.17	10
Methyl t-butyl ether (MTBE)	8260(5030)(low level)	1	70-130	<=30	0.17	10
Naphthalene	8260(5030)	1	58-143	<=30	0.12	5.0
Naphthalene	8260(5030)(low level)	1	58-143	<=30	0.12	5.0
Pentachloroethane	8260(5030)	1	D-200	<=100	0.47	25
Pentachloroethane	8260(5030)(low level)	1	D-200	<=100	0.47	5.0
Propionitrile (ethylcyanide)	8260(5030)	1	72-121	<=30	2.5	100
Propionitrile (ethylcyanide)	8260(5030)(low level)	1	72-121	<=30	2.5	20
n-Propylbenzene	8260(5030)	1	53-125	<=30	0.13	5.0
n-Propylbenzene	8260(5030)(low level)	1	53-125	<=30	0.13	1.0
Styrene	8260(5030)	1	75-123	<=30	0.050	5.0
Styrene	8260(5030)(low level)	1	75-123	<=30	0.050	1.0
1,1,1,2-Tetrachloroethane	8260(5030)	1	62-107	<=30	0.20	5.0
1,1,1,2-Tetrachloroethane	8260(5030)(low level)	1	62-107	<=30	0.20	1.0
1,1,2,2-Tetrachloroethane	8260(5030)	1	61-139	<=30	0.17	5.0
1,1,2,2-Tetrachloroethane	8260(5030)(low level)	1	61-139	<=30	0.17	1.0
Tetrachloroethene	8260(5030)	1	71-129	<=30	0.43	5.0
Tetrachloroethene	8260(5030)(low level)	1	71-129	<=30	0.43	1.0

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Toluene (MS)	8260(5030)	1	71-129	<=30	0.065	5.0
Toluene (MS)	8260(5030)(low level)	1	71-129	<=30	0.065	1.0
1,2,3-Trichlorobenzene	8260(5030)	1	38-130	<=30	0.27	5.0
1,2,3-Trichlorobenzene	8260(5030)(low level)	1	38-130	<=30	0.27	1.0
1,2,4-Trichlorobenzene	8260(5030)	1	48-131	<=30	0.068	5.0
1,2,4-Trichlorobenzene	8260(5030)(low level)	1	48-131	<=30	0.068	1.0
1,1,1-Trichloroethane	8260(5030)	1	68-135	<=30	0.065	5.0
1,1,1-Trichloroethane	8260(5030)(low level)	1	68-135	<=30	0.065	1.0
1,1,2-Trichloroethane	8260(5030)	1	70-129	<=30	0.11	5.0
1,1,2-Trichloroethane	8260(5030)(low level)	1	70-129	<=30	0.11	1.0
Trichloroethene(MS)	8260(5030)	1	70-123	<=30	0.13	5.0
Trichloroethene(MS)	8260(5030)(low level)	1	70-123	<=30	0.13	1.0
Trichlorofluoromethane	8260(5030)	1	74-165	<=50	0.27	5.0
Trichlorofluoromethane	8260(5030)(low level)	1	74-165	<=50	0.27	1.0
1,2,3-Trichloropropane	8260(5030)	1	60-147	<=30	0.53	5.0
1,2,3-Trichloropropane	8260(5030)(low level)	1	60-147	<=30	0.53	1.0
1,1,2-Trichloro-1,2,2-trifluoroethane	8260(5030)	1	70-130	<=30	0.067	5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	8260(5030)(low level)	1	70-130	<=30	0.067	1.0
1,2,4-Trimethylbenzene	8260(5030)	1	53-142	<=30	0.097	5.0
1,2,4-Trimethylbenzene	8260(5030)(low level)	1	53-142	<=30	0.097	1.0
1,3,5-Trimethylbenzene	8260(5030)	1	50-127	<=30	0.12	5.0
1,3,5-Trimethylbenzene	8260(5030)(low level)	1	50-127	<=30	0.12	1.0
Vinyl acetate	8260(5030)	1	47-150	<=30	0.36	10
Vinyl acetate	8260(5030)(low level)	1	47-150	<=30	0.36	2.0
Vinyl chloride	8260(5030)	1	50-142	<=50	0.13	5.0
Vinyl chloride	8260(5030)(low level)	1	50-142	<=50	0.13	1.0
Xylenes (total)	8260(5030)	1	77-121	<=30	0.28	10
Xylenes (total)	8260(5030) (low level)	1	77-121	<=30	0.28	2.0
o-Xylene	8260(5030)	1	77-121	<=30	0.096	5.0
o-Xylene	8260(5030)(low level)	1	77-121	<=30	0.096	1.0
m&p-Xylene	8260(5030)	1	78-119	<=30	0.13	5.0
m&p-Xylene	8260(5030)(low level)	1	78-119	<=30	0.13	1.0
Surrogates						
p-Bromofluorobenzene	8260(5030)	1	70-119	NA	NA	NA
p-Bromofluorobenzene	8260(5030)(low level)	1	70-119	NA	NA	NA
Dibromofluoromethane	8260(5030)	1	68-129	NA	NA	NA
Dibromofluoromethane	8260(5030)(low level)	1	68-129	NA	NA	NA
Toluene-d8	8260(5030)	1	74-122	NA	NA	NA
Toluene-d8	8260(5030)(low level)	1	74-122	NA	NA	NA
Non-Routine Analytes						
Cyclohexane	8260(5030)	1	70-130	<=30	0.15	10
1-Chlorohexane	8260(5030)	1	70-130	<=30	0.24	5.0
Cyclohexanone	8260(5030)	1	70-130	<=30	6.9	50
Diethyl ether	8260(5030)	1	70-130	<=30	0.14	10
Diethyl ether	8260(5030)(low level)	1	70-130	<=30	0.14	2.0
Furan	8260(5030)	1	70-130	<=30	0.14	10
Methyl acetate	8260(5030)	1	70-130	<=30	0.45	10
Methyl cyclohexane	8260(5030)	1	70-130	<=30	0.24	10
Tetrahydrofuran	8260(5030)	1	70-130	<=30	0.56	10

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Semivolatiles in Groundwater by GC/MS						
Acenaphthene (MS)	8270(3520)	1	53-116	<=40	1.0	10
Acenaphthene	8270(3520)(low level)	1	41-132	<=40	0.025	0.20
Acenaphthylene	8270(3520)	1	52-121	<=40	1.0	10
Acenaphthylene	8270(3520)(low level)	1	43-140	<=40	0.024	0.20
Acetophenone	8270(3520)	1	54-130	<=40	0.83	10
2-Acetylaminofluorene	8270(3520)	1	10-97	<=40	0.60	10
4-Aminobiphenyl	8270(3520)	1	20-105	<=40	0.51	10
Aniline	8270(3520)	1	10-92	<=40	0.54	20
Anthracene	8270(3520)	1	54-126	<=40	0.50	10
Anthracene	8270(3520)(low level)	1	50-139	<=40	0.031	0.20
Aramite	8270(3520)	1	10-168	<=40	2.1	10
Benzidine	8270(3520)	1	10-63	<=100	10	80
Benzoic acid	8270(3520)	1	10-160	<=100	5.0	50
Benzo(a)anthracene	8270(3520)	1	54-131	<=40	0.80	10
Benzo(a)anthracene	8270(3520)(low level)	1	58-141	<=40	0.070	0.20
Benzo(a)anthracene	SIM	1	58-141	<=40	0.10	0.10
Benzo(b)fluoranthene	8270(3520)	1	45-136	<=40	2.0	10
Benzo(b)fluoranthene	8270(3520)(low level)	1	42-156	<=40	0.074	0.20
Benzo(b)fluoranthene	SIM	1	42-156	<=40	0.10	0.10
Benzo(k)fluoranthene	8270(3520)	1	41-143	<=40	1.2	10
Benzo(k)fluoranthene	8270(3520)(low level)	1	49-165	<=40	0.058	0.20
Benzo(k)fluoranthene	SIM	1	49-165	<=40	0.10	0.10
Benzo(g,h,i)perylene	8270(3520)	1	34-145	<=40	0.62	10
Benzo(g,h,i)perylene	8270(3520)(low level)	1	12-171	<=40	0.096	0.20
Benzo(a)pyrene	8270(3520)	1	43-132	<=40	0.59	10
Benzo(a)pyrene	8270(3520)(low level)	1	31-142	<=40	0.060	0.20
Benzo(a)pyrene	SIM	1	31-142	<=40	0.10	0.10
Benzyl alcohol	8270(3520)	1	52-113	<=40	1.2	10
Bis(2-chloroethoxy) methane	8270(3520)	1	57-110	<=40	1.0	10
Bis(2-chloroethyl) ether	8270(3520)	1	43-111	<=40	1.0	10
Bis(2-chloroisopropyl)ether (2,2-Oxybis(1-chloropropane))	8270(3520)	1	40-115	<=40	0.58	10
Bis(2-ethylhexyl) phthalate	8270(3520)	1	57-126	<=40	2.4	10
4-Bromophenyl phenyl ether	8270(3520)	1	45-106	<=40	1.0	10
Butyl benzyl phthalate	8270(3520)	1	58-129	<=40	0.74	10
Carbazole	8270(3520)	1	39-126	<=40	0.54	10
4-Chloroaniline	8270(3520)	1	10-95	<=100	1.0	20
4-Chloro-3-methyl-phenol (MS)	8270(3520)	1	53-117	<=40	1.0	10
2-Chloronaphthalene	8270(3520)	1	54-104	<=40	1.0	10
2-Chlorophenol (MS)	8270(3520)	1	43-110	<=40	0.79	10
4-Chlorophenylphenyl ether	8270(3520)	1	47-119	<=40	0.70	10
Chrysene	8270(3520)	1	52-135	<=40	0.78	10
Chrysene	8270(3520)(low level)	1	51-155	<=40	0.088	0.20
Chrysene	SIM	1	51-155	<=40	0.10	0.10
Diallate	8270(3520)	1	24-148	<=40	1.4	10
Dibenz(a,h)anthracene	8270(3520)	1	42-136	<=40	0.64	10
Dibenz(a,h)anthracene	8270(3520)(low level)	1	28-153	<=40	0.065	0.20
Dibenz(a,h)anthracene	SIM	1	28-153	<=40	0.10	0.10
Dibenzofuran	8270(3520)	1	57-113	<=40	1.0	10
Di-n-butyl phthalate	8270(3520)	1	53-131	<=40	1.0	10
1,2-Dichlorobenzene	8270(3520)	1	33-99	<=40	1.0	10
1,3-Dichlorobenzene	8270(3520)	1	31-95	<=40	1.0	10
1,4-Dichlorobenzene(MS)	8270(3520)	1	36-91	<=40	1.0	10

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PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
3,3'-Dichlorobenzidine	8270(3520)	1	10-109	<=40	1.0	20
2,4-Dichlorophenol	8270(3520)	1	47-115	<=40	0.76	10
2,6-Dichlorophenol	8270(3520)	1	17-125	<=40	2.9	10
Diethyl phthalate	8270(3520)	1	58-120	<=40	1.0	10
Dimethoate	8270(3520)	1	48-77	<=40	0.66	10
p-(Dimethylamino)azobenzene	8270(3520)	1	10-113	<=40	0.86	10
7,12-Dimethylbenz(a)anthracene	8270(3520)	1	19-112	<=40	1.0	10
3,3'-Dimethylbenzidine	8270(3520)	1	10-200	<=40	0.81	20
a,a-Dimethylphenethylamine	8270(3520)	1	10-200	<=40	2000	2000
2,4-Dimethylphenol	8270(3520)	1	38-114	<=40	1.1	10
Dimethylphthalate	8270(3520)	1	59-115	<=40	0.57	10
m-Dinitrobenzene	8270(3520)	1	10-118	<=40	0.69	10
4,6-Dinitro-2-methylphenol	8270(3520)	1	34-164	<=40	10	50
2,4-Dinitrophenol	8270(3520)	1	12-172	<=40	10	50
2,4-Dinitrotoluene (MS)	8270(3520)	1	44-129	<=40	1.1	10
2,6-Dinitrotoluene	8270(3520)	1	57-126	<=40	0.87	10
Dinoseb (2-sec-Butyl-4,6-dinitrophenol)	8270(3520)	1	10-127	<=40	0.78	10
Di-n-octyl phthalate	8270(3520)	1	56-127	<=40	1.2	10
Diphenylamine/ Nitrosodiphenylamine	8270(3520)	1	30-130	<=40	1.0	10
1,4-Dioxane	8270(3520)	1	22-134	<=40	1.6	10
1,2-Diphenyl hydrazine	8270(3520)	1	14-135	<=40	1.0	10
Disulfoton	8270(3520)	1	36-82	<=40	0.70	10
Ethyl methanesulfonate	8270(3520)	1	45-127	<=40	0.85	10
Ethyl parathion	8270(3520)	1	10-75	<=40	0.57	10
Famphur	8270(3520)	1	10-248	<=40	1.7	10
Fluoranthene	8270(3520)	1	47-136	<=40	0.61	10
Fluoranthene	8270(3520)(low level)	1	47-158	<=40	0.061	0.20
Fluorene	8270(3520)	1	49-126	<=40	1.0	10
Fluorene	8270(3520)(low level)	1	40-140	<=40	0.026	0.20
Hexachlorobenzene	8270(3520)	1	39-125	<=40	0.61	10
Hexachlorobutadiene	8270(3520)	1	35-106	<=40	0.50	10
Hexachlorocyclopentadiene	8270(3520)	1	D-78	<=100	1.1	10
Hexachloroethane	8270(3520)	1	27-93	<=40	0.70	10
Hexachlorophene	8270(3520)	1	D-253	<=100	11	5000
Hexachloropropene	8270(3520)	1	10-117	<=40	1.0	10
Indeno(1,2,3-cd)pyrene	8270(3520)	1	29-150	<=40	0.85	10
Indeno(1,2,3-cd)pyrene	8270(3520)(low level)	1	20-167	<=40	0.080	0.20
Indeno(1,2,3-cd)pyrene	SIM	1	20-167	<=40	0.10	0.10
Isophorone	8270(3520)	1	49-120	<=40	1.0	10
Isosafrole	8270(3520)	1	26-127	<=40	0.70	10
Methapyrilene	8270(3520)	1	10-86	<=40	1.1	2000
3-Methylcholanthrene	8270(3520)	1	10-129	<=40	0.72	10
Methylmethanesulfonate	8270(3520)	1	34-136	<=40	1.2	10
2-Methylnaphthalene	8270(3520)	1	46-116	<=40	2.1	10
2-Methylnaphthalene	8270(3520)(low level)	1	36-121	<=40	0.022	0.20
1-Methylnaphthalene	8270(3520)	1	33-123	<=40	0.58	10
1-Methylnaphthalene	8270(3520)(low level)	1	35-131	<=40	0.028	0.20
Methyl parathion	8270(3520)	1	10-82	<=40	1.0	10
2-Methyl phenol	8270(3520)	1	48-113	<=40	0.59	10
3 -Methyl phenol	8270(3520)	1	40-116	<=40	1.0	10
4-Methyl phenol	8270(3520)	1	40-116	<=40	1.0	10
3- and 4-Methyl phenol	8270(3520)	1	40-116	<=40	1.0	10
Naphthalene	8270(3520)	1	41-111	<=40	1.0	10

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Naphthalene	8270(3520)(low level)	1	39-125	<=40	0.028	0.20
1,4-Naphthoquinone	8270(3520)	1	23-49	<=40	1.0	10
1-Naphthylamine	8270(3520)	1	10-127	<=40	1.0	10
2-Naphthylamine	8270(3520)	1	10-119	<=40	0.84	10
2-Nitroaniline	8270(3520)	1	51-125	<=40	0.72	50
3-Nitroaniline	8270(3520)	1	41-117	<=40	0.64	50
4-Nitroaniline	8270(3520)	1	42-132	<=40	0.86	50
Nitrobenzene	8270(3520)	1	49-107	<=40	1.0	10
2-Nitrophenol	8270(3520)	1	43-121	<=40	1.1	10
4-Nitrophenol (MS)	8270(3520)	1	38-131	<=40	5.0	50
4-Nitroquinoline-1-oxide	8270(3520)	1	30-130	<=40	2.2	20
N-Nitrosodi-n-butylamine	8270(3520)	1	30-123	<=40	1.0	10
N-Nitrosodiethylamine	8270(3520)	1	50-99	<=40	0.63	10
N-Nitrosodimethylamine	8270(3520)	1	50-137	<=40	1.2	10
N-Nitrosodi-n-propylamine(MS)	8270(3520)	1	42-117	<=40	1.0	10
Nitrosodiphenylamine/ Diphenylamine	8270(3520)	1	30-130	<=40	1 0	10
N-Nitrosomethylethylamine	8270(3520)	1	10-279	<=40	3.5	10
N-Nitrosomorpholine	8270(3520)	1	17-151	<=40	1.1	10
N-Nitrosopiperidine	8270(3520)	1	21-156	<=40	0.58	10
N-Nitrosopyrrolidine	8270(3520)	1	52-91	<=40	0.78	10
5-Nitro-o-toluidine	8270(3520)	1	10-112	<=40	0.92	10
Pentachlorobenzene	8270(3520)	1	26-127	<=40	0.72	10
Pentachloronitrobenzene	8270(3520)Ω	1	10-157	<=40	0.90	10
Pentachlorophenol (MS)	8270(3520)	1	49-126	<=40	2.0	50
Pentachlorophenol (MS)	SIM	1	30-130	<=40	2.0	1.0
Phenacetin	8270(3520)	1	18-104	<=40	0.80	10
Phenanthrene	8270(3520)	1	56-128	<=40	1.0	10
Phenanthrene	8270(3520)(low level)	1	46-144	<=40	0.025	0.20
Phenol (MS)	8270(3520)	1	40-109	<=40	1.0	10
p-Phenylenediamine	8270(3520)	1	10-177	<=40	8.2	2000
Phorate	8270(3520)	1	36-113	<=40	1.0	10
2-Picoline	8270(3520)	1	35-102	<=40	1.3	10
Pronamide	8270(3520)	1	18-122	<=40	0.57	10
Pyrene(MS)	8270(3520)	1	52-141	<=40	1.0	10
Pyrene	8270(3520)(low level)	1	39-158	<=40	0.042	0.20
Pyridine	8270(3520)	1	10-178	<=40	2.6	50
Safrole	8270(3520)	1	36-114	<=40	0.76	10
Sulfotepp	8270(3520)	1	30-117	<=40	0.54	10
1,2,4,5-Tetrachlorobenzene	8270(3520)	1	17-127	<=40	0.60	10
2,3,4,5-Tetrachlorophenol	8270(3520)	1	10-127	<=40	1.3	10
2,3,4,6-Tetrachlorophenol	8270(3520)	1	10-151	<=40	2 0	10
Tetrachlorophenols (2,3,4,5 and 2,3,4,6)	8270(3520)	1	10-151	<=40	1.3	10
Thionazin	8270(3520)	1	42-93	<=40	0.70	10
o-Toluidine	8270(3520)	1	10-129	<=40	0.56	10
1,2,4-Trichlorobenzene (MS)	8270(3520)	1	41-97	<=40	0.51	10
2,4,5-Trichlorophenol	8270(3520)	1	51-118	<=40	1.1	10
2,4,6-Trichlorophenol	8270(3520)	1	50-117	<=40	1.1	10
Trichlorophenols (2,4,5 and 2,4,6)	8270(3520)	1	51-118	<=40	1.1	10
o,o,o-Triethyl-phosphorothioate	8270(3520)	1	46-138	<=40	0.89	10
1,3,5-Trinitrobenzene	8270(3520)	1	10-123	<=40	1.5	10
Surrogates						
2-Fluorobiphenyl	8270(3520)	1	55-116	NA	NA	NA
2-Fluorophenol	8270(3520)	1	43-114	NA	NA	NA

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Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Nitrobenzene-d5	8270(3520)	1	51-115	NA	NA	NA
Phenol-d5	8270(3520)	1	46-112	NA	NA	NA
Terphenyl-d14	8270(3520)	1	11-120	NA	NA	NA
2,4,6-Tribromophenol	8270(3520)	1	47-133	NA	NA	NA
O-Terphenyl	8270(3520)-low level	1	34-167	NA	NA	NA
Non-Routine Analytes						
Atrazine	8270(3520)	1	40-132	<=50	0.85	10
Benzaldehyde	8270(3520)	1	30-150	<=50	0.87	10
1,4-Benzoquinone	8270(3520)	1	10-50	<=50	0.56	10
1,1-Biphenyl (1,1-Diphenyl)	8270(3520)	1	53-118	<=50	0.94	10
Bis(2-ethylhexyl)adipate	8270(3520)	1	30-150	<=50	1.2	10
Caprolatam	8270(3520)	1	30-150	<=50	1.9	10
1-Chloronaphthalene	8270(3520)	1	30-130	<=50	0.82	10
2,3-Dimethylphenol	8270(3520)	1	30-150	<=50	1.2	10
2,5-Dimethylphenol	8270(3520)	1	30-150	<=50	1.3	10
2,6-Dimethylphenol	8270(3520)	1	30-150	<=50	1.2	10
3,4-Dimethylphenol	8270(3520)	1	30-150	<=50	1.3	10
2,5-Dinitrophenol	8270(3520)	1	50-99	<=50	5.7	50
3-Nitrophenol	8270(3520)	1	30-150	<=50	1.3	10
Phenyl ether (Diphenyl oxide)	8270(3520)	1	30-130	<=50	0.54	10
Terpineol	8270(3520)	1	30-130	<=50	1.0	10
1,2,3,5-Tetrachlorobenzene	8270(3520)	1	10-150	<=50	1.0	10
1,2,3-Trichlorobenzene	8270(3520)	1	36-111	<=50	1.3	10
1,3,5-Trichlorobenzene	8270(3520)	1	30-150	<=50	0.80	10

SEVERN TRENT STL

Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)
Dioxins and Furans in Groundwater by GC/MS (SIM)						
Polychlorinated Dibenzo-p-dioxin 2,3,7,8- substituted Congeners						
2,3,7,8-TCDD	8280	1	54-144	<=40	0.00018	0.0050
Polychlorinated Dibenzo-p-dioxin and Dibenzofuran classes						
tetra-CDD (MS)	8280	1	54-144	<=40	0.00018	0.0050
tetra-CDF (MS)	8280	1	64-140	<=40	0.00022	0.0050
penta-CDD (MS)	8280	1	54-154	<=40	0.00049	0.0050
penta-CDF+A1283 (MS)	8280	1	70-147	<=40	0.00054	0.0050
hexa-CDD (MS)	8280	1	44-176	<=40	0.00063	0.0050
hexa-CDF (MS)	8280	1	55-166	<=40	0.0013	0.0050
hepta-CDD (MS)	8280	1	47-170	<=50	0.00047	0.010
hepta-CDF (MS)	8280	1	62-155	<=50	0.00030	0.010
octa-CDD (MS)	8280	1	74-135	<=50	0.00024	0.010
octa-CDF (MS)	8280	1	74-135	<=50	0.00043	0.010
Internal Standards						
2,3,7,8-tetra-CDD-13C12	8280	1	25-150	NA	NA	NA
octa-CDD-13C12	8280	1	25-150	NA	NA	NA
PAHs in Groundwater by HPLC						
Acenaphthene (MS)	8310(3520)	1	25-83	<=40	0.14	0.50
Acenaphthylene	8310(3520)	1	25-100	<=40	0.12	0.50
Anthracene	8310(3520)	1	30-120	<=40	0.031	0.10
Benzo(a)anthracene	8310(3520)	1	50-120	<=40	0.024	0.10
Benzo(b)fluoranthene	8310(3520)	1	50-120	<=40	0.022	0.10
Benzo(k)fluoranthene	8310(3520)	1	50-120	<=40	0.026	0.10
Benzo(g,h,i)perylene	8310(3520)	1	50-120	<=40	0.066	0.25
Benzo(a)pyrene	8310(3520)	1	50-120	<=40	0.040	0.10
Chrysene (MS)	8310(3520)	1	54-104	<=40	0.024	0.10
Dibenzo(a,h)anthracene	8310(3520)	1	50-120	<=40	0.070	0.25
Fluoranthene	8310(3520)	1	30-120	<=40	0.14	0.25
Fluorene (MS)	8310(3520)	1	27-96	<=40	0.074	0.25
Indeno(1,2,3-cd)pyrene	8310(3520)	1	50-120	<=40	0.040	0.10
1-Methylnaphthalene	8310(3520)	1	25-100	<=40	0.14	0.50
2-Methylnaphthalene	8310(3520)	1	25-100	<=40	0.14	0.50
Naphthalene (MS)	8310(3520)	1	24-77	<=40	0.11	0.50
Phenanthrene	8310(3520)	1	30-120	<=40	0.045	0.10
Pyrene (MS)	8310(3520)	1	31-116	<=40	0.078	0.25
Surrogate						
p-Terphenyl-d14	8310(3520)	1	18-136	NA	NA	NA
Dissolved Gases in Water (GC/FID)						
Methane	RSK175/LAB SOP	32	75-125	<=30	0.04	0.19
Ethane	RSK175/LAB SOP	32	75-125	<=30	0.05	0.35
Ethene	RSK175/LAB SOP	32	75-125	<=30	0.051	0.33
Dissolved Gases in Water (GC/TCD)						
Carbon dioxide	RSK175/LAB SOP	32	75-125	<=30	32	2600
Carbon monoxide	RSK175/LAB SOP	32	75-125	<=30	21	82
Ethane	RSK175/LAB SOP	32	75-125	<=30	12	350
Ethene	RSK175/LAB SOP	32	75-125	<=30	5.4	330
Methane	RSK175/LAB SOP	32	75-125	<=30	3	190
Nitrogen	RSK175/LAB SOP	32	75-125	<=30	200	2000
Oxygen	RSK175/LAB SOP	32	75-125	<=30	200	2000

SEVERN TRENT STL	REFERENCES AND NOTES FOR APPENDIX A

A "non-routine analyte" is an analyte that requires advance notice prior to arrival in the laboratory. In general, at least one week notice is required to ensure that the laboratory has sufficient instrument capacity, standards, and reagents to adequately process the samples.

Accuracy data are presented as recoveries for spikes or surrogates. For routine analysis of organics using SW-846 methods, percent recoveries are evaluated only on the subset spike compound lists specified by the methods unless noted in a pre-project plan or QAPP. An (MS) following the parameter name designates the routine matrix and laboratory control spike compounds. Precision data are presented as relative percent difference (% RPD) and are advisory; i.e., not used for laboratory control. Since reportable levels (above detection limit) for most of the organic parameters may not be detected in all environmental samples, precision is usually based on duplicate spike data and evaluated according to method requirements.

Accuracy and precision control limits are primarily derived from in-house laboratory data. Some accuracy and precision limits have been rounded to the nearest "5". In some cases, method limits may be used in lieu of in-house limits because in-house limits are broader than the method limits or are too broad to be usable.

ABBREVIATIONS USED IN THE APPENDICES

PARAMETER-refers to the compound, analyte or measurement being tested; the field of testing

METHOD-refers to the reference method used to measure the parameter

REF-a number designation that corresponds to the method references and citations

ACC-accuracy measured as percent recovery

PREC-precision measured as relative percent difference

RL-reporting limit

MDL-method detection limit

D-analyte detected (meets qualitative identification criteria)

ICP-inductively coupled (argon) plasma

ICP-MS-inductively coupled (argon) plasma coupled to a mass spectrometer

GFAA -graphite furnace atomic absorption

CVAA - cold vapor atomic absorption

IC - ion chromatography

GC/HECD - gas chromatograph equipped with a Hall electrolytic conductivity detector

GC/PID - gas chromatograph equipped with a photoionization detector

GC/FID - gas chromatograph equipped with a flame ionization detector

GC/EC - gas chromatograph equipped with an electron capture detector

GC/NPD - gas chromatograph equipped with a nitrogen-phosphorus detector

GC/MS - gas chromatrograph equipped with a mass spectrometer

HPLC - high performance liquid chromatography

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REFERENCES AND NOTES FOR APPENDIX A

REF #	REFERENCE
1	Test Methods for Evaluating Solid Waste, Third Edition, SW-846 (Including Update III) USEPA Office of Solid Waste and Emergency Response, Washington, DC.
2	EPA 600/4-79-020:Methods for Chemical Analysis of Water and Wastes; U.S. EPA Office of Research and Development, Cincinatti, OH, March 1983.
3	EPA 600/R-94/111: "Methods for the Determination of Metals in Environmental Samples" May 1994, Supplement 1.
4	Standard Methods for the Examination of Water and Wastewater, 18th Edition, American Public Health Association, Washington, DC.
5	EPA 200.9: Determination of Trace Elements by Stabilized Temperature Graphite Furnace Atomic Adsorption Spectrometry; Revision 1.2, April 1991; EPA-EMSL
6	Laboratory SOP ME72: *Silica: Preparation and Analysis*
7	Laboratory SOP GE115: *Ion Chromatography*
8	Florida Department of Environmental Regulation; Chemistry Laboratory Methods Manual, Tallahassee. "Calculation of Un-Ionized Ammonia in Fresh Water" Revision 1, 10/03/83.
9	ASTM Method D 4282-89 "Standard Test Method for Determination of Free Cyanide in Water and Wastewater by Microdiffusion." (reapproved 1994)
10	Method 1650: Absorbable Organic Halides by Adsorption in Microcoulometric Titrations; Analytical Methods for the Determination of Pollutants in Pulp and Paper Industry Water and Wastewater: U.S. EPA Office of Water, Engineering, and Analysis Division, Washington, D.C.
11	HACH Method 8141, Hydrazine by p-Dimethylaminobenzaldehyde Method. Adapted from ASTM Manual of Industrial Wastes, D1385-78, 376 (1979)
12	EPA/CE-81-1 Technical Report, May 1981: Environmental Protection Agency/Corps of Engineers Technical Committee on Criteria for Dredged and Fill Material; Procedures for Handling and Chemical Analysis of Sediment and Water Samples.
13	*Laboratory SOP GE27: Calculation of Total and Organic Nitrogen*
14	Method 1664:N-Hexane Extractable Material (HEM) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM) by Extraction and Gravimetry (Oil and Grease and Total Petroleum Hydrocarbons), EPA-821-B-94-004b, April 1995.
15	Method 314.0: Determination of Perchlorate in Drinking Water Using Ion Chromatography, Revision 1.0, November 1999. USEPA Office of Water.
16	American Society for Testing and Materials (ASTM) Method D1498-76 (re-approved in 1981); Laboratory SOP BA72: Oxidation-Reduction Potential (ORP)
17	EPA 600/4-88-039: Methods for the Determination of Organic Compounds in Drinking Water, December, 1988, Revised July, 1991.Methods for the Determination of Organic Compounds in Drinking Water, Supplement I, July 1990. Methods for the Determination of Organic Compounds in Drinking Water, Supplement II, August 1992
18	Code of Federal Regulations, Title 40, Part 136 ; U.S. Government Printing Office: Washington, DC, July 1, 1997.
19	Determination of Organophosphorus Pesticides in Municipal and Industrial Wastewater: EPA Method 614, February 1982.
20	Determination of Organophosphorus Pesticides in Wastewater: EPA Method 614.1

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REFERENCES AND NOTES FOR APPENDIX A

REF #	REFERENCE
21	Determination of Organophosphorus Pesticides in Industrial and Municipal Wastewater: EPA Method 622 ; January, 1982.
22	Determination of Thiophosphate Pesticides in Industrial and Municipal Wastewater: EPA Method 622.1; January, 1982.
23	Determination of Chlorinated Herbicides in Industrial and Municipal Wastewater. EPA Method 615, January 1982.
24	Method 680: Determination of Pesticides and PCBs in Water and Soil/Sediment by GC/MS U.S. EPA, Washington, D.C..
25	Method 1653: Chlorinated Phenolics in Water by In-situ Acetylation/GC/MS Determination, Method cp. 86.01, National Council of the Paper Industry for Air and Stream Improvement, Inc., 260 Madison Avenue, NY 10016 (July 1986)
26	Method for the Determination of Gasoline Range Organics , State of Tennessee Department of Environment and Conservation, Division of Underground Storage Tanks
27	FL-PRO Method, "Method for Determination of Petroleum Range Organics," FL DEP, Revision 1, November 1, 1995.
28	Method for the Determination of Extractable Petroleum Hydrocarbons by GC/FID ; State of Tennessee Department of Environment and Conservation. Effective May 1, 1999.
29	TNRCC Method for Total Petroleum Hydrocarbons, TNRCC Method 1005 (Revision 03, 6/1/01), State of Texas Method.
30	"NCASI Method DI/HAPS-99.01 Selected HAPS in Condensates by GC/FID. NCASI Southern Regional Center May 2000. National Council for Air and Stream Improvement, Inc., 2000. Methods Manual.
31	"NCASI Method DI/MEOH-94.03 Methanol in Process Liquids by GC/FID" NCASI Southern Regional Center May 2000. National Council for Air and Stream Improvement, Inc., 2000. Methods Manual.
32	RSKSOP 175: Dissolved Oxygen and Methane in Water by GC Headspace Equilibration Technique by Kampbell and Wilson, USEPS, March 1989. Laboratory SOP AR30: *Dissolved Gases in Water*.
33	Method 200.8: Determination of Trace Elements in Water and Wastes by ICP/MS. Revision 5.4 (EMMC Version). USEPA Office of Research and Development (1994)
34	California LUFT (Leaking Underground Fuel Tanks) Method; LUFT Manual: Guidelines for Assessment, Cleanup, and Underground Storage Tank Closure. State of California LUFT Task Force, May 1988.

SEVERN TRENT STL

Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/kg)	RL (mg/kg)
Metals Parameters						
Aluminum (ICP)	6010(3050)	1	75-125	<=20	1.4	20
Aluminum (ICP/MS)	6020(3050)	1	75-125	<=20	2.0	10
Antimony (ICP)	6010(3050)	1	75-125	<=20	0.66	2.0
Antimony (ICP/MS)	6020(3050)	1	75-125	<=20	0.018	0.50
Antimony (GFAA)	7041(3050)	1	80-120	<=20	0.21	1.0
Arsenic (ICP)	6010(3050)	1	75-125	<=20	0.74	1.0
Arsenic (ICP/MS)	6020(3050)	1	75-125	<=20	0.16	1.0
Arsenic (GFAA)	7060(3050)	1	80-120	<=20	0.12	1.0
Barium (ICP)	6010(3050)	1	75-125	<=20	0.10	1.0
Barium (ICP/MS)	6020(3050)	1	75-125	<=20	0.048	1.0
Beryllium (ICP)	6010(3050)	1	75-125	<=20	0.040	0.40
Beryllium (ICP/MS)	6020(3050)	1	75-125	<=20	0.0093	0.10
Boron(ICP)	6010(3050)	1	75-125	<=20	0.52	5.0
Boron(ICP/MS)	6020(3050)	1	75-125	<=20	0.31	5.0
Cadmium (ICP)	6010(3050)	1	75-125	<=20	0.056	0.50
Cadmium (ICP/MS)	6020(3050)	1	75-125	<=20	0.034	0.50
Cadmium (GFAA)	7131 (3050)	1	80-120	<=20	0.012	0.10
Calcium (ICP)	6010(3050)	1	75-125	<=20	5.0	50
Calcium (ICP/MS)	6020(3050)	1	75-125	<=20	2.3	50
Chromium (ICP)	6010(3050)	1	75-125	<=20	0.11	1.0
Chromium (ICP/MS)	6020(3050)	1	75-125	<=20	0.074	1.0
Chromium (GFAA)	7191(3050)	1	80-120	<=20	0.059	1.0
Chromium, hexavalent	7196 (3060)	1	80-120	<=30	0.20	1.0
Cobalt (ICP)	6010 (3050)	1	75-125	<=20	0.16	1.0
Cobalt (ICP/MS)	6020(3050)	1	75-125	<=20	0.0043	1.0
Copper (ICP)	6010 (3050)	1	75-125	<=20	0.20	2.0
Copper (ICP/MS)	6020(3050)	1	75-125	<=20	0.037	1.0
Copper (GFAA)	7211(3050)	1	80-120	<=20	0.085	1.0
Iron (ICP)	6010 (3050)	1	75-125	<=20	1.6	5.0
Iron (ICP/MS)	6020(3050)	1	75-125	<=20	1.3	5.0
Lead (ICP)	6010 (3050)	1	75-125	<=20	0.34	0.50
Lead (ICP/MS)	6020(3050)	1	75-125	<=20	0.015	0.30
Lead (GFAA)	7421(3050)	1	80-120	<=20	0.062	0.50
Magnesium (ICP)	6010 (3050)	1	75-125	<=20	5.0	50
Magnesium (ICP/MS)	6020(3050)	1	75-125	<=20	0.43	50
Manganese (ICP)	6010(3050)	1	75-125	<=20	0.10	1.0
Manganese (ICP/MS)	6020(3050)	1	75-125	<=20	0.0059	1.0
Mercury (CVAA)	7471	1	80-120	<=20	0.0043	0.020
Molybdenum (ICP)	6010(3050)	1	75-125	<=20	0.35	1.0
Molybdenum (ICP/MS)	6020(3050)	1	75-125	<=20	0.012	1.0
Nickel (ICP)	6010(3050)	1	75-125	<=20	0.24	4.0
Nickel (ICP/MS)	6020(3050)	1	75-125	<=20	0.030	1.0
Potassium (ICP)	6010(3050)	1	75-125	<=20	10	100
Potassium (ICP/MS)	6020(3050)	1	75-125	<=20	2.7	50
Selenium (ICP)	6010(3050)	1	75-125	<=20	0.78	1.0
Selenium (ICP/MS)	6020(3050)	1	75-125	<=20	0.058	0.50
Selenium (GFAA)	7740(3050)	1	80-120	<=20	0.13	1.0
Silica (water soluble)	6010(ASTM 3987-85)	1/2	70-130	<=20	0.67	10

SEVERN TRENT STL

Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/kg)	RL (mg/kg)
Silver (ICP)	6010(3050)	1	75-125	<=20	0.12	1.0
Silver (ICP/MS)	6020(3050)	1	75-125	<=20	0.011	1.0
Silver (GFAA)	7761 (3050)	1	80-120	<=20	0.011	0.10
Sodium (ICP)	6010(3050)	1	75-125	<=20	17	50
Sodium (ICP/MS)	6020(3050)	1	75-125	<=20	2.3	50
Strontium(ICP)	6010(3050)	1	75-125	<=20	0.10	1.0
Strontium(ICP/MS)	6020(3050)	1	75-125	<=20	0.082	1.0
Thallium (ICP)	6010(3050)	1	75-125	<=20	0.93	1.0
Thallium (ICP/MS)	6020(3050)	1	75-125	<=20	0.019	0.20
Thallium (GFAA)	7841 (3050)	1	80-120	<=20	0.051	1.0
Tin (ICP)	6010(3050)	1	75-125	<=20	0.84	5.0
Tin (ICP/MS)	6020(3050)	1	75-125	<=20	0.060	1.0
Titanium(ICP)	6010(3050)	1	70-130	<=20	0.1	1.0
Titanium(ICP/MS)	6020(3050)	1	75-125	<=20	0.29	1.0
Vanadium (ICP)	6010 (3050)	1	75-125	<=20	0.12	1.0
Vanadium (ICP/MS)	6020(3050)	1	75-125	<=20	0.11	1.0
Zinc (ICP)	6010 (3050)	1	75-125	<=20	0.13	2.0
Zinc (ICP/MS)	6020(3050)	1	75-125	<=20	0.48	2.0
Simultaneously Extracted Metals (SEM)-routinely performed with Acid Volatile Sulfides (AVS)						
Arsenic (ICP)	Lab SOP	11/1	75-125	<=20	0.07	0.14
Cadmium (ICP)	Lab SOP	11/1	75-125	<=20	0.036	0.072
Chromium (ICP)	Lab SOP	11/1	75-125	<=20	0.07	0.14
Copper (ICP)	Lab SOP	11/1	75-125	<=20	0.15	0.29
Lead (ICP)	Lab SOP	11/1	75-125	<=20	0.036	0.072
Nickel (ICP)	Lab SOP	11/1	75-125	<=20	0.29	0.58
Silver (ICP)	Lab SOP	11/1	75-125	<=20	0.07	0.14
Zinc (ICP)	Lab SOP	11/1	75-125	<=20	0.36	0.72

SEVERN TRENT STL

Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/kg)	RL (mg/kg)
General Chemistry Parameters						
Ammonia (as N)	350.1(EPA-CE:3-140)	3/4	75-125	<=30	0.10	0.15
BOD	EPA-CE:3-380	4	60-140	<=40	NA	200
Bromide (extractable)(1)	300.0/9056		75-125	<=30	3.0	20
BTU	D240-87	5	70-130	<=30	NA	200 BTU/lb
Carbon, total organic	EPA-CE [Walkley-Black]	6	60-140	<=40	500	500
Carbon, total organic	Combustion (Lloyd Kahn)	7	60-140	<=40	390	1000
Cation exchange capacity	9080	1	70-130	<=40	0.0033meq/100g	0.0033meq/100g
Cation exchange capacity	9081	1	70-130	<=40	0.0033meq/100g	0.0033meq/100g
Chloride (extractable)(1)	9251	1	75-125	<=30	10	20
Chloride (extractable)(1)	300.0/9056	8/1	75-125	<=30	5.2	20
Chloride, total	5050/325.2	1	70-130	<=40	200	200
COD	EPA-CE:3-373	4	60-140	<=40	100	100
Cyanide, amenable to chlorination	9012(9013)	1	NA	<=50	NA	1.0
Cyanide, reactive	7.3.3.2/9014	1	NA	<=50	100mg HCN/Kg Waste	100mg HCN/Kg Waste
Cyanide, total	9012	1	75-125	<=30	0.25	0.50
Cyanide, total extractable	9012(9013)	1	75-125	<=30	0.25	0.50
Fluoride (extractable)(1)	340.2	3	75-125	<=30	0.80	4.0
Fluoride (extractable)(1)	300.0/9056	8/1	75-125	<=30	1.5	4.0
Halogens, total	9056(5050)	1	70-130	<=40	200	200
Halogens, extractable organic (EOX)	9023	1	60-140	<=50	10	10
Hydrogen ion (pH)	9045	1	63-158 (+/-0.2 SU)	<=40	NA	NA
Ignitability	1010	1	NA	NA	NA	NA
Nitrate (as N)	353.2 (EPA-CE:3-183)	3/4	75-125	<=30	2.5	5.0
Nitrate (as N)	300.0/9056	8/1	75-125	<=30	0.61	2.0
Nitrite (as N)	353.2 (EPA-CE:3-183)	3/4	75-125	<=30	0.50	1.0
Nitrite (as N)	300.0/9056	8/1	75-125	<=30	0.31	2.0
Nitrogen, organic (TKN-NH3)	EPA-CE:3-205	4	NA	NA	50	50
Nitrogen, total	TKN + NO3/NO2	4	NA	NA	NA	55
Nitrogen, total Kjeldahl	351.3 (EPA-CE:3-201)	3/4	65-135	<=50	25	50
Oil and Grease (gravimetric)	9071 (HEM-1664)	1/9	60-140	<=50	22	100
Oil and Grease (infra-red)	413.2(9071)	3/1.	60-140	<=50	4.6	10
Paint filter liquids	9095	1	NA	<=40	NA	NA

SEVERN TRENT STL

Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/kg)	RL (mg/kg)
Perchlorate (extractable)(1)	314.0(300.0)	10	75-125	<=25	0.0072	0.040
Petroleum hydrocarbons (gravimetric)	9071 (1664 HEM-SGT)	1	60-140	<=50	13	100
Petroleum hydrocarbons (infra-red)	418.1(3550) (sonication)	3/1	60-140	<=50	4 6	10
Phenolics, total recoverable	9065(EPA-CE: 3-355)	1/4	60-140	<=40	0.50	1.0
Phosphorus, Ortho(extractable)	365.2 (EPA-CE)	3/4	75-125	<=30	0.50	1.0
Phosphorus, total	365.4 (EPA-CE:3-207)	3/4	60-140	<=40	10	20
Residue, fixed (% ash)	EPA-CE:3-59	4	NA	<=40	0.10%	0.10%
Solids, total	EPA-CE:3-58	4	NA	<=30	0.10%	0.10%
Solids, volatile	EPA-CE:3-59	4	75-125	<=30	0.10%	0.10%
Specific gravity	EPA-CE:3-61	4	NA	<=10	NA	NA
Sulfate (extractable)(1)	300.0/9056	8/1	75-125	<=25	6.9	20
Sulfide	9034(9030)	1	50-150	<=50	13	25
Sulfide, acid volatile	Lab SOP	11	50-150	<=50	1.3	2.5
Sulfide, reactive	7.3.4.2/9034	1	NA	<=50	50 mg H_2S/ kg Waste	50 mg H_2S/ kg Waste
Sulfur	5050/375.4	1	50-120	<=30	170	170

(1) extractable: 5g of soil/solid is mixed with 100mL of reagent water and tumbled for 2 hours in a rotary extractor. The leachate is filtered and analyzed by the referenced method.

Microbiological						
Coliform, fecal	9221C (EPA:62)	1/12	NA	<=200	3 MPN/g	3 MPN/g
Coliform, total	9221B (EPA:62)	1/12	NA	<=200	3 MPN/g	3 MPN/g

Leaching Procedures for Solids	
EP Toxicity	SW-846 1310 Followed by 6010, 7470, 8081, 8151, 8260, and 8270
Toxicity Characteristic Leaching Procedure	SW-846 1311 followed by requested analytical procedure(s): metals: 6010 mercury: 7470 pesticides: 8081 herbicides: 8151 VOC: 8260 BNA:8270 Reporting limits and QC limits : Appendix C
Synthetic Precipitation Leaching Procedure	SW-846 1311 followed by requested analytical procedure(s): metals: 6010 mercury: 7470 pesticides: 8081 herbicides: 8151 VOC: 8260 BNA:8270 Cyanide: 9010/9012 Reporting limits and QC limits : Appendix A

SEVERN TRENT STL

Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/kg)	RL (mg/kg)
GRO and Other Volatile Petroleum Products by GC/FID and GC/PID-FID						
Gasoline Range Organics (GRO)	GRO (Tennessee)	13	50-100	<=20	0.090	0.18
Gasoline Range Organics (GRO)	GRO(ext) (Tennessee)	13	50-100	<=20	3.6	7.2
Gasoline Range Organics (GRO)	GRO 8015 (5035)	1	40-140	<=40	0.13	1.0
Gasoline Range Organics (GRO)	GRO 8015 (5035ext)	1	40-140	<=40	5.0	10
Surrogates						
a,a,a-Trifluorotoluene	GRO (Tennessee)	13	50-150	NA	NA	NA
a,a,a-Trifluorotoluene	8015/8015ext	1	61-139	NA	NA	NA
(ext)= methanol extraction 1mL of methanol per gram of sample						
Non-Routine Compounds-GC Fingerprint						
Gasoline	8015 (5035)	1	40-140	<=40	0.25	0.25
Gasoline	8015(5035ext)	1	40-140	<=40	10	10
Lacolene	8015(3035)	1	60-140	<=30	0.25	0.25
Lacolene	8015(5035ext)	1	60-140	<=30	10	10
2,5-Dibromotoluene (surrogate for Lacolene)	8015(3035)/ 8015(5035ext)	1	60-140	NA	NA	NA
PARAMETER	**METHOD**	**REF**	**ACC (%REC)**	**PREC (%RPD)**	**MDL (ug/kg)**	**RL (ug/kg)**
Non-Routine Non-Halogenated Volatiles by GC/FID						
Acetone (MS)	8015(5035)	1	40-130	<=50	48	130
Acetone (MS)	8015(5035ext)	1	40-130	<=50	1900	5000
2-Butanone (MEK) (MS)	8015(5035)	1	40-130	<=50	39	130
2-Butanone (MEK) (MS)	8015(5035ext)	1	40-130	<=50	1600	5000
Diethyl ether	8015(5035)	1	40-130	<=50	28	130
Diethyl ether	8015(5035ext)	1	40-130	<=50	1100	5000
Heptane	8015(5035)	1	40-130	<=50	0.88	5
Heptane	8015(5035ext)	1	40-130	<=50	35	200
Hexane	8015(5035)	1	40-130	<=50	1.4	5
Hexane	8015(5035ext)	1	40-130	<=50	56	200
2-Hexanone	8015(5035)	1	40-130	<=50	15	130
2-Hexanone	8015(5035ext)	1	40-130	<=50	600	5000
4-Methyl-2-pentanone (MIBK) (MS)	8015(5035)	1	40-130	<=50	23	130
4-Methyl-2-pentanone (MIBK) (MS)	8015(5035ext)	1	40-130	<=50	920	5000
Methyl t-butyl ether (MTBE)	8015(5035)	1	40-130	<=50	1.5	50
Methyl t-butyl ether (MTBE)	8015(5035ext)	1	40-130	<=50	60	2000
Surrogates*						
a,a,a-Trifluorotoluene	8021(5035)	1	64-139	NA	NA	NA
a,a,a-Trifluorotoluene	8021 (5035ext)	1	64-139	NA	NA	NA

(ext)= methanol extraction; 1ml methanol per gram of sample and analysis of 100uL of extract. MDL are extrapolated from the direct purge soils, assumming the methanol extraction paramenters.

SEVERN TRENT STL

Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/kg)	RL (mg/kg)
DRO and Other Semivolatile (Extractable) Petroleum Products						
Diesel Range Organics(DRO)	8015 (3550)	1	40-140	<=40	1.7	3.3
California LUFT (CALUFT)	8015 (3550)	19	40-140	<=40	1.7	3.3
Petroleum Hydrocarbons	FL-PRO (sonication)	14	26-116	<=25	5	10
Tennessee Extractable Petroleum Hydrocarbons (EPH)	Tennessee EPH	15	50-130	<=20	1.7	3.3
Texas TPH	TPH	16	70-130	<=30	25	50
Texas TPH	C6-C12 Hydrocarbons	16	70-130	<=30	25	50
Texas TPH	>C12-C28 Hydrocarbons	16	70-130	<=30	25	50
Texas TPH	>C28-C35 Hydrocarbons	16	70-130	<=30	25	50
Surrogates						
1-Chlorooctane	Texas TPH	16	70-130	NA	NA	NA
2-Fluorobiphenyl	8015 (3550)	1	10-152	NA	NA	NA
o-Terphenyl	8015 (3550)/ CALUFT	1/19	15-154	NA	NA	NA
o-Terphenyl	FL-PRO (sonication)	14	15-154	NA	NA	NA
o-Terphenyl	Texas TPH	16	70-130	NA	NA	NA
Nonatricontane (C39)	FL-PRO (sonication)	14	30-118	NA	NA	NA
Non-Routine Compounds-GC Fingerprint						
Diesel	8015 (3550)	1	40-140	<=40	10	10
Heavy oil	8015 (3550)	1	40-140	<=40	20	20
Kerosene	8015 (3550)	1	40-140	<=40	10	10
Mineral Spirits	8015 (3550)	1	40-140	<=40	10	10

SEVERN TRENT STL

Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/kg)	RL (mg/kg)
Acetates - Direct Injection of Aqueous Extract by GC/FID						
n-Butyl acetate	8015 (DAI)	1	50-150	<=50	0.78	5.0
sec-Butyl acetate	8015 (DAI)	1	50-150	<=50	0.65	5.0
Cellosolve acetate	8015 (DAI)	1	50-150	<=50	1.2	5.0
Ethyl acetate (MS)	8015 (DAI)	1	50-150	<=50	0.76	5.0
Isoamyl acetate	8015 (DAI)	1	50-150	<=50	0.74	5
Isobutyl acetate	8015 (DAI)	1	50-150	<=50	0.80	5.0
Isopropyl acetate	8015 (DAI)	1	50-150	<=50	0.74	5.0
Methyl acetate	8015 (DAI)	1	50-150	<=50	0.68	5.0
n-Propyl acetate (MS)	8015 (DAI)	1	50-150	<=50	1.1	5.0
Alcohols - Direct Injection of Aqueous Extract by GC/FID						
Tert-Amyl alcohol	8015 (DAI)	1	50-150	<=50	0.26	1.0
Sec-Butanol	8015 (DAI)	1	50-150	<=50	0.21	1.0
n-Butanol	8015 (DAI)	1	50-150	<=50	0.16	1.0
tert-Butanol	8015 (DAI)	1	50-150	<=50	0.18	1.0
Ethanol (MS)	8015 (DAI)	1	50-150	<=50	0.25	1.0
Methanol (MS)	8015 (DAI)	1	50-150	<=50	0.25	1.0
n-Propanol	8015 (DAI)	1	50-150	<=50	0.25	1.0
Isopropanol (MS)	8015 (DAI)	1	50-150	<=50	0.28	1.0
Isobutanol	8015 (DAI)	1	50-150	<=50	0.15	1.0
Cellosolves - Direct Injection of Aqueous Extract by GC/FID						
Butyl cellosolve	8015 (DAI)	1	50-150	<=50	1.6	5.0
Ethyl cellosolve	8015 (DAI)	1	50-150	<=50	5.4	20
Glycols - Direct Injection of Aqueous Extract by GC/FID						
Diethylene glycol	8015 (DAI)	1	50-150	<=50	1.7	5.0
Ethylene glycol (MS)	8015 (DAI)	1	50-150	<=50	0.78	5.0
Propylene glycol (MS)	8015 (DAI)	1	50-150	<=50	0.90	5.0
Tetraethylene glycol	8015 (DAI)	1	50-150	<=50	1.6	10
Triethylene glycol	8015 (DAI)	1	50-150	<=50	1.0	5.0
Miscellaneous - Direct Injection of Aqueous Extract by GC/FID						
Cyclohexanone	8015 (DAI)	1	50-150	<=50	1.5	5.0
1,4-Dioxane	8015 (DAI)	1	50-150	<=50	0.78	5.0
2-Nitropropane	8015 (DAI)	1	50-150	<=50	1.0	5.0
Tetrahydrofuran (MS)	8015 (DAI)	1	50-150	<=50	0.84	5.0
Non-Routine Solvents - Direct Injection of Aqueous Extract by GC/FID						
Allyl alcohol	8015 (DAI)	1	50-150	<=50	0.38	1.0
Diacetone alcohol	8015 (DAI)	1	50-150	<=50	0.51	5.0
2-Pentanone	8015 (DAI)	1	50-150	<=50	0.36	1.0

(1) Extraction: 5g of soil/soilld is leached with 5mL of reagent water. The aqueous leachate is analyzed by the referenced method. Soil RL and MDL are extrapolated from the aqueous RL and MDL assumming 100% extraction.

SEVERN TRENT STL

Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Volatiles by GC/HECD-PID or GC/HECD-FID						
Benzene (MS)	8021(5035)	1	54-154	<=31	0.65	5.0
Benzene (MS)	8021 (5035ext)	1	54-154	<=31	26	200
Bromodichloromethane	8021(5035)	1	74-171	<=54	0.99	5.0
Bromodichloromethane	8021 (5035ext)	1	74-171	<=54	40	200
Bromoform	8021(5035)	1	74-148	<=40	5	25
Bromoform	8021 (5035ext)	1	74-148	<=40	200	1000
Bromomethane	8021(5035)	1	19-221	<=78	2.2	5.0
Bromomethane	8021 (5035ext)	1	19-221	<=78	88	200
Carbon tetrachloride	8021(5035)	1	76-142	<=50	0.99	5.0
Carbon tetrachloride	8021 (5035ext)	1	76-142	<=50	40	200
Chlorobenzene (MS)	8021(5035)	1	56-122	<=25	1.2	5.0
Chlorobenzene (MS)	8021 (5035ext)	1	56-122	<=25	48	200
Chloroethane	8021(5035)	1	34-227	<=52	1.4	5.0
Chloroethane	8021 (5035ext)	1	34-227	<=52	56	200
Chloroform	8021(5035)	1	63-181	<=36	0.81	5.0
Chloroform	8021 (5035ext)	1	63-181	<=36	32	200
Chloromethane	8021(5035)	1	29-173	<=53	1.0	5.0
Chloromethane	8021 (5035ext)	1	29-173	<=53	40	200
Dibromochloromethane	8021(5035)	1	70-161	<=56	1.0	5.0
Dibromochloromethane	8021 (5035ext)	1	70-161	<=56	40	200
1,2-Dichlorobenzene	8021(5035)	1	57-118	<=39	1.0	5.0
1,2-Dichlorobenzene	8021 (5035ext)	1	57-118	<=39	40	200
1,3-Dichlorobenzene	8021(5035)	1	57-117	<=28	1.0	5.0
1,3-Dichlorobenzene	8021 (5035ext)	1	57-117	<=28	40	200
1,4-Dichlorobenzene	8021(5035)	1	59-117	<=42	1.0	5.0
1,4-Dichlorobenzene	8021 (5035ext)	1	59-117	<=42	40	500
Dichlorodifluoromethane	8021(5035)	1	27-207	<=50	1.0	5.0
Dichlorodifluoromethane	8021 (5035ext)	1	27-207	<=50	40	200
1,1-Dichloroethane	8021(5035)	1	48-209	<=36	1.5	5.0
1,1-Dichloroethane	8021 (5035ext)	1	48-209	<=36	60	200
1,2-Dichloroethane	8021(5035)	1	49-207	<=58	0.77	5.0
1,2-Dichloroethane	8021 (5035ext)	1	49-207	<=58	31	200
1,1-Dichloroethene (MS)	8021(5035)	1	56-185	<=35	1.0	5.0
1,1-Dichloroethene (MS)	8021 (5035ext)	1	56-185	<=35	40	200
cis-1,2-Dichloroethene	8021(5035)	1	40-138	<=39	1.0	5.0
cis-1,2-Dichloroethene	8021(5035ext)	1	40-138	<=39	40	200
trans-1,2-Dichloroethene	8021(5035)	1	64-139	<=43	1.8	5.0
trans-1,2-Dichloroethene	8021 (5035ext)	1	64-139	<=43	72	200
1,2-Dichloropropane	8021(5035)	1	62-178	<=45	0.89	5.0
1,2-Dichloropropane	8021 (5035ext)	1	62-178	<=45	36	200
cis-1,3-Dichloropropene	8021(5035)	1	44-146	<=45	0.74	5.0
cis-1,3-Dichloropropene	8021 (5035ext)	1	44-146	<=45	30	200
trans-1,3-Dichloropropene	8021(5035)	1	30-152	<=55	0.71	5.0
trans-1,3-Dichloropropene	8021 (5035ext)	1	30-152	<=55	28	200
Ethylbenzene	8021(5035)	1	68-118	<=29	0.60	5.0
Ethylbenzene	8021 (5035ext)	1	68-118	<=29	24	200

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Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Methylene chloride	8021(5035)	1	40-224	<=40	2.6	25
Methylene chloride	8021 (5035ext)	1	40-224	<=40	100	1000
Methy t-butyl ether (MTBE)	8021(5035)	1	70-130	<=30	1.1	50
Methy t-butyl ether (MTBE)	8021 (5035ext)	1	70-130	<=30	44	2000
Styrene	8021(5035)	1	70-130	<=30	1.0	5.0
Styrene	8021 (5035ext)	1	70-130	<=30	40	200
1,1,2,2-Tetrachloroethane	8021(5035)	1	58-166	<=48	1.0	5.0
1,1,2,2-Tetrachloroethane	8021 (5035ext)	1	58-166	<=48	40	200
Tetrachloroethene	8021(5035)	1	53-150	<=57	0.70	5.0
Tetrachloroethene	8021 (5035ext)	1	53-150	<=57	28	200
Toluene (MS)	8021(5035)	1	64-144	<=25	1.2	5.0
Toluene (MS)	8021 (5035ext)	1	64-144	<=25	48	200
1,1,1-Trichloroethane	8021(5035)	1	72-170	<=47	0.87	5.0
1,1,1-Trichloroethane	8021 (5035ext)	1	72-170	<=47	35	200
1,1,2-Trichloroethane	8021(5035)	1	61-182	<=53	0.70	5.0
1,1,2-Trichloroethane	8021 (5035ext)	1	61-182	<=53	28	200
Trichloroethene (MS)	8021(5035)	1	56-133	<=25	0.67	5.0
Trichloroethene (MS)	8021 (5035ext)	1	56-133	<=25	27	200
Trichlorofluoromethane	8021(5035)	1	48-165	<=37	2.1	5.0
Trichlorofluoromethane	8021 (5035ext)	1	48-165	<=37	84	200
Vinyl Chloride	8021(5035)	1	20-216	<=61	1.0	5.0
Vinyl Chloride	8021 (5035ext)	1	20-216	<=61	40	200
o-Xylene	8021(5035)	1	50-150	<=25	1.0	5.0
o-Xylene	8021 (5035ext)	1	50-150	<=25	40	200
m&p-Xylene	8021(5035)	1	62-138	<=49	1.0	5.0
m&p-Xylene	8021 (5035ext)	1	62-138	<=49	40	200
Total Xylenes	8021(5035)	1	62-138	<=49	2.0	10
Total Xylenes	8021 (5035ext)	1	62-138	<=49	80	400
Surrogates*						
Bromochloromethane	8021(5035)	1	46-132	NA	NA	NA
Bromochloromethane	8021 (5035ext)	1	46-132	NA	NA	NA
a,a,a-Trifluorotoluene	8021(5035)	1	64-139	NA	NA	NA
a,a,a-Trifluorotoluene	8021 (5035ext)	1	64-139	NA	NA	NA

(ext)= methanol extraction; 1ml methanol per gram of sample and analysis of 100uL of extract. MDL are extrapolated from the direct purge soils, assumming the methanol extraction paramenters.

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Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Chlorinated Pesticides by GC/EC						
Aldrin (MS)	8081(3550)	1	34-124	<=50	0.11	1.7
alpha-BHC	8081(3550)	1	22-125	<=50	0.24	1.7
beta-BHC	8081(3550)	1	36-144	<=50	0.29	1.7
gamma-BHC (Lindane) (MS)	8081(3550)	1	35-132	<=50	0.15	1.7
delta-BHC	8081(3550)	1	32-140	<=50	0.12	1.7
Technical Chlordane	8081(3550)	1	41-177	<=50	3.3	17
alpha Chlordane	8081(3550)	1	40-139	<=50	0.11	1.7
gamma Chlordane	8081(3550)	1	39-143	<=50	0.13	1.7
Chlorobenzilate	8081(3550)	1	73-201	<=50	3.8	17
4,4'-DDD	8081(3550)	1	37-149	<=50	0.35	3.3
4,4'-DDE	8081(3550)	1	33-139	<=50	0.54	3.3
4,4'-DDT (MS)	8081(3550)	1	46-156	<=50	0.31	3.3
Dieldrin (MS)	8081(3550)	1	40-133	<=50	0.31	3.3
Endosulfan I	8081(3550)	1	31-133	<=50	0.17	1.7
Endosulfan II	8081(3550)	1	34-150	<=50	0.22	3.3
Endosulfan sulfate	8081(3550)	1	45-163	<=50	0.44	3.3
Endrin (MS)	8081(3550)	1	42-137	<=50	0.43	3.3
Endrin aldehyde	8081(3550)	1	37-152	<=50	0.31	3.3
Endrin ketone	8081(3550)	1	44-165	<=50	0.38	3.3
Heptachlor (MS)	8081(3550)	1	31-142	<=50	0.28	1.7
Heptachlor epoxide	8081(3550)	1	29-133	<=50	0.17	1.7
Isodrin	8081(3550)	1	14-188	<=50	0.33	3.3
Kepone	8081(3550)	1	10-65	<=50	6.7	170
Methoxychlor	8081(3550)	1	37-185	<=50	0.20	17
Toxaphene	8081(3550)	1	36-159	<=50	33	170
Surrogates						
Tetrachloro-m-xylene	8081(3550)	1	30-150	NA	NA	NA
Decachlorobiphenyl	8081(3550)	1	30-150	NA	NA	NA

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Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Polychlorinated Biphenyls as Aroclors by GC/EC						
PCB-1016	8082(3550)	1	24-132	<=50	3.9	33
PCB 1221	8082(3550)	1	30-130	<=50	17	67
PCB 1232	8082(3550)	1	30-130	<=50	6.7	33
PCB-1242	8082(3550)	1	30-130	<=50	6.7	33
PCB-1248	8082(3550)	1	30-150	<=50	6.5	33
PCB-1254	8082(3550)	1	30-150	<=50	6.7	33
PCB-1260	8082(3550)	1	28-153	<=50	4.4	33
PCB-1268	8082(3550)	1	30-150	<=50	2.4	33
Surrogates						
2,4,5,6-Tetrachloro-m-xylene	8082(3550)	1	30-150	NA	NA	NA
Decachlorobiphenyl	8082(3550)	1	30-150	NA	NA	NA
Polychlorinated Biphenyls Congener Homologs by GC/MS (SIM)						
Monochlorobiphenyls	680/(3550)	17	30-130	<=50	0.51	3.3
Dichlorobiphenyls	680/(3550)	17	30-130	<=50	0.49	3.3
Trichlorobiphenyls	680/(3550)	17	30-130	<=50	0.42	3.3
Tetrachlorobiphenyls	680/(3550)	17	40-140	<=50	0.97	6.7
Pentachlorobiphenyls	680/(3550)	17	40-140	<=50	0.74	6.7
Hexachlorobiphenyls	680/(3550)	17	40-140	<=50	0.68	6.7
Heptachlorobiphenyls	680/(3550)	17	40-140	<=50	1.2	10
Octachlorobiphenyls	680/(3550)	17	40-140	<=50	1.2	10
Nonachlorobiphenyls	680/(3550)	17	30-130	<=50	1.5	17
Decachlorobiphenyl	680/(3550)	17	30-130	<=50	1.5	17
Surrogate						
Decachlorobiphenyl-13C12	680/(3550)	17	30-130	NA	NA	NA

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Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Phosphorus-containing Pesticides and Herbicides by GC/NPD-FPD						
Azinphos methyl	8141(3550)	1	30-150	<=50	36	66
Bolstar (Sulprofos)	8141(3550)	1	30-150	<=50	9.4	33
Chlorpyrifos	8141(3550)	1	30-150	<=50	12	33
Coumaphos	8141(3550)	1	30-150	<=50	28	33
Demeton-O	8141(3550)	1	30-150	<=50	7.2	83
Demeton-S	8141(3550)	1	30-150	<=50	27	83
Diazinon (MS)	8141(3550)	1	30-150	<=50	13	33
Dichlorvos	8141(3550)	1	30-150	<=50	9	66
Dimethoate	8141(3550)	1	30-150	<=50	17	66
Disulfoton	8141(3550)	1	30-150	<=50	10	66
EPN	8141(3550)	1	30-150	<=50	14	33
Ethoprop	8141(3550)	1	30-150	<=50	9.4	17
Famphur	8141(3550)	1	30-150	<=50	13	66
Fensulfothion	8141(3550)	1	30-150	<=50	23	330
Fenthion	8141(3550)	1	30-150	<=50	6.6	33
Malathion	8141(3550)	1	30-150	<=50	9.6	33
Merphos/Merphos oxone	8141(3550)	1	30-150	<=50	17	33
Mevinphos	8141(3550)	1	30-150	<=50	9.3	66
Monocrotophos	8141(3550)	1	30-150	<=50	320	330
Naled	8141(3550)	1	30-150	<=50	22	330
Parathion, ethyl (MS)	8141(3550)	1	30-150	<=50	8.4	33
Parathion, methyl (MS)	8141(3550)	1	30-150	<=50	6.8	17
Phorate	8141(3550)	1	30-150	<=50	12	33
Ronnel (MS)	8141(3550)	1	30-150	<=50	10	33
Stirophos (Tetrachlorvinphos)	8141(3550)	1	30-150	<=50	12	33
Sulfotepp (MS)	8141(3550)	1	30-150	<=50	7.2	17
Thionazin (MS)	8141(3550)	1	30-150	<=50	7.4	33
Tokuthion (Prothiofos)	8141(3550)	1	30-150	<=50	6.5	33
Trichloronate	8141(3550)	1	30-150	<=50	8.5	33
Surrogate						
Triphenylphosphate	8141(3550)	1	28-152	NA	NA	NA
Chlorinated Herbicides by GC/EC						
2,4-D (MS)	8151	1	29-161	<=50	0.76	8.3
2,4-DB	8151	1	20-182	<=50	0.74	9.3
2,4,5-T (MS)	8151	1	33-165	<=50	0.54	8.3
2,4,5-TP (Silvex) (MS)	8151	1	39-137	<=50	0.53	8.3
Dalapon	8151	1	D-182	<=50	2.4	2000
Dicamba	8151	1	36-154	<=50	1.7	20
Dichlorprop	8151	1	11-125	<=50	0.92	100
Dinoseb	8151	1	D-116	<=50	9	100
MCPA	8151	1	30-144	<=50	360	2000
MCPP	8151	1	30-140	<=50	200	2000
Pentachlorophenol	8151	1	10-207	<=50	2.8	17
Surrogates						
2,4-Dichlorophenyl acetic acid	8151	1	34-127	NA	NA	NA
Non-Routine Compounds						
Picloram	8151	1	30-150	<=50	3.3	8.3

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Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Volatiles by GC/MS						
Acetone	8260(5035)	1	30-195	<=100	5	50
Acetone	8260(5035ext)	1	30-195	<=100	510	2000
Acetonitrile	8260(5035)	1	61-148	<=50	15	200
Acetonitrile	8260(5035ext)	1	61-148	<=50	4000	8000
Acrolein	8260(5035)	1	D-123	<=100	21	100
Acrolein	8260(5035ext)	1	D-123	<=100	2000	4000
Acrylonitrile	8260(5035)	1	44-125	<=50	4.3	100
Acrylonitrile	8260(5035ext)	1	44-125	<=50	2000	4000
Benzene (MS)	8260(5035)	1	65-130	<=50	0.38	5.0
Benzene (MS)	8260(5035ext)	1	65-130	<=50	46	200
Bromobenzene	8260(5035)	1	77-147	<=50	0.31	5.0
Bromobenzene	8260(5035ext)	1	77-147	<=50	55	200
Bromochloromethane	8260(5035)	1	63-136	<=50	0.51	5.0
Bromochloromethane	8260(5035ext)	1	63-136	<=50	98	200
Bromodichloromethane	8260(5035)	1	71-120	<=50	0.31	5.0
Bromodichloromethane	8260(5035ext)	1	71-120	<=50	86	200
Bromoform	8260(5035)	1	58-134	<=50	0.68	5.0
Bromoform	8260(5035ext)	1	58-134	<=50	45	200
Bromomethane	8260(5035)	1	22-184	<=100	0.57	5.0
Bromomethane	8260(5035ext)	1	22-184	<=100	100	200
2-Butanone (Methyl Ethyl Ketone-MEK)	8260(5035)	1	30-185	<=50	0.28	25
2-Butanone (Methyl Ethyl Ketone-MEK)	8260(5035ext)	1	30-185	<=50	170	1000
n-Butylbenzene	8260(5035)	1	59-120	<=50	0.48	5.0
n-Butylbenzene	8260(5035ext)	1	59-120	<=50	140	200
sec-Butylbenzene	8260(5035)	1	60-128	<=50	0.80	5.0
sec-Butylbenzene	8260(5035ext)	1	60-128	<=50	65	200
tert-Butylbenzene	8260(5035)	1	62-140	<=50	1.1	5.0
tert-Butylbenzene	8260(5035ext)	1	62-140	<=50	63	200
Carbon disulfide	8260(5035)	1	43-143	<=50	0.40	5.0
Carbon disulfide	8260(5035ext)	1	43-143	<=50	78	200
Carbon tetrachloride	8260(5035)	1	66-128	<=50	0.35	5.0
Carbon tetrachloride	8260(5035ext)	1	66-128	<=50	120	200
Chlorobenzene (MS)	8260(5035)	1	69-128	<=50	0.74	5.0
Chlorobenzene (MS)	8260(5035ext)	1	69-128	<=50	62	200
2-Chloro-1,3-butadiene (Chloroprene)	8260(5035)	1	65-137	<=50	0.48	5.0
2-Chloro-1,3-butadiene (Chloroprene)	8260(5035ext)	1	65-137	<=50	100	200
Chloroethane	8260(5035)	1	46-152	<=100	0.57	5.0
Chloroethane	8260(5035ext)	1	46-152	<=100	100	200
2-Chloroethyl vinyl ether	8260(5035)	1	D-208	<=100	50	50
2-Chloroethyl vinyl ether	8260(5035ext)	1	D-208	<=100	2000	2000
Chloroform	8260(5035)	1	70-124	<=50	0.44	5.0
Chloroform	8260(5035ext)	1	70-124	<=50	39	200
Chloromethane	8260(5035)	1	42-143	<=100	1.4	5.0
Chloromethane	8260(5035ext)	1	42-143	<=100	100	200
3-Chloropropene (Allyl chloride)	8260(5035)	1	40-165	<=50	0.79	5.0
3-Chloropropene (Allyl chloride)	8260(5035ext)	1	40-165	<=50	100	200
2-Chlorotoluene	8260(5035)	1	49-219	<=50	0.28	5.0
2-Chlorotoluene	8260(5035ext)	1	49-219	<=50	72	200
4-Chlorotoluene	8260(5035)	1	45-218	<=50	0.35	5.0
4-Chlorotoluene	8260(5035ext)	1	45-218	<=50	72	200

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Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Dibromochloromethane	8260(5035)	1	70-124	<=50	0.39	5.0
Dibromochloromethane	8260(5035ext)	1	70-124	<=50	66	200
1,2-Dibromo-3-chloropropane (DBCP)	8260(5035)	1	21-180	<=100	0.86	10
1,2-Dibromo-3-chloropropane (DBCP)	8260(5035ext)	1	21-180	<=100	95	400
1,2-Dibromoethane (EDB)	8260(5035)	1	76-130	<=50	0.57	5.0
1,2-Dibromoethane (EDB)	8260(5035ext)	1	76-130	<=50	84	200
Dibromomethane	8260(5035)	1	71-134	<=50	0.48	5.0
Dibromomethane	8260(5035ext)	1	71-134	<=50	120	200
1,2-Dichlorobenzene	8260(5035)	1	56-132	<=50	1.1	5.0
1,2-Dichlorobenzene	8260(5035ext)	1	56-132	<=50	46	200
1,3-Dichlorobenzene	8260(5035)	1	56-136	<=50	0.39	5.0
1,3-Dichlorobenzene	8260(5035ext)	1	56-136	<=50	51	200
1,4-Dichlorobenzene	8260(5035)	1	44-139	<=50	0.54	5.0
1,4-Dichlorobenzene	8260(5035ext)	1	44-139	<=50	60	200
trans-1,4-Dichloro-2-butene	8260(5035)	1	27-150	<=100	1.5	10
trans-1,4-Dichloro-2-butene	8260(5035ext)	1	27-150	<=100	200	400
Dichlorodifluoromethane	8260(5035)	1	D-184	<=100	2.2	5.0
Dichlorodifluoromethane	8260(5035ext)	1	D-184	<=100	60	200
1,1-Dichloroethane	8260(5035)	1	34-166	<=50	0.8	5.0
1,1-Dichloroethane	8260(5035ext)	1	34-166	<=50	35	200
1,2-Dichloroethane	8260(5035)	1	39-158	<=50	0.66	5.0
1,2-Dichloroethane	8260(5035ext)	1	39-158	<=50	100	200
cis-1,2-Dichloroethene	8260(5035)	1	33-150	<=50	0.39	5.0
cis-1,2-Dichloroethene	8260(5035ext)	1	33-150	<=50	58	200
trans-1,2-Dichloroethene	8260(5035)	1	23-159	<=50	0.80	5.0
trans-1,2-Dichloroethene	8260(5035ext)	1	23-159	<=50	52	200
1,2-Dichloroethenes (total)	8260(5035)	1	33-150	<=50	0.31	10
1,2-Dichloroethenes (total)	8260(5035ext)	1	33-150	<=50	78	400
1,1-Dichloroethene (MS)	8260(5035)	1	46-142	<=50	0.58	5.0
1,1-Dichloroethene (MS)	8260(5035ext)	1	46-142	<=50	82	200
1,2-Dichloropropane	8260(5035)	1	72-118	<=50	0.65	5.0
1,2-Dichloropropane	8260(5035ext)	1	72-118	<=50	96	200
1,3-Dichloropropane	8260(5035)	1	73-146	<=50	0.4	5.0
1,3-Dichloropropane	8260(5035ext)	1	73-146	<=50	73	200
2,2-Dichloropropane	8260(5035)	1	28-187	<=50	0.35	5.0
2,2-Dichloropropane	8260(5035ext)	1	28-187	<=50	59	200
1,1-Dichloropropene	8260(5035)	1	76-126	<=50	0.6	5.0
1,1-Dichloropropene	8260(5035ext)	1	76-126	<=50	89	200
cis-1,3-Dichloropropene	8260(5035)	1	71-123	<=50	0.7	5.0
cis-1,3-Dichloropropene	8260(5035ext)	1	71-123	<=50	100	200
trans-1,3-Dichloropropene	8260(5035)	1	66-128	<=50	1.0	5.0
trans-1,3-Dichloropropene	8260(5035ext)	1	66-128	<=50	59	200
Ethylbenzene	8260(5035)	1	71-120	<=50	0.30	5.0
Ethylbenzene	8260(5035ext)	1	71-120	<=50	50	200
Ethyl methacrylate	8260(5035)	1	66-152	<=50	1.5	5.0
Ethyl methacrylate	8260(5035ext)	1	66-152	<=50	100	200
Hexachlorobutadiene	8260(5035)	1	29-135	<=100	0.87	5.0
Hexachlorobutadiene	8260(5035ext)	1	29-135	<=100	100	200
2-Hexanone	8260(5035)	1	46-163	<=50	0.43	25
2-Hexanone	8260(5035ext)	1	46-163	<=50	500	1000

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Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Iodomethane	8260(5035)	1	35-162	<=50	0.5	5.0
Iodomethane	8260(5035ext)	1	35-162	<=50	100	200
Isobutyl alcohol	8260(5035)	1	74-136	<=50	22	200
Isobutyl alcohol	8260(5035ext)	1	74-136	<=50	4000	8000
Isopropylbenzene	8260(5035)	1	75-134	<=50	3.8	5.0
Isopropylbenzene	8260(5035ext)	1	75-134	<=50	55	200
p-Isopropyltoluene	8260(5035)	1	39-141	<=50	0.44	5.0
p-Isopropyltoluene	8260(5035ext)	1	39-141	<=50	86	200
Methacrylonitrile	8260(5035)	1	60-142	<=50	6.7	100
Methacrylonitrile	8260(5035ext)	1	60-142	<=50	2000	4000
Methylene chloride	8260(5035)	1	29-153	<=100	0.54	5.0
Methylene chloride	8260(5035ext)	1	29-153	<=100	51	200
Methyl methacrylate	8260(5035)	1	54-155	<=50	2.8	5.0
Methyl methacrylate	8260(5035ext)	1	54-155	<=50	100	200
4-Methyl-2-pentanone (MIBK)	8260(5035)	1	47-160	<=50	0.38	25
4-Methyl-2-pentanone (MIBK)	8260(5035ext)	1	47-160	<=50	140	1000
Methyl t-butyl ether (MTBE)	8260(5035)	1	37-168	<=50	0.47	50
Methyl t-butyl ether (MTBE)	8260(5035ext)	1	37-168	<=50	96	2000
Naphthalene	8260(5035)	1	42-250	<=50	0.42	5.0
Naphthalene	8260(5035ext)	1	42-250	<=50	120	200
Pentachloroethane	8260(5035)	1	D-195	<=100	0.48	25
Pentachloroethane	8260(5035ext)	1	D-195	<=100	500	1000
Propionitrile (ethylcyanide)	8260(5035)	1	58-142	<=50	9.3	100
Propionitrile (ethylcyanide)	8260(5035ext)	1	58-142	<=50	2000	4000
n-Propylbenzene	8260(5035)	1	67-134	<=50	0.48	5.0
n-Propylbenzene	8260(5035ext)	1	67-134	<=50	79	200
Styrene	8260(5035)	1	73-121	<=50	0.53	5.0
Styrene	8260(5035ext)	1	73-121	<=50	130	200
1,1,1,2-Tetrachloroethane	8260(5035)	1	64-143	<=50	0.56	5.0
1,1,1,2-Tetrachloroethane	8260(5035ext)	1	64-143	<=50	41	200
1,1,2,2-Tetrachloroethane	8260(5035)	1	59-138	<=50	0.57	5.0
1,1,2,2-Tetrachloroethane	8260(5035ext)	1	59-138	<=50	79	200
Tetrachloroethene	8260(5035)	1	64-134	<=50	0.98	5.0
Tetrachloroethene	8260(5035ext)	1	64-134	<=50	89	200
Toluene (MS)	8260(5035)	1	63-133	<=50	0.65	5.0
Toluene (MS)	8260(5035ext)	1	63-133	<=50	63	200
1,2,3-Trichlorobenzene	8260(5035)	1	29-169	<=50	3.4	5.0
1,2,3-Trichlorobenzene	8260(5035ext)	1	29-169	<=50	100	200
1,2,4-Trichlorobenzene	8260(5035)	1	49-152	<=50	0.44	5.0
1,2,4-Trichlorobenzene	8260(5035ext)	1	49-152	<=50	94	200
1,1,1-Trichloroethane	8260(5035)	1	70-123	<=50	0.54	5.0
1,1,1-Trichloroethane	8260(5035ext)	1	70-123	<=50	110	200
1,1,2-Trichloroethane	8260(5035)	1	66-127	<=50	0.97	5.0
1,1,2-Trichloroethane	8260(5035ext)	1	66-127	<=50	41	200
Trichloroethene (MS)	8260(5035)	1	64-126	<=50	0.77	5.0
Trichloroethene (MS)	8260(5035ext)	1	64-126	<=50	100	200
Trichlorofluoromethane	8260(5035)	1	38-146	<=100	2.0	5.0
Trichlorofluoromethane	8260(5035ext)	1	38-146	<=100	54	200

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PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
1,2,3-Trichloropropane	8260(5035)	1	33-210	<=50	0.24	5.0
1,2,3-Trichloropropane	8260(5035ext)	1	33-210	<=50	85	200
1,1,2-Trichloro-1,2,2-trifluoroethane	8260(5035)	1	70-130	<=50	0.46	5.0
1,1,2-Trichloro-1,2,2-trifluoroethane	8260(5035ext)	1	70-130	<=50	100	200
1,2,4-Trimethylbenzene	8260(5035)	1	74-133	<=50	0.80	5.0
1,2,4-Trimethylbenzene	8260(5035ext)	1	74-133	<=50	120	200
1,3,5-Trimethylbenzene	8260(5035)	1	72-124	<=50	1.7	5.0
1,3,5-Trimethylbenzene	8260(5035ext)	1	72-124	<=50	39	200
Vinyl acetate	8260(5035)	1	D-184	<=100	1.1	10
Vinyl acetate	8260(5035ext)	1	D-184	<=100	100	400
Vinyl chloride	8260(5035)	1	38-151	<=100	1.5	5.0
Vinyl chloride	8260(5035ext)	1	38-151	<=100	100	200
Xylenes (total)	8260(5035)	1	74-122	<=50	0.97	10
Xylenes (total)	8260(5035ext)	1	74-122	<=50	140	400
o-Xylene	8260(5035)	1	74-122	<=50	0.31	5.0
o-Xylene	8260(5035ext)	1	74-122	<=50	56	200
m&p-Xylene	8260(5035)	1	74-121	<=50	2.3	5.0
m&p-Xylene	8260(5035ext)	1	74-121	<=50	96	200
Surrogates						
p-Bromofluorobenzene	8260(5035)	1	68-121	NA	NA	NA
p-Bromofluorobenzene	8260(5035ext)	1	68-121	NA	NA	NA
Dibromofluoromethane	8260(5035)	1	66-127	NA	NA	NA
Dibromofluoromethane	8260(5035ext)	1	66-127	NA	NA	NA
Toluene-d8	8260(5035)	1	65-128	NA	NA	NA
Toluene-d8	8260(5035ext)	1	65-128	NA	NA	NA
(ext) = methanol extraction; 1mL methanol per gram of sample and analysis of 25uL (0.025mL) of extract.						
Non-Routine Compounds						
1-Chlorohexane	8260(5035)	1	70-130	<=50	0.72	5.0
1-Chlorohexane	8260(5035ext)	1	70-130	<=50	100	200
Cyclohexane	8260 (5035)	1	70-130	<=50	0.8	10
Cyclohexane	8260(5035ext)	1	70-130	<=50	200	400
Cyclohexanone	8260 (5035)	1	70-130	<=50	15	50
Cyclohexanone	8260(5035ext)	1	70-130	<=50	1000	2000
Diethyl ether	8260(5035)	1	70-130	<=50	0.78	10
Diethyl ether	8260(5035ext)	1	70-130	<=50	200	400
Furan	8260(5035)	1	70-130	<=50	0.36	5.0
Furan	8260(5035ext)	1	70-130	<=50	100	200
Methyl acetate	8260(5035)	1	70-130	<=50	1.6	10
Methyl acetate	8260(5035ext)	1	70-130	<=50	200	400
Methyl cyclohexane	8260(5035)	1	70-130	<=50	0.48	10
Methyl cyclohexane	8260(5035ext)	1	70-130	<=50	200	400
Tetrahydrofuran	8260(5035)	1	70-130	<=50	0.36	5.0
Tetrahydrofuran	8260(5035ext)	1	70-130	<=50	100	200

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Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Semivolatiles (Base-Neutrals/Acids) by GC/MS						
Acenaphthene (MS)	8270(3550)	1	39-104	<=50	34	330
Acenaphthene (MS)	8270(3550) (Low Level)	1	28-110	<=50	0.90	6.7
Acenaphthylene	8270(3550)	1	37-112	<=50	25	330
Acenaphthylene	8270(3550) (Low Level)	1	23-126	<=50	0.86	6.7
Acetophenone	8270(3550)	1	24-108	<=50	28	330
2-Acetylaminofluorene	8270(3550)	1	D-126	<=100	26	330
4-Aminobiphenyl	8270(3550)	1	10-47	<=50	100	330
Aniline	8270(3550)	1	D-86	<=100	23	330
Anthracene	8270(3550)	1	34-120	<=50	32	330
Anthracene	8270(3550) (Low Level)	1	28-136	<=50	0.96	6.7
Aramite	8270(3550)	1	D-140	<=100	30	330
Benzidine	8270(3550)	1	D-95	<=100	330	2700
Benzo(a)anthracene	8270(3550)	1	28-134	<=50	36	330
Benzo(a)anthracene	8270(3550) (Low Level)	1	31-146	<=50	0.76	6.7
Benzoic acid	8270(3550)	1	10-94	<=100	180	1700
Benzo(b)fluoranthene	8270(3550)	1	29-128	<=50	33	330
Benzo(b)fluoranthene	8270(3550) (Low Level)	1	30-139	<=50	0.96	6.7
Benzo(k)fluoranthene	8270(3550)	1	25-127	<=50	13	330
Benzo(k)fluoranthene	8270(3550) (Low Level)	1	42-129	<=50	0.98	6.7
Benzo(g,h,i)perylene	8270(3550)	1	33-122	<=50	23	330
Benzo(g,h,i)perylene	8270(3550) (Low Level)	1	21-149	<=50	0.61	6.7
Benzo(a)pyrene	8270(3550)	1	30-128	<=50	32	330
Benzo(a)pyrene	8270(3550) (Low Level)	1	28-128	<=50	0.90	6.7
Benzyl alcohol	8270(3550)	1	21-110	<=50	38	330
Bis(2-chloroethoxy) methane	8270(3550)	1	34-102	<=50	32	330
Bis(2-chloroethyl) ether	8270(3550)	1	27-96	<=50	37	330
Bis(2-chloroisopropyl) ether	8270(3550)	1	30-94	<=50	32	330
Bis(2-ethylhexyl) phthalate	8270(3550)	1	39-122	<=50	44	330
4-Bromophenyl phenyl ether	8270(3550)	1	33-94	<=50	30	330
Butyl benzyl phthalate	8270(3550)	1	44-121	<=50	32	330
Carbazole	8270(3550)	1	26-129	<=50	30	330
4-Chloroaniline	8270(3550)	1	18-94	<=50	29	660
4-Chloro-3-methylphenol (MS)	8270(3550)	1	22-124	<=50	40	330
2-Chloronaphthalene	8270(3550)	1	42-96	<=50	37	330
2-Chlorophenol (MS)	8270(3550)	1	22-109	<=50	41	330
4-Chlorophenylphenyl ether	8270(3550)	1	38-101	<=50	26	330
Chrysene	8270(3550)	1	35-130	<=50	31	330
Chrysene	8270(3550) (Low Level)	1	39-134	<=50	1.0	6.7

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Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Diallate	8270(3550)	1	24-137	<=50	28	330
Dibenz(a,h)anthracene	8270(3550)	1	29-126	<=50	31	330
Dibenz(a,h)anthracene	8270(3550) (Low Level)	1	30-138	<=50	0.88	6.7
Dibenzofuran	8270(3550)	1	34-112	<=50	34	330
Di-n-butylphthalate	8270(3550)	1	39-116	<=50	39	330
1,2-Dichlorobenzene	8270(3550)	1	31-86	<=50	23	330
1,3-Dichlorobenzene	8270(3550)	1	33-81	<=50	23	330
1,4-Dichlorobenzene (MS)	8270(3550)	1	25-93	<=50	24	330
3,3'-Dichlorobenzidine	8270(3550)	1	10-98	<=50	26	660
2,4-Dichlorophenol	8270(3550)	1	37-103	<=50	29	330
2,6-Dichlorophenol	8270(3550)	1	20-138	<=50	24	330
Diethylphthalate	8270(3550)	1	37-112	<=50	35	330
Dimethoate	8270(3550)	1	22-102	<=50	35	330
p-(Dimethylamino)azobenzene	8270(3550)	1	D-124	<=100	26	330
7,12-Dimethylbenz(a)anthracene	8270(3550)	1	11-128	<=50	25	330
3,3'-Dimethylbenzidine	8270(3550)	1	D-58	<=100	1700	1700
a,a-Dimethylphenethylamine	8270(3550)	1	D-65	<=100	67000	67000
2,4-Dimethylphenol	8270(3550)	1	45-99	<=50	28	330
Dimethylphthalate	8270(3550)	1	40-106	<=50	35	330
m-Dinitrobenzene	8270(3550)	1	D-134	<=100	18	330
4,6-Dinitro-2-methylphenol	8270(3550)	1	24-128	<=50	31	1700
2,4-Dinitrophenol	8270(3550)	1	19-126	<=50	340	1700
2,4-Dinitrotoluene (MS)	8270(3550)	1	18-125	<=50	22	330
2,6-Dinitrotoluene	8270(3550)	1	42-109	<=50	29	330
Dinoseb (2-sec-Butyl-4,6-dinitrophenol)	8270(3550)	1	D-114	<=100	27	330
Di-n-octylphthalate	8270(3550)	1	38-126	<=50	32	330
1,4-Dioxane	8270(3550)	1	D-156	<=100	44	330
Diphenylamine/ N-nitrosodiphenylamine	8270(3550)	1	16-113	<=50	30	330
1,2-Diphenyl hydrazine	8270(3550)	1	22-129	<=50	48	330
Disulfoton	8270(3550)	1	31-65	<=50	18	330
Ethyl methanesulfonate	8270(3550)	1	28-113	<=50	28	330
Ethyl parathion	8270(3550)	1	28-113	<=50	11	330
Famphur	8270(3550)	1	D-124	<=100	58	330
Fluoranthene	8270(3550)	1	18-137	<=50	30	330
Fluoranthene	8270(3550) (Low Level)	1	30-142	<=50	0.86	6.7
Fluorene	8270(3550)	1	35-112	<=50	22	330
Fluorene	8270(3550) (Low Level)	1	27-116	<=50	0.78	6.7
Hexachlorobenzene	8270(3550)	1	34-103	<=50	38	330
Hexachlorobutadiene	8270(3550)	1	35-98	<=50	27	330
Hexachlorocyclopentadiene	8270(3550)	1	19-107	<=50	270	330
Hexachloroethane	8270(3550)	1	29-84	<=50	19	330
Hexachlorophene	8270(3550)	1	D-164	<=100	170000	170000
Hexachloropropene	8270(3550)	1	34-116	<=50	34	330

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PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Indeno(1,2,3-cd)pyrene	8270(3550)	1	24-136	<=50	17	330
Indeno(1,2,3-cd)pyrene	8270(3550) (Low Level)	1	17-164	<=50	0.65	6.7
Isophorone	8270(3550)	1	34-103	<=50	26	330
Isosafrole	8270(3550)	1	25-133	<=50	17	330
Methapyrilene	8270(3550)	1	D-110	<=100	350	67000
3-Methylcholanthrene	8270(3550)	1	D-151	<=100	22	330
Methyl methanesulfonate	8270(3550)	1	37-108	<=50	31	330
1-Methylnaphthalene	8270(3550)	1	12-128	<=50	22	330
1-Methylnaphthalene	8270(3550) (Low Level)	1	30-111	<=50	0.35	6.7
2-Methylnaphthalene	8270(3550)	1	37-108	<=50	29	330
2-Methylnaphthalene	8270(3550) (Low Level)	1	30-111	<=50	0.53	6.7
Methyl parathion	8270(3550)	1	19-60	<=50	15	330
2-Methyl phenol (o-Cresol)	8270(3550)	1	34-108	<=50	46	330
3- Methyl phenol (m- Cresol)	8270(3550)	1	35-102	<=50	40	330
4-Methyl phenol (p-Cresol)	8270(3550)	1	35-102	<=50	40	330
3- and 4-Methyl phenol	8270(3550)	1	35-102	<=50	40	330
Naphthalene	8270(3550)	1	36-94	<=50	31	330
Naphthalene	8270(3550) (Low Level)	1	29-106	<=50	0.71	6.7
1,4-naphthoquinone	8270(3550)	1	D-122	<=100	18	330
1-Naphthylamine	8270(3550)	1	D-47	<=100	90	330
2-Naphthylamine	8270(3550)	1	D-51	<=100	140	330
2-Nitroaniline	8270(3550)	1	35-113	<=50	25	1700
3-Nitroanline	8270(3550)	1	22-99	<=50	30	1700
4-Nitroaniline	8270(3550)	1	32-111	<=50	26	1700
Nitrobenzene	8270(3550)	1	24-110	<=50	31	330
2-Nitrophenol	8270(3550)	1	33-102	<=50	26	330
4-Nitrophenol(MS)	8270(3550)	1	13-133	<=50	25	1700
4-Nitroquinoline-1-oxide	8270(3550)	1	D-200	<=100	36	3300
N-Nitroso-di-N-butylamine	8270(3550)	1	32-99	<=50	32	330
N-Nitrosodiethylamine	8270(3550)	1	10-111	<=50	23	330
N-Nitrosodimethylamine	8270(3550)	1	10-132	<=50	200	330
N-Nitrosodiphenylamine/ Diphenylamine	8270(3550)	1	16-113	<=50	30	330
N-Nitrosos-di-N-propylamine (MS)	8270(3550)	1	17-110	<=50	30	330
N-Nitrosomethylethylamine	8270(3550)	1	22-137	<=50	36	330
N-Nitrosomorpholine	8270(3550)	1	18-129	<=50	17	330
N-Nitrosopiperidine	8270(3550)	1	26-125	<=50	20	330
N-Nitrosopyrrolidine	8270(3550)	1	20-108	<=50	22	330
5-Nitro-o-toluidine	8270(3550)	1	10-100	<=50	19	330
Pentachlorobenzene	8270(3550)	1	30-133	<=50	18	330
Pentachloronitrobenzene	8270(3550)	1	22-127	<=50	26	330
Pentachlorophenol (MS)	8270(3550)	1	17-140	<=50	34	1700
Phenacetin	8270(3550)	1	D-117	<=100	34	330

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PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Phenanthrene	8270(3550)	1	34-123	<=50	34	330
Phenanthrene	8270(3550) (Low Level)	1	32-127	<=50	0.80	6.7
Phenol (MS)	8270(3550)	1	20-108	<=50	41	330
p-Phenylenediamine	8270(3550)	1	D-130	<=100	1700	1700
Phorate	8270(3550)	1	37-81	<=50	22	330
2-Picoline	8270(3550)	1	19-76	<=50	53	330
Pronamide	8270(3550)	1	27-84	<=50	17	330
Pyrene (MS)	8270(3550)	1	36-132	<=50	15	330
Pyrene (MS)	8270(3550) (Low Level)	1	28-130	<=50	1.2	6.7
Pyridine	8270(3550)	1	D-107	<=100	160	330
Safrole	8270(3550)	1	34-119	<=50	20	330
Sulfotepp	8270(3550)	1	31-102	<=50	24	330
1,2,4,5-Tetrachlorobenzene	8270(3550)	1	37-124	<=50	21	330
2,3,4,5-Tetrachlorophenol	8270(3550)	1	14-138	<=50	40	330
2,3,4,6-Tetrachlorophenol	8270(3550)	1	21-106	<=50	40	330
Tetrachlorophenols (2,3,4,5 + 2,3,4,6)	8270(3550)	1	21-106	<=50	40	330
Thionazin	8270(3550)	1	21-86	<=50	22	330
o-Toluidine	8270(3550)	1	10-58	<=50	20	330
1,2,4-Trichlorobenzene (MS)	8270(3550)	1	26-102	<=50	38	330
2,4,5-Trichlorophenol	8270(3550)	1	44-110	<=50	31	330
2,4,6-Trichlorophenol	8270(3550)	1	43-110	<=50	32	330
Trichlorophenols (2,4,5 + 2,4,6)	8270(3550)	1	43-110	<=50	32	330
o,o,o-Triethylphosphorothioate	8270(3550)	1	28-124	<=50	26	330
1,3,5-Trinitrobenzene	8270(3550)	1	D-131	<=100	38	330
Surrogates						
2-Fluorobiphenyl	8270(3550)	1	37-106	NA	NA	NA
2-Fluorophenol	8270(3550)	1	31-105	NA	NA	NA
Nitrobenzene-d5	8270(3550)	1	31-99	NA	NA	NA
Phenol-d5	8270(3550)	1	31-105	NA	NA	NA
p-Terphenyl-d14	8270(3550)	1	38-120	NA	NA	NA
2,4,6- Tribromophenol	8270(3550)	1	26-127	NA	NA	NA
Ortho Terphenyl	8270(3550) (Low Level)	1	14-129	NA	NA	NA

SEVERN TRENT STL

Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Non-Routine Compounds						
Atrazine	8270(3550)	1	30-130	<=50	44	330
Benzaldehyde	8270(3550)	1	30-130	<=50	26	330
1,4-Benzoquinone	8270(3550)	1	D-147	<=50	21	330
1,1-Biphenyl (1,1-Diphenyl)	8270(3550)	1	42-128	<=50	28	330
Bis(2-ethylhexyl) adipate	8270(3550)	1	30-130	<=50	42	330
Caprolactam	8270(3550)	1	30-130	<=50	65	330
1-Chloronaphthalene	8270(3550)	1	30-130	<=50	21	330
2,3-Dimethylphenol	8270(3550)	1	30-130	<=50	20	330
2,5-Dimethylphenol	8270(3550)	1	30-130	<=50	22	330
2,6-Dimethylphenol	8270(3550)	1	30-130	<=50	18	330
3,4-Dimethylphenol	8270(3550)	1	30-130	<=50	22	330
2,5-Dinitrophenol	8270(3550)	1	30-130	<=50	19	1700
3-Nitrophenol	8270(3550)	1	30-130	<=50	26	330
Phenyl ether (Diphenyl oxide)	8270(3550)	1	33-98	<=50	17	660
Terpineol	8270(3550)	1	30-130	<=50	25	330
1,2,3,5-Tetrachlorobenzene	8270(3550)	1	30-130	<=50	21	330
1,2,3-Trichlorobenzene	8270(3550)	1	30-130	<=50	39	330
1,3,5-Trichlorobenzene	8270(3550)	1	21-138	<=50	38	330

SEVERN TRENT STL

Soils, Solids, and Semisolids

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Poychlorinated Dioxins and Furans by GC/MS (low resolution SIM)						
Polychlorinated Dibenzo-p-dioxin 2,3,7,8-substituted Congeners						
2,3,7,8-TCDD	8280	18	56-140	<=40	0.066	0.50
Polychlorinated Dibenzo-p-dioxin and Dibenzofuran Classes						
tetra-CDD (MS)	8280	18	56-140	<=40	0.066	0.50
tetra-CDF (MS)	8280	18	58-163	<=40	0.13	0.50
penta-CDD (MS)	8280	18	44-184	<=40	0.085	0.50
Penta-CDF (MS)	8280	18	73-148	<=40	0.054	0.50
hexa-CDD (MS)	8280	18	38-177	<=40	0.051	0.50
hexa-CDF (MS)	8280	18	63-164	<=40	0.092	0.50
hepta-CDD (MS)	8280	18	69-137	<=50	0.12	1.0
hepta-CDF (MS)	8280	18	61-147	<=50	0.099	1.0
octa-CDD (MS)	8280	18	56-148	<=50	0.18	1.0
octa-CDF (MS)	8280	18	56-148	<=50	0.10	1.0
Internal Standards						
2,3,7,8-tetra-CDD-13C12	8280	18	25-150	NA	NA	NA
octa-CDD-13C12	8280	18	25-150	NA	NA	NA
Polyaromatic Hydrocarbons by HPLC						
Acenaphthene (MS)	8310(3550)	1	28-110	<=40	4.6	17
Acenaphthylene	8310(3550)	1	25-110	<=40	6.7	17
Anthracene	8310(3550)	1	40-140	<=40	1.3	3.3
Benzo(a)anthracene	8310(3550)	1	40-140	<=40	1.3	3.3
Benzo(b)fluoranthene	8310(3550)	1	40-140	<=40	1.5	3.3
Benzo(k)fluoranthene	8310(3550)	1	40-140	<=40	1.2	3.3
Benzo(g,h,i)perylene	8310(3550)	1	40-140	<=40	3.6	8.3
Benzo(a)pyrene	8310(3550)	1	40-140	<=40	0.97	3.3
Chrysene (MS)	8310(3550)	1	47-112	<=40	0.97	3.3
Dibenzo(a,h)anthracene	8310(3550)	1	40-140	<=40	3.0	8.3
Fluoranthene	8310(3550)	1	40-140	<=40	5.3	8.3
Fluorene (MS)	8310(3550)	1	33-110	<=40	2.8	8.3
Indeno(1,2,3-cd)pyrene	8310(3550)	1	40-140	<=40	1.3	3.3
1-Methylnaphthalene	8310(3550)	1	25-110	<=40	5.4	17
2-Methylnaphthalene	8310(3550)	1	25-110	<=40	5.9	17
Naphthalene (MS)	8310(3550)	1	26-91	<=40	6.9	17
Phenanthrene	8310(3550)	1	40-140	<=40	2.2	3.3
Pyrene (MS)	8310(3550)	1	43-124	<=40	4.0	8.3
Surrogate						
4-Terphenyl-d14	8310(3550)	1	22-134	NA	NA	NA

STL

REFERENCES AND NOTES FOR APPENDIX B

A "non-routine analyte" is an analyte that requires advance notice prior to arrival in the laboratory. In general, at least one week notice is required to ensure that the laboratory has sufficient instrument capacity, standards, and reagents to adequately process the samples.

Accuracy data are presented as recoveries for spikes or surrogates. For routine analysis of organics using SW-846 methods, percent recoveries are evaluated only on the subset spike compound lists specified by the methods unless noted in a pre-project plan or QAPP. An (MS) following the parameter name designates the routine matrix and laboratory control spike compounds. Precision data are presented as relative percent difference (% RPD) and are advisory; i.e., not used for laboratory control. Since reportable levels (above detection limit) for most of the organic parameters may not be detected in all environmental samples, precision is usually based on duplicate spike data and evaluated according to method requirements.

Accuracy and precision control limits are primarily derived from in-house laboratory data. Some accuracy and precision limits have been rounded to the nearest "5". In some cases, method limits may be used in lieu of in-house limits because in-house limits are broader than the method limits or are too broad to be usable.

ABBREVIATIONS USED IN THE APPENDIX

PARAMETER-refers to the compound, analyte, or measurement being tested or performed (the field of test)

METHOD-refers to the reference method used to measure the parameter

REF-a number designation that corresponds to the method references and citations listed below

ACC-accuracy control limits measured as percent recovery

PREC-precision measured as relative percent difference

RL-reporting limit

MDL-method detection limit

D-analyte detected (meets qualitative identification criteria)

ICP-inductively coupled (argon) plasma

ICP-inductively coupled (argon) plasma coupled to a mass spectrometer

GFAA -graphite furnace atomic absorption

CVAA - cold vapor atomic absorption

IC - ion chromatography

GC/HECD - gas chromatograph equipped with a Hall electrolytic conductivity detector

GC/PID- gas chromatograph equipped with a photoionization detector

GC/FID - gas chromatograph equipped with a flame ionization detector

GC/EC - gas chromatograph equipped with an electron capture detector

GC/NPD - gas chromatograph equipped with a nitrogen-phosphorus detector

GC/MS - gas chromatrograph equipped with a mass spectrometer

HPLC -high performance liquid chromatography

STL

REFERENCES AND NOTES FOR APPENDIX B

REF #	REFERENCE
1	Test Methods for Evaluating Solid Waste, Third Edition, SW-846 (Including Update III) USEPA Office of Solid Waste and Emergency Response, Washington, DC.
2	ASTM 3987-85: Standard Test Method for Shake Extraction of Solid Waste with Water. American Society of Testing and Materials(1992).
3	EPA 600/4-79-020:Methods for Chemical Analysis of Water and Wastes; U.S. EPA Office of Reseach and Development, Cincinnati, OH, March 1983.
4	EPA/CE-81-1 Technical Report, May 1981: Environmental Protection Agency/Corps of Engineers Technical Committee on Criteria for Dredged and Fill Material; Procedures for Handling and Chemical Analysis of Sediment and Water Samples.
5	ASTM D240-87; Standard Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter. American Society of Testing and Materials (1991)
6	Methods of Soil Analysis, American Society of Agronomy, Inc., Number 9, Part 2, page 570, (Walkley-Black Procedure).
7	Determination of Total Organic Carbon in Sediment; USEPA Region II Environmental Services Division Monitoring Management Branch; Edison, NJ.Lloyd Kahn, QA Specialist. 7/10/86
8	Methods for the Determination of Inorganic Substances in Environmental Samples, USEPA Office of Research and Development: Washington, DC August 1993, EPA/600/R-93/100.
9	Method 1664:N-Hexane Extractable Material (HEM) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM) by Extraction and Gravimetry (Oil and Grease and Total Petroleum Hydrocarbons) EPA-821-B-94-004b, April 1995.
10	Method 314.0: Determination of Perchlorate in Drinking Water Using Ion Chromatography, revision 1.0, November 1999. USEPA Office of Groundwater and Drinking Water.
11	Development of an Analytical Method of the Determination of Acid Volatile Sulfides (AVS) in Sediments; EPA Contract No. 68-03-3534, October 1990.
12	EPA/600/8-78/017: Microbiological Methods for Monitoring the Environment - Water and Wastes, December 1978.
13	Method for the Determination of Gasoline Range Organics , State of Tennessee Department of Environment and Conservation, Division of Underground Storage Tanks
14	FL-PRO Method, "Method for Determination of Petroleum Range Organics," FL DEP, Revision 1, November 1, 1995.
15	Method for the Determination of Extractable Petroleum Hydrocarbons by GC/FID ; State of Tennessee Department of Environment and Conservation. Effective May 1, 1999.
16	TNRCC Method for Total Petroleum Hydrocarbons, TNRCC Method 1005 (Revision 03, 6/1/01), State of Texas Method.
17	Method 680: Determination of Pesticides and PCBs in Water and Soils/Sediment by Gas Chromatography/Mass Spectrometry. November 1985. Physical and Chemical Methods Branch, Environmental Monitoring and Support Laboratory, Office of Research and Development, USEPA, Cincinnati, OH
18	Test Methods for Evaluating Solid Waste, Third Edition; U.S. EPA Office of Solid Waste and Emergency Response: Washington, DC,. Method 8280
19	California LUFT (Leaking Underground Fuel Tanks) Method; LUFT Manual: Guidelines for Assessment, Cleanup, and Underground Storage Tank Closure. State of California LUFT Task Force, May 1988.

SEVERN TRENT STL

TCLP Parameters (SW-846 Method 1311)

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/L)	RL (mg/L)	Reg Level (mg/L)
Metals							
Arsenic (ICP)	6010 (3010)	1	75-125	<=20	0.069	0.20	5.0
Barium (ICP)	6010 (3010)	1	75-125	<=20	0.010	1.0	100.0
Cadmium (ICP)	6010 (3010)	1	75-125	<=20	0.0055	0.10	1.0
Chromium (ICP)	6010 (3010)	1	75-125	<=20	0.0066	0.20	5.0
Lead (ICP)	6010 (3010)	1	75-125	<=20	0.011	0.20	5.0
Mercury (CVAA)	7470	1	80-120	<=20	0.0078	0.020	0.2
Selenium (ICP)	6010 (3010)	1	75-125	<=20	0.058	0.50	1.0
Silver (ICP)	6010 (3010)	1	75-125	<=20	0.020	0.10	5.0
Chlorinated Pesticides by GC/EC							
Chlordane (technical)	8081 (3520)	1	38-141	<=40	0.0045	0.025	0.03
Endrin	8081 (3520)	1	37-128	<=40	0.0049	0.0050	0.02
Lindane (gamma BHC)	8081 (3520)	1	26-119	<=40	0.0015	0.0025	0.4
Methoxychlor	8081 (3520)	1	30-163	<=40	0.0035	0.025	10.0
Heptachlor	8081 (3520)	1	21-114	<=40	0.0007	0.0025	0.008
Heptachlor Epoxide	8081 (3520)	1	43-118	<=40	0.00013	0.0025	0.008
Toxaphene	8081 (3520)	1	39-137	<=40	0.038	0.25	0.5
Surogates							
Decachlorobiphenyl (DCB)	8081 (3520)	1	30-150	NA	NA	NA	
Tetrachloro-m-xylene (TCMX)	8081 (3520)	1	30-150	NA	NA	NA	
Chlorinated Herbicides by GC/EC							
2,4-D	8151	1	33-156	<=40	0.0065	0.025	10.0
2,4,5-TP (Silvex)	8151	1	48-135	<=40	0.0027	0.025	1.0
Surrogate							
DCAA	8151	1	35-134	NA	NA	NA	
Volatiles by GC/MS							
Benzene	8260 (5030)	1	69-128	<=30	0.0019	0.020	0.5
Carbon tetrachloride	8260 (5030)	1	67-136	<=30	0.0096	0.020	0.5
Chlorobenzene	8260 (5030)	1	72-126	<=30	0.0020	0.020	100.0
Chloroform	8260 (5030)	1	72-124	<=30	0.0024	0.020	6.0
1,2-Dichloroethane	8260 (5030)	1	61-143	<=30	0.0036	0.020	0.5
1,1-Dichloroethylene	8260 (5030)	1	57-132	<=30	0.0062	0.020	0.7
Methyl ethyl ketone (MEK)	8260 (5030)	1	38-153	<=30	0.010	0.10	200.0
Trichloroethylene	8260 (5030)	1	70-123	<=30	0.0086	0.020	0.5
Tetrachloroethylene	8260 (5030)	1	71-129	<=30	0.0026	0.020	0.7
Vinyl chloride	8260 (5030)	1	50-142	<=50	0.0026	0.040	0.2
Surrogates							
p-Bromofluorobenzene	8260 (5030)	1	70-119	NA	NA	NA	
Dibromofluoromethane	8260 (5030)	1	68-129	NA	NA	NA	
Toluene-d8	8260 (5030)	1	74-122	NA	NA	NA	

SEVERN TRENT STL

TCLP Parameters (SW-846 Method 1311)

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/L)	RL (mg/L)	Reg Level (mg/L)
Semivolatiles (Base-Neutrals/Acids) GC/MS							
Cresols	8270 (3520)	1	40-116	<=40	0.0080	0.050	200.0
1,4-Dichlorobenzene	8270 (3520)	1	36-91	<=40	0.0050	0.050	7.5
2,4-Dinitrotoluene	8270 (3520)	1	44-129	<=40	0.0055	0.050	0.13
Hexachloroethane	8270 (3520)	1	27-93	<=40	0.0035	0.050	3.0
Hexachlorobenzene	8270 (3520)	1	39-125	<=40	0.0031	0.050	0.13
Hexachlorobutadiene	8270 (3520)	1	35-106	<=40	0.0025	0.050	0.5
Nitrobenzene	8270 (3520)	1	49-107	<=40	0.0050	0.050	2.0
Pentachlorophenol	8270 (3520)	1	49-126	<=40	0.010	0.25	100.0
Pyridine	8270 (3520)	1	10-178	<=40	0.013	0.25	5.0
2,4,5-Trichlorophenol	8270 (3520)	1	51-118	<=40	0.0055	0.050	400.0
2,4,6-Trichlorophenol	8270 (3520)	1	50-117	<=40	0.0055	0.050	2.0
Surrogates							
2-Fluorobiphenyl	8270 (3520)	1	55-116	NA	NA	NA	
2-Fluorophenol	8270 (3520)	1	43-114	NA	NA	NA	
Nitrobenzene-d5	8270 (3520)	1	51-115	NA	NA	NA	
Phenol-d5	8270 (3520)	1	46-112	NA	NA	NA	
p-Terphenyl-d14	8270 (3520)	1	11-120	NA	NA	NA	
2,4,6-Tribromophenol	8270 (3520)	1	47-133	NA	NA	NA	

NOTE: Appendix C lists the routine TCLP analytes. Leachates are routinely diluted prior to preparation and/or analysis since the TCLP regulatory threshold limts (Reg Level) can be met using a diluted sample. If additional analytes are requested, the RL for aqueous samples (Appendix A) is reported with the approporiate dilution factor applied. The TCLP leaching fluid and extraction procedure may contribute background levels of some analytes when non-routine methods and non-routine analytes are performed on TCLP leachates. For example, TCLP extraction fluid #2 is prepared with a sodium acetate buffer that will contribute significant concentrations of sodium. Calcium and boron have been detected in the TCLP filters.

REF #	REFERENCE
1	Test Methods for Evaluating Solid Waste, Third Edition, SW-846 (including Update III) USEPA Office of Solid Waste and Emergency Response, Washington, DC.

SEVERN TRENT STL

Air Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug)	RL (ug)
Chlorinated Pesticides and PCBs by GC/EC						
Aldrin	TO4/TO10	1	30-130	<=40	0.0041	0.050
alpha-BHC	TO4/TO10	1	30-130	<=40	0.0022	0.050
beta-BHC	TO4/TO10	1	30-130	<=40	0.0053	0.050
gamma-BHC (Lindane)	TO4/TO10	1	30-130	<=40	0.0019	0.050
delta-BHC	TO4/TO10	1	30-130	<=40	0.0019	0.050
Technical Chlordane	TO4/TO10	1	30-130	<=40	0.061	0.50
alpha Chlordane	TO4/TO10	1	30-130	<=40	0.0028	0.050
gamma Chlordane	TO4/TO10	1	30-130	<=40	0.0026	0.050
4,4'-DDD	TO4/TO10	1	30-130	<=40	0.006	0.10
4,4'-DDE	TO4/TO10	1	30-130	<=40	0.0069	0.10
4,4'-DDT	TO4/TO10	1	30-130	<=40	0.0074	0.10
Dieldrin	TO4/TO10	1	30-130	<=40	0.0023	0.10
Endosulfan I	TO4/TO10	1	30-130	<=40	0.0027	0.050
Endosulfan II	TO4/TO10	1	30-130	<=40	0.0037	0.10
Endosulfan sulfate	TO4/TO10	1	30-130	<=40	0.0053	0.10
Endrin	TO4/TO10	1	30-130	<=40	0.0085	0.10
Endrin aldehyde	TO4/TO10	1	30-130	<=40	0.0079	0.10
Endrin ketone	TO4/TO10	1	30-130	<=40	0.011	0.10
Heptachlor	TO4/TO10	1	30-130	<=40	0.0025	0.050
Heptachlor epoxide	TO4/TO10	1	30-130	<=40	0.0085	0.050
Methoxychlor	TO4/TO10	1	30-130	<=40	0.032	0.50
Toxaphene	TO4/TO10	1	30-130	<=40	0.55	5.0
PCB-1016	TO4/TO10	1	30-130	<=40	0.15	1.0
PCB 1221	TO4/TO10	1	30-130	<=40	0.27	1.0
PCB 1232	TO4/TO10	1	30-130	<=40	0.21	1.0
PCB-1242	TO4/TO10	1	30-130	<=40	0.25	1.0
PCB-1248	TO4/TO10	1	30-130	<=40	0.18	1.0
PCB-1254	TO4/TO10	1	30-130	<=40	0.11	1.0
PCB-1260	TO4/TO10	1	30-130	<=40	0.12	1.0
Surrogates						
Tetrachloro-m-xylene(TCMX)	TO4/TO10	1	10-114	NA	NA	NA
Decachlorobiphenyl (DCB)	TO4/TO10	1	27-128	NA	NA	NA

SEVERN TRENT STL

Air Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug)	RL (ug)
Semivolatiles (Polyaromatic Hydrocarbons) by GC/MS						
Acenaphthene	TO13	1	40-140	<=40	4.4	10
Acenaphthylene	TO13	1	40-140	<=40	4.1	10
Anthracene	TO13	1	40-140	<=40	3.8	10
Benzo(a)anthracene	TO13	1	40-140	<=40	2.7	10
Benzo(b)fluoranthene	TO13	1	40-140	<=40	3	10
Benzo(k)fluoranthene	TO13	1	40-140	<=40	4.9	10
Benzo(a)pyrene	TO13	1	40-140	<=40	2.9	10
Benzo(g,h,i)perylene	TO13	1	40-140	<=40	2.2	10
Chrysene	TO13	1	40-140	<=40	2.4	10
Dibenz(a,h)anthracene	TO13	1	40-140	<=40	2.4	10
Fluoranthene	TO13	1	40-140	<=40	3.8	10
Fluorene	TO13	1	40-140	<=40	5.1	10
Indeno(1,2,3-cd)pyrene	TO13	1	40-140	<=40	2.6	10
2-Methyl naphthalene	TO13	1	40-140	<=40	8	10
Naphthalene	TO13	1	40-140	<=40	6.5	10
Phenanthrene	TO13	1	40-140	<=40	3.6	10
Pyrene	TO13	1	40-140	<=40	3.7	10
Surrogates						
Nitribenzene-d5	TO13	1	40-140	NA	NA	NA
2-Flurobiphenyl	TO13	1	40-140	NA	NA	NA
Terphenyl-d14	TO13	1	10-140	NA	NA	NA

SEVERN TRENT STL

Air Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/m3)	RL (mg/m3)
Volatile Organic Compounds Collected in Tedlar Bags or Canisters						
Benzene	EPA 18/SW-0040	2/3	60-140	<=30	0.36	1.0
Bromobenzene	EPA 18/SW-0040	2/3	60-140	<=30	0.29	1.0
Bromochloromethane	EPA 18/SW-0040	2/3	60-140	<=30	0.28	1.0
Bromodichloromethane	EPA 18/SW-0040	2/3	60-140	<=30	0.3	1.0
Bromoform	EPA 18/SW-0040	2/3	60-140	<=30	0.4	1.0
Bromomethane	EPA 18/SW-0040	2/3	60-140	<=30	0.72	2.0
2-Butanone (MEK)	EPA 18/SW-0040	2/3	60-140	<=30	5.1	10
n-Butylbenzene	EPA 18/SW-0040	2/3	60-140	<=30	0.48	1.0
sec-Butylbenzene	EPA 18/SW-0040	2/3	60-140	<=30	0.24	1.0
tert-Butylbenzene	EPA 18/SW-0040	2/3	60-140	<=30	0.32	1.0
Carbon disulfide	EPA 18/SW-0040	2/3	60-140	<=30	0.9	1.0
Carbon tetrachloride	EPA 18/SW-0040	2/3	60-140	<=30	0.29	1.0
Chlorobenzene	EPA 18/SW-0040	2/3	60-140	<=30	0.34	1.0
Chloroethane	EPA 18/SW-0040	2/3	60-140	<=30	0.44	2.0
Chloroform	EPA 18/SW-0040	2/3	60-140	<=30	0.28	1.0
Chloromethane	EPA 18/SW-0040	2/3	60-140	<=30	1.2	2.0
2-Chlorotoluene	EPA 18/SW-0040	2/3	60-140	<=30	0.23	1.0
4-Chlorotoluene	EPA 18/SW-0040	2/3	60-140	<=30	0.29	1.0
Dibromochloromethane	EPA 18/SW-0040	2/3	60-140	<=30	0.38	1.0
1,2-Dibromo-3-chloropropane	EPA 18/SW-0040	2/3	60-140	<=30	0.46	2.0
1,2-Dibromoethane(EDB)	EPA 18/SW-0040	2/3	60-140	<=30	0.18	1.0
Dibromomethane	EPA 18/SW-0040	2/3	60-140	<=30	0.28	1.0
1,2-Dichlorobenzene	EPA 18/SW-0040	2/3	60-140	<=30	0.35	1.0
1,3-Dichlorobenzene	EPA 18/SW-0040	2/3	60-140	<=30	0.35	1.0
1,4-Dichlorobenzene	EPA 18/SW-0040	2/3	60-140	<=30	0.37	1.0
1,1-Dichloroethane	EPA 18/SW-0040	2/3	60-140	<=30	0.24	1.0
1,2-Dichloroethane	EPA 18/SW-0040	2/3	60-140	<=30	0.42	1.0
1,1-Dichloroethene	EPA 18/SW-0040	2/3	60-140	<=30	0.18	1.0
Cis-1,2-Dichloroethene	EPA 18/SW-0040	2/3	60-140	<=30	0.35	1.0
Trans-1,2-Dichloroethene	EPA 18/SW-0040	2/3	60-140	<=30	0.18	1.0
1,2-Dichloropropane	EPA 18/SW-0040	2/3	60-140	<=30	0.29	1.0
1,3-Dichloropropane	EPA 18/SW-0040	2/3	60-140	<=30	0.25	1.0
2,2-Dichloropropane	EPA 18/SW-0040	2/3	60-140	<=30	0.5	1.0
1,1-Dichloropropene	EPA 18/SW-0040	2/3	60-140	<=30	0.11	1.0
Cis-1,3-Dichloropropene	EPA 18/SW-0040	2/3	60-140	<=30	0.18	1.0
Trans-1,3-Dichloropropene	EPA 18/SW-0040	2/3	60-140	<=30	0.27	1.0
Ethylbenzene	EPA 18/SW-0040	2/3	60-140	<=30	0.16	1.0
Isopropylbenzene	EPA 18/SW-0040	2/3	60-140	<=30	0.16	1.0
p-Isopropyltoluene	EPA 18/SW-0040	2/3	60-140	<=30	0.29	1.0
Methyl t-butyl ether (MTBE)	EPA 18/SW-0040	2/3	60-140	<=30	0.24	1.0
Methylene chloride (Dichloromethane)	EPA 18/SW-0040	2/3	60-140	<=30	0.46	1.0
n-Propylbenzene	EPA 18/SW-0040	2/3	60-140	<=30	0.19	1.0
Styrene	EPA 18/SW-0040	2/3	60-140	<=30	0.31	1.0

SEVERN TRENT STL

Air Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/m3)	RL (mg/m3)
Tetrachloroethene	EPA 18/SW-0040	2/3	60-140	<=30	0.48	1.0
Toluene	EPA 18/SW-0040	2/3	60-140	<=30	0.47	1.0
1,1,2,2-Tetrachloroethane	EPA 18/SW-0040	2/3	60-140	<=30	0.32	1.0
1,1,1-Trichloroethane	EPA 18/SW-0040	2/3	60-140	<=30	0.28	1.0
1,1,2-Trichloroethane	EPA 18/SW-0040	2/3	60-140	<=30	0.45	1.0
Trichloroethene	EPA 18/SW-0040	2/3	60-140	<=30	0.43	1.0
Trichlorofluoromethane	EPA 18/SW-0040	2/3	60-140	<=30	0.45	2.0
1,2,3-Trichloropropane	EPA 18/SW-0040	2/3	60-140	<=30	0.2	2.0
1,2,4-Trimethylbenzene	EPA 18/SW-0040	2/3	60-140	<=30	0.32	1.0
1,3,5-Trimethylbenzene	EPA 18/SW-0040	2/3	60-140	<=30	0.21	1.0
Vinyl Acetate	EPA 18/SW-0040	2/3	60-140	<=30	0.54	2.0
Vinyl chloride	EPA 18/SW-0040	2/3	60-140	<=30	0.38	2.0
m&p-Xylene	EPA 18/SW-0040	2/3	60-140	<=30	0.3	1.0
o-Xylene	EPA 18/SW-0040	2/3	60-140	<=30	0.36	1.0
Total hydrocarbons, gasoline range	EPA 18/SW-0040	2/3	60-140	<=30	5	10
Permanent Gases and Light Hydrocarbons						
Nitrogen	EPA 18/SW-0040	2/3	60-140	<=30	10000	10000
Oxygen	EPA 18/SW-0040	2/3	60-140	<=30	10000	10000
Carbon dioxide	EPA 18/SW-0040	2/3	60-140	<=30	10000	10000
Carbon monoxide	EPA 18/SW-0040	2/3	60-140	<=30	100	570
Methane(TCD)	EPA 18/SW-0040	2/3	60-140	<=30	100	330
Methane (FID)	EPA 18/SW-0040	2/3	60-140	<=30	1.5	5.0
Ethane(TCD)	EPA 18/SW-0040	2/3	60-140	<=30	150	610
Ethane (FID)	EPA 18/SW-0040	2/3	60-140	<=30	1.5	5.0
Ethene (TCD)	EPA 18/SW-0040	2/3	60-140	<=30	150	670
Ethene (FID)	EPA 18/SW-0040	2/3	60-140	<=30	1.5	5.0

REFERENCES AND NOTES FOR APPENDIX D

A "non-routine analyte" is an analyte that requires advance notice prior to arrival in the laboratory. In general, at least one week notice is required to ensure that the laboratory has sufficient instrument capacity, standards, and reagents to adequately process the samples.

Accuracy data are presented as recoveries for spikes or surrogates. For routine analysis of organics using SW-846 methods, percent recoveries are evaluated only on the subset spike compound lists specified by the methods unless noted in a pre-project plan or QAPP. An (MS) following the parameter name designates the routine matrix and laboratory control spike compounds. Precision data are presented as relative percent difference (% RPD) and are advisory; i.e., not used for laboratory control. Since reportable levels (above detection limit) for most of the organic parameters may not be detected in all environmental samples, precision is usually based on duplicate spike data and evaluated according to method requirements.

ABBREVIATIONS USED IN THE APPENDIX

PARAMETER-refers to the compound, analyte, or measurement being tested or performed (the field of test)

METHOD-refers to the reference method used to measure the parameter

REF-a number designation that corresponds to the method references and citations listed below

ACC-accuracy control limits measured as percent recovery

PREC-precision measured as relative percent difference

RL-reporting limit

MDL-method detection limit

REF #	REFERENCE
1	Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air (Rev 6/88).
2	Method 18: Measurement of Gaseous Organic Compound Emissions by Gas Chromatography, Section 3.16. U.S. EPA Quality Assurance Handbook for Air Pollution Measurement Systems: Volume III. Stationary Sources Specific Methods. EPA/600/4-77/0276, August, 1988.
3	Test Methods for Evaluating Solid Waste, Third Edition, SW-846 (including Update III) USEPA Office of Solid Waste and Emergency Response, Washington, DC.

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SEVERN TRENT STL

Biological Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/kg)	RL (mg/kg)
Metals						
Aluminum (ICP)	6010(3050)	1/2	75-125	<=20	1.4	20
Aluminum (ICP/MS)	6020(3050)	1/2	75-125	<=20	2.0	10
Antimony (ICP)	6010(3050)	1/2	75-125	<=20	0.66	2.0
Antimony (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.018	0.50
Antimony (GFAA)	7041(3050)	1/2	80-120	<=20	0.21	1.0
Arsenic (ICP)	6010(3050)	1/2	75-125	<=20	0.74	1.0
Arsenic (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.16	1.0
Arsenic (GFAA)	7060(3050)	1/2	80-120	<=20	0.12	1.0
Barium (ICP)	6010(3050)	1/2	75-125	<=20	0.10	1.0
Barium (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.048	1.0
Beryllium (ICP)	6010(3050)	1/2	75-125	<=20	0.040	0.40
Beryllium (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.0093	0.10
Cadmium (ICP)	6010(3050)	1/2	75-125	<=20	0.056	0.50
Cadmium (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.034	0.50
Cadmium (GFAA)	7131 (3050)	1/2	80-120	<=20	0.012	0.10
Calcium (ICP)	6010(3050)	1/2	75-125	<=20	5.0	50
Calcium (ICP/MS)	6020(3050)	1/2	75-125	<=20	2.3	50
Chromium (ICP)	6010(3050)	1/2	75-125	<=20	0.11	1.0
Chromium (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.074	1.0
Chromium (GFAA)	7191(3050)	1/2	80-120	<=20	0.059	1.0
Cobalt (ICP)	6010 (3050)	1/2	75-125	<=20	0.16	1.0
Cobalt (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.0043	1.0
Copper (ICP)	6010 (3050)	1/2	75-125	<=20	0.20	2.0
Copper (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.037	1.0
Copper (GFAA)	7211(3050)	1/2	80-120	<=20	0.085	1.0
Iron (ICP)	6010 (3050)	1/2	75-125	<=20	1.6	5.0
Iron (ICP/MS)	6020(3050)	1/2	75-125	<=20	1.3	5.0
Lead (ICP)	6010 (3050)	1/2	75-125	<=20	0.34	0.50
Lead (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.015	0.30
Lead (GFAA)	7421(3050)	1/2	80-120	<=20	0.062	0.50
Magnesium (ICP)	6010 (3050)	1/2	75-125	<=20	5.0	50
Magnesium (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.43	50
Manganese (ICP)	6010(3050)	1/2	75-125	<=20	0.10	1.0
Manganese (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.0059	1.0
Mercury (CVAA)	7471	1/2	80-120	<=20	0.0043	0.020
Molybdenum (ICP)	6010(3050)	1/2	75-125	<=20	0.35	1.0
Molybdenum (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.012	1.0
Nickel (ICP)	6010(3050)	1/2	75-125	<=20	0.24	4.0
Nickel (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.030	1.0
Potassium (ICP)	6010(3050)	1/2	75-125	<=20	10	100
Potassium (ICP/MS)	6020(3050)	1/2	75-125	<=20	2.7	50
Selenium (ICP)	6010(3050)	1/2	75-125	<=20	0.78	1.0
Selenium (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.058	0.50
Selenium (GFAA)	7740(3050)	1/2	80-120	<=20	0.13	1.0
Silver (ICP)	6010(3050)	1/2	75-125	<=20	0.12	1.0
Silver (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.011	1.0
Silver (GFAA)	7761 (3050)	1/2	80-120	<=20	0.011	0.10

SEVERN TRENT STL

Biological Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/kg)	RL (mg/kg)
Sodium (ICP)	6010(3050)	1/2	75-125	<=20	17	50
Sodium (ICP/MS)	6020(3050)	1/2	75-125	<=20	2.3	50
Strontium(ICP)	6010(3050)	1/2	75-125	<=20	0.10	1.0
Strontium(ICP/MS)	6020(3050)	1/2	75-125	<=20	0.082	1.0
Thallium (ICP)	6010(3050)	1/2	75-125	<=20	0.93	1.0
Thallium (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.019	0.20
Thallium (GFAA)	7841 (3050)	1/2	80-120	<=20	0.051	1.0
Tin (ICP)	6010(3050)	1/2	75-125	<=20	0.84	5.0
Tin (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.06	1.0
Titanium(ICP)	6010(3050)	1/2	70-130	<=20	0.10	1.0
Titanium(ICP/MS)	6020(3050)	1/2	75-125	<=20	0.29	1.0
Vanadium (ICP)	6010 (3050)	1/2	75-125	<=20	0.12	1.0
Vanadium (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.11	1.0
Zinc (ICP)	6010 (3050)	1/2	75-125	<=20	0.13	2.0
Zinc (ICP/MS)	6020(3050)	1/2	75-125	<=20	0.48	2.0
RL and MDL are based on soil values with a final digest volume of 100mL per gram of sample.						
Cyanide, total	9012	1	75-125	<=30	0.25	0.50
Cyanide, total extractable	9012(9013)	1	75-125	<=30	0.25	0.50

SEVERN TRENT STL

Biological Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Chlorinated Pesticides by GC/EC						
Aldrin (MS)	8081(3550)	1/2	34-124	<=50	0.33	5.0
alpha-BHC	8081(3550)	1/2	22-125	<=50	0.72	5.0
beta-BHC	8081(3550)	1/2	36-144	<=50	0.87	5.0
gamma-BHC (Lindane) (MS)	8081(3550)	1/2	35-132	<=50	0.45	5.0
delta-BHC	8081(3550)	1/2	32-140	<=50	0.36	5.0
Technical Chlordane	8081(3550)	1/2	41-177	<=50	9.9	50
alpha Chlordane	8081(3550)	1/2	40-139	<=50	0.33	5.0
gamma Chlordane	8081(3550)	1/2	39-143	<=50	0.39	5.0
4,4'-DDD	8081(3550)	1/2	37-149	<=50	1.1	10
4,4'-DDE	8081(3550)	1/2	33-139	<=50	1.6	10
4,4'-DDT (MS)	8081(3550)	1/2	46-156	<=50	0.93	10
Dieldrin (MS)	8081(3550)	1/2	40-133	<=50	0.93	10
Endosulfan I	8081(3550)	1/2	31-133	<=50	0.51	5.0
Endosulfan II	8081(3550)	1/2	34-150	<=50	0.66	10
Endosulfan sulfate	8081(3550)	1/2	45-163	<=50	1.3	10
Endrin (MS)	8081(3550)	1/2	42-137	<=50	1.3	10
Endrin aldehyde	8081(3550)	1/2	37-152	<=50	0.93	10
Endrin ketone	8081(3550)	1/2	44-165	<=50	1.1	10
Heptachlor (MS)	8081(3550)	1/2	31-142	<=50	0.84	5.0
Heptachlor epoxide	8081(3550)	1/2	29-133	<=50	0.51	5.0
Methoxychlor	8081(3550)	1/2	37-185	<=50	0.60	50
Toxaphene	8081(3550)	1/2	36-159	<=50	99	500
Surrogates						
Tetrachloro-m-xylene	8081(3550)	1/2	30-150	NA	NA	NA
Decachlorobiphenyl	8081(3550)	1/2	30-150	NA	NA	NA
RL and MDL are based on soil values with a final extract volume of 10mL per 10gram of sample.						

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Biological Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Polychlorinated Biphenyls as Aroclors by GC/EC						
PCB-1016	8082(3550)	1/2	24-132	<=50	12	100
PCB 1221	8082(3550)	1/2	30-130	<=50	51	200
PCB 1232	8082(3550)	1/2	30-130	<=50	20	100
PCB-1242	8082(3550)	1/2	30-130	<=50	20	100
PCB-1248	8082(3550)	1/2	30-150	<=50	20	100
PCB-1254	8082(3550)	1/2	30-150	<=50	20	100
PCB-1260	8082(3550)	1/2	28-153	<=50	13	100
PCB-1268	8082(3550)	1/2	30-150	<=50	7.2	100
Surrogates						
2,4,5,6-Tetrachloro-m-xylene	8082(3550)	1/2	30-150	NA	NA	NA
Decachlorobiphenyl	8082(3550)	1/2	30-150	NA	NA	NA
RL and MDL are based on soil values with a final extract volume of 10mL per 10gram of sample.						
Polychlorinated Biphenyls Congener Homologs by GC/MS (SIM)						
Monochlorobiphenyls	680/(3550)	3/2	30-130	<=50	1.5	10
Dichlorobiphenyls	680/(3550)	3/2	30-130	<=50	1.5	10
Trichlorobiphenyls	680/(3550)	3/2	30-130	<=50	1.3	10
Tetrachlorobiphenyls	680/(3550)	3/2	40-140	<=50	2.9	20
Pentachlorobiphenyls	680/(3550)	3/2	40-140	<=50	2.2	20
Hexachlorobiphenyls	680/(3550)	3/2	40-140	<=50	2.0	20
Heptachlorobiphenyls	680/(3550)	3/2	40-140	<=50	3.6	30
Octachlorobiphenyls	680/(3550)	3/2	40-140	<=50	3.6	30
Nonachlorobiphenyls	680/(3550)	3/2	30-130	<=50	4.5	50
Decachlorobiphenyl	680/(3550)	3/2	30-130	<=50	4.5	50
Surrogate						
Decachlorobiphenyl-13C12	680/(3550)	3/2	30-130	NA	NA	NA
RL and MDL are based on soil values with a final extract volume of 1.0mL per 10gram of sample.						

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Biological Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Volatiles by GC/MS						
Acetone	8260(5035)	1/2	30-195	<=100	5.0	50
Acetone	8260(5035ext)	1/2	30-195	<=100	510	2000
Benzene (MS)	8260(5035)	1/2	65-130	<=50	0.38	5.0
Benzene (MS)	8260(5035ext)	1/2	65-130	<=50	46	200
Bromodichloromethane	8260(5035)	1/2	71-120	<=50	0.31	5.0
Bromodichloromethane	8260(5035ext)	1/2	71-120	<=50	86	200
Bromoform	8260(5035)	1/2	58-134	<=50	0.68	5.0
Bromoform	8260(5035ext)	1/2	58-134	<=50	45	200
Bromomethane	8260(5035)	1/2	22-184	<=100	0.57	5.0
Bromomethane	8260(5035ext)	1/2	22-184	<=100	100	200
2-Butanone (Methyl Ethyl Ketone-MEK)	8260(5035)	1/2	30-185	<=50	0.28	25
2-Butanone (Methyl Ethyl Ketone-MEK)	8260(5035ext)	1/2	30-185	<=50	170	1000
Carbon disulfide	8260(5035)	1/2	43-143	<=50	0.40	5.0
Carbon disulfide	8260(5035ext)	1/2	43-143	<=50	78	200
Carbon tetrachloride	8260(5035)	1/2	66-128	<=50	0.35	5.0
Carbon tetrachloride	8260(5035ext)	1/2	66-128	<=50	120	200
Chlorobenzene (MS)	8260(5035)	1/2	69-128	<=50	0.74	5.0
Chlorobenzene (MS)	8260(5035ext)	1/2	69-128	<=50	62	200
Chloroethane	8260(5035)	1/2	46-152	<=100	0.57	5.0
Chloroethane	8260(5035ext)	1/2	46-152	<=100	100	200
Chloroform	8260(5035)	1/2	70-124	<=50	0.44	5.0
Chloroform	8260(5035ext)	1/2	70-124	<=50	39	200
Chloromethane	8260(5035)	1/2	42-143	<=100	1.4	5.0
Chloromethane	8260(5035ext)	1/2	42-143	<=100	100	200
Dibromochloromethane	8260(5035)	1/2	70-124	<=50	0.39	5.0
Dibromochloromethane	8260(5035ext)	1/2	70-124	<=50	66	200
1,1-Dichloroethane	8260(5035)	1/2	34-166	<=50	0.80	5.0
1,1-Dichloroethane	8260(5035ext)	1/2	34-166	<=50	35	200
1,2-Dichloroethane	8260(5035)	1/2	39-158	<=50	0.66	5.0
1,2-Dichloroethane	8260(5035ext)	1/2	39-158	<=50	100	200
cis-1,2-Dichloroethene	8260(5035)	1/2	33-150	<=50	0.39	5.0
cis-1,2-Dichloroethene	8260(5035ext)	1/2	33-150	<=50	58	200
trans-1,2-Dichloroethene	8260(5035)	1/2	23-159	<=50	0.80	5.0
trans-1,2-Dichloroethene	8260(5035ext)	1/2	23-159	<=50	52	200
1,1-Dichloroethene (MS)	8260(5035)	1/2	46-142	<=50	0.58	5.0
1,1-Dichloroethene (MS)	8260(5035ext)	1/2	46-142	<=50	82	200
1,2-Dichloropropane	8260(5035)	1/2	72-118	<=50	0.65	5.0
1,2-Dichloropropane	8260(5035ext)	1/2	72-118	<=50	96	200
cis-1,3-Dichloropropene	8260(5035)	1/2	71-123	<=50	0.70	5.0
cis-1,3-Dichloropropene	8260(5035ext)	1/2	71-123	<=50	100	200
trans-1,3-Dichloropropene	8260(5035)	1/2	66-128	<=50	1.0	5.0
trans-1,3-Dichloropropene	8260(5035ext)	1/2	66-128	<=50	59	200
Ethylbenzene	8260(5035)	1/2	71-120	<=50	0.30	5.0
Ethylbenzene	8260(5035ext)	1/2	71-120	<=50	50	200
2-Hexanone	8260(5035)	1/2	46-163	<=50	0.43	25
2-Hexanone	8260(5035ext)	1/2	46-163	<=50	500	1000
Methylene chloride	8260(5035)	1/2	29-153	<=100	0.54	5.0
Methylene chloride	8260(5035ext)	1/2	29-153	<=100	51	200
4-Methyl-2-pentanone (MIBK)	8260(5035)	1/2	47-160	<=50	0.38	25
4-Methyl-2-pentanone (MIBK)	8260(5035ext)	1/2	47-160	<=50	140	1000
Styrene	8260(5035)	1/2	73-121	<=50	0.53	5.0
Styrene	8260(5035ext)	1/2	73-121	<=50	130	200
1,1,2,2-Tetrachloroethane	8260(5035)	1/2	59-138	<=50	0.57	5.0

SEVERN TRENT STL

Biological Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
1,1,2,2-Tetrachloroethane	8260(5035ext)	1/2	59-138	<=50	79	200
Tetrachloroethene	8260(5035)	1/2	64-134	<=50	0.98	5.0
Tetrachloroethene	8260(5035ext)	1/2	64-134	<=50	89	200
Toluene (MS)	8260(5035)	1/2	63-133	<=50	0.65	5.0
Toluene (MS)	8260(5035ext)	1/2	63-133	<=50	63	200
1,1,1-Trichloroethane	8260(5035)	1/2	70-123	<=50	0.54	5.0
1,1,1-Trichloroethane	8260(5035ext)	1/2	70-123	<=50	110	200
1,1,2-Trichloroethane	8260(5035)	1/2	66-127	<=50	0.97	5.0
1,1,2-Trichloroethane	8260(5035ext)	1/2	66-127	<=50	41	200
Trichloroethene (MS)	8260(5035)	1/2	64-126	<=50	0.77	5.0
Trichloroethene (MS)	8260(5035ext)	1/2	64-126	<=50	100	200
Vinyl chloride	8260(5035)	1/2	38-151	<=100	1.5	5.0
Vinyl chloride	8260(5035ext)	1/2	38-151	<=100	100	200
Xylenes (total)	8260(5035)	1/2	74-122	<=50	0.97	10
Xylenes (total)	8260(5035ext)	1/2	74-122	<=50	140	400
o-Xylene	8260(5035)	1/2	74-122	<=50	0.31	5.0
o-Xylene	8260(5035ext)	1/2	74-122	<=50	56	200
m+p-Xylene	8260(5035)	1/2	74-121	<=50	2.3	5.0
m+p-Xylene	8260(5035ext)	1/2	74-121	<=50	96	200
Surrogates						
p-Bromofluorobenzene	8260(5035)	1/2	68-121	NA	NA	NA
p-Bromofluorobenzene	8260(5035ext)	1/2	68-121	NA	NA	NA
Dibromofluoromethane	8260(5035)	1/2	66-127	NA	NA	NA
Dibromofluoromethane	8260(5035ext)	1/2	66-127	NA	NA	NA
Toluene-d8	8260(5035)	1/2	65-128	NA	NA	NA
Toluene-d8	8260(5035ext)	1/2	65-128	NA	NA	NA
(ext) = methanol extraction; 1mL methanol per gram of sample and analysis of 25uL (0.025mL) of extract.						

SEVERN TRENT STL

Biological Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Semivolatiles (Base-Neutrals/Acids) by GC/MS						
Acenaphthene (MS)	8270(3550)	1/2	39-104	<=50	100	1000
Acenaphthylene	8270(3550)	1/2	37-112	<=50	75	1000
Anthracene	8270(3550)	1/2	34-120	<=50	96	1000
Benzo(a)anthracene	8270(3550)	1/2	28-134	<=50	110	1000
Benzo(b)fluoranthene	8270(3550)	1/2	29-128	<=50	99	1000
Benzo(k)fluoranthene	8270(3550)	1/2	25-127	<=50	39	1000
Benzo(g,h,i)perylene	8270(3550)	1/2	33-122	<=50	69	1000
Benzo(a)pyrene	8270(3550)	1/2	30-128	<=50	96	1000
Benzyl alcohol	8270(3550)	1/2	21-110	<=50	110	1000
Bis(2-chloroethoxy) methane	8270(3550)	1/2	34-102	<=50	96	1000
Bis(2-chloroethyl) ether	8270(3550)	1/2	27-96	<=50	110	1000
Bis(2-chloroisopropyl) ether	8270(3550)	1/2	30-94	<=50	96	1000
Bis(2-ethylhexyl) phthalate	8270(3550)	1/2	39-122	<=50	130	1000
4-Bromophenyl phenyl ether	8270(3550)	1/2	33-94	<=50	90	1000
Butyl benzyl phthalate	8270(3550)	1/2	44-121	<=50	96	1000
4-Chloroaniline	8270(3550)	1/2	18-94	<=50	87	2000
4-Chloro-3-methylphenol (MS)	8270(3550)	1/2	22-124	<=50	120	1000
2-Chloronaphthalene	8270(3550)	1/2	42-96	<=50	110	1000
2-Chlorophenol (MS)	8270(3550)	1/2	22-109	<=50	120	1000
4-Chlorophenylphenyl ether	8270(3550)	1/2	38-101	<=50	78	1000
Chrysene	8270(3550)	1/2	35-130	<=50	93	1000
Dibenz(a,h)anthracene	8270(3550)	1/2	29-126	<=50	93	1000
Dibenzofuran	8270(3550)	1/2	34-112	<=50	100	1000
Di-n-butylphthalate	8270(3550)	1/2	39-116	<=50	120	1000
1,2-Dichlorobenzene	8270(3550)	1/2	31-86	<=50	69	1000
1,3-Dichlorobenzene	8270(3550)	1/2	33-81	<=50	69	1000
1,4-Dichlorobenzene (MS)	8270(3550)	1/2	25-93	<=50	72	1000
3,3'-Dichlorobenzidine	8270(3550)	1/2	10-98	<=50	78	2000
2,4-Dichlorophenol	8270(3550)	1/2	37-103	<=50	87	1000
Diethylphthalate	8270(3550)	1/2	37-112	<=50	100	1000
2,4-Dimethylphenol	8270(3550)	1/2	45-99	<=50	84	1000
Dimethylphthalate	8270(3550)	1/2	40-106	<=50	100	1000
4,6-Dinitro-2-methylphenol	8270(3550)	1/2	24-128	<=50	93	5000
2,4-Dinitrophenol	8270(3550)	1/2	19-126	<=50	1000	5000
2,4-Dinitrotoluene (MS)	8270(3550)	1/2	18-125	<=50	66	1000
2,6-Dinitrotoluene	8270(3550)	1/2	42-109	<=50	87	1000
Di-n-octylphthalate	8270(3550)	1/2	38-126	<=50	96	1000
Fluoranthene	8270(3550)	1/2	18-137	<=50	90	1000
Fluorene	8270(3550)	1/2	35-112	<=50	66	1000
Hexachlorobenzene	8270(3550)	1/2	34-103	<=50	110	1000
Hexachlorobutadiene	8270(3550)	1/2	35-98	<=50	81	1000
Hexachlorocyclopentadiene	8270(3550)	1/2	19-107	<=50	810	1000
Hexachloroethane	8270(3550)	1/2	29-84	<=50	57	1000
Indeno(1,2,3-cd)pyrene	8270(3550)	1/2	24-136	<=50	51	1000
Isophorone	8270(3550)	1/2	34-103	<=50	78	1000
2-Methylnaphthalene	8270(3550)	1/2	37-108	<=50	87	1000
2-Methyl phenol (o-Cresol)	8270(3550)	1/2	34-108	<=50	140	1000
3- and 4-Methyl phenol	8270(3550)	1/2	35-102	<=50	120	1000
Naphthalene	8270(3550)	1/2	36-94	<=50	93	1000
2-Nitroaniline	8270(3550)	1/2	35-113	<=50	75	5000
3-Nitroaniline	8270(3550)	1/2	22-99	<=50	90	5000
4-Nitroaniline	8270(3550)	1/2	32-111	<=50	78	5000
Nitrobenzene	8270(3550)	1/2	24-110	<=50	93	1000

SEVERN TRENT STL

Biological Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
2-Nitrophenol	8270(3550)	1/2	33-102	<=50	78	1000
4-Nitrophenol(MS)	8270(3550)	1/2	13-133	<=50	75	5000
N-Nitrosodiphenylamine/ Diphenylamine	8270(3550)	1/2	16-113	<=50	90	1000
N-Nitrosos-di-N-propylamine (MS)	8270(3550)	1/2	17-110	<=50	90	1000
Pentachlorophenol (MS)	8270(3550)	1/2	17-140	<=50	100	5000
Phenanthrene	8270(3550)	1/2	34-123	<=50	100	1000
Phenol (MS)	8270(3550)	1/2	20-108	<=50	120	1000
Pyrene (MS)	8270(3550)	1/2	36-132	<=50	45	1000
1,2,4-Trichlorobenzene (MS)	8270(3550)	1/2	26-102	<=50	110	1000
2,4,5-Trichlorophenol	8270(3550)	1/2	44-110	<=50	93	1000
2,4,6-Trichlorophenol	8270(3550)	1/2	43-110	<=50	96	1000
Surrogates						
2-Fluorobiphenyl	8270(3550)	1/2	37-106	NA	NA	NA
2-Fluorophenol	8270(3550)	1/2	31-105	NA	NA	NA
Nitrobenzene-d5	8270(3550)	1/2	31-99	NA	NA	NA
Phenol-d5	8270(3550)	1/2	31-105	NA	NA	NA
p-Terphenyl-d14	8270(3550)	1/2	38-120	NA	NA	NA
2,4,6- Tribromophenol	8270(3550)	1/2	26-127	NA	NA	NA
RL and MDL are based on soil values with a final extract volume of 1.0mL per 10gram of sample.						
Poychlorinated Dioxins and Furans by GC/MS (low resolution SIM)						
Polychlorinated Dibenzo-p-dioxin 2,3,7,8-substituted Congeners						
2,3,7,8-TCDD	8280	4/2	56-140	<=40	0.066	0.50
Polychlorinated Dibenzo-p-dioxin and Dibenzofuran classes						
tetra-CDD (MS)	8280	4/2	56-140	<=40	0.066	0.50
tetra-CDF (MS)	8280	4/2	58-163	<=40	0.13	0.50
penta-CDD (MS)	8280	4/2	44-184	<=40	0.085	0.50
Penta-CDF (MS)	8280	4/2	73-148	<=40	0.054	0.50
hexa-CDD (MS)	8280	4/2	38-177	<=40	0.051	0.50
hexa-CDF (MS)	8280	4/2	63-164	<=40	0.092	0.50
hepta-CDD (MS)	8280	4/2	69-137	<=50	0.12	1.0
hepta-CDF (MS)	8280	4/2	61-147	<=50	0.099	1.0
octa-CDD (MS)	8280	4/2	56-148	<=50	0.18	1.0
octa-CDF (MS)	8280	4/2	56-148	<=50	0.10	1.0
Internal Standards						
2,3,7,8-tetra-CDD-13C12	8280	4/2	25-150	NA	NA	NA
octa-CDD-13C12	8280	4/2	25-150	NA	NA	NA

RL and MDL are based on soil values.

REFERENCES AND NOTES FOR APPENDIX E

The MDL for biological tissues is based on the soil MDL extrapolated to the extraction weight used for biological tissues.

Accuracy data are presented as recoveries for spikes or surrogates. For routine analysis of organics using SW-846 methods, percent recoveries are evaluated only on the subset spike compound lists specified by the methods unless noted in a pre-project plan or QAPP. An (MS) following the parameter name designates the routine matrix and laboratory control spike compounds. Precision data are presented as relative percent difference (% RPD) and are advisory; i.e., not used for laboratory control. Since reportable levels (above detection limit) for most of the organic parameters may not be detected in all environmental samples, precision is usually based on duplicate spike data and evaluated according to method requirements.

Accuracy and precision control limits are primarily derived from in-house laboratory data for soils. Some accuracy and precision limits have been rounded to the nearest "5". In some cases, method limits may be used in lieu of in-house limits because in-house limits are broader than the method limits or are too broad to be usable.

ABBREVIATIONS USED IN THE APPENDIX

PARAMETER-refers to the compound, analyte, or measurement being tested or performed (the field of test)

METHOD-refers to the reference method used to measure the parameter

REF-a number designation that corresponds to the method references and citations listed below

ACC-accuracy control limits measured as percent recovery

PREC-precision measured as relative percent difference

RL-reporting limit

MDL-method detection limit

REF #	REFERENCE
1	Test Methods for Evaluating Solid Waste, Third Edition, SW-846 (including Update III) USEPA Office of Solid Waste and Emergency Response, Washington, DC.
2	"Extraction and Analysis of Organics in Biological Tissues", Method 0B 10/90, USEPA Environmental Services Division, Region IV, Analytical Support Branch, Athens, GA.
3	Method 680: Determination of Pesticides and PCBs in Water and Soils/Sediment by Gas Chromatography/Mass Spectrometry. November 1985. Physical and Chemical Methods Branch, Environmental Monitoring and Support Laboratory, Office of Research and Development, USEPA, Cincinnati, OH
4	Test Methods for Evaluating Solid Waste, Third Edition; U.S. EPA Office of Solid Waste and Emergency Response: Washington, DC,. Method 8280

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SEVERN TRENT STL

Wipe Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/wipe)	RL (mg/wipe)
Metals						
Aluminum (ICP)	6010(3050)	1/2	75-125	<=20	1.4	20
Antimony (ICP)	6010(3050)	1/2	75-125	<=20	0.66	2.0
Antimony (GFAA)	7041(3050)	1/2	80-120	<=20	0.21	1.0
Arsenic (ICP)	6010(3050)	1/2	75-125	<=20	0.74	1.0
Arsenic (GFAA)	7060(3050)	1/2	80-120	<=20	0.12	1.0
Barium (ICP)	6010(3050)	1/2	75-125	<=20	0.10	1.0
Beryllium (ICP)	6010(3050)	1/2	75-125	<=20	0.040	0.40
Cadmium (ICP)	6010(3050)	1/2	75-125	<=20	0.056	0.50
Cadmium (GFAA)	7131 (3050)	1/2	80-120	<=20	0.012	0.10
Calcium (ICP)	6010(3050)	1/2	75-125	<=20	5.0	50
Chromium (ICP)	6010(3050)	1/2	75-125	<=20	0.11	1.0
Chromium (GFAA)	7191(3050)	1/2	80-120	<=20	0.059	1.0
Cobalt (ICP)	6010 (3050)	1/2	75-125	<=20	0.16	1.0
Copper (ICP)	6010 (3050)	1/2	75-125	<=20	0.20	2.0
Copper (GFAA)	7211(3050)	1/2	80-120	<=20	0.085	1.0
Iron (ICP)	6010 (3050)	1/2	75-125	<=20	1.6	5.0
Lead (ICP)	6010 (3050)	1/2	75-125	<=20	0.34	0.50
Lead (GFAA)	7421(3050)	1/2	80-120	<=20	0.062	0.50
Magnesium (ICP)	6010 (3050)	1/2	75-125	<=20	5.0	50
Manganese (ICP)	6010(3050)	1/2	75-125	<=20	0.10	1.0
Mercury (CVAA)	7471	1/2	80-120	<=20	0.0043	0.020
Molybdenum (ICP)	6010(3050)	1/2	75-125	<=20	0.35	1.0
Nickel (ICP)	6010(3050)	1/2	75-125	<=20	0.24	4.0
Potassium (ICP)	6010(3050)	1/2	75-125	<=20	10	100
Selenium (ICP)	6010(3050)	1/2	75-125	<=20	0.78	1.0
Selenium (GFAA)	7740(3050)	1/2	80-120	<=20	0.13	1.0
Silver (ICP)	6010(3050)	1/2	75-125	<=20	0.12	1.0
Silver (GFAA)	7761 (3050)	1/2	80-120	<=20	0.011	0.10
Sodium (ICP)	6010(3050)	1/2	75-125	<=20	17	50
Strontium(ICP)	6010(3050)	1/2	75-125	<=20	0.10	1.0
Thallium (ICP)	6010(3050)	1/2	75-125	<=20	0.93	1.0
Thallium (GFAA)	7841 (3050)	1/2	80-120	<=20	0.051	1.0
Tin (ICP)	6010(3050)	1/2	75-125	<=20	0.84	5.0
Titanium(ICP)	6010(3050)	1/2	70-130	<=20	0.10	1.0
Vanadium (ICP)	6010 (3050)	1/2	75-125	<=20	0.12	1.0
Zinc (ICP)	6010 (3050)	1/2	75-125	<=20	0.13	2.0

RL and MDL are based on soil values with a final digest volume of 100mL per wipe.

SEVERN TRENT STL

Wipe Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/wipe)	RL (mg/wipe)
Chlorinated Pesticides by GC/EC						
Aldrin (MS)	8081(3550)	1/2	34-124	<=50	0.0037	0.050
alpha-BHC	8081(3550)	1/2	22-125	<=50	0.0080	0.050
beta-BHC	8081(3550)	1/2	36-144	<=50	0.0097	0.050
gamma-BHC (Lindane) (MS)	8081(3550)	1/2	35-132	<=50	0.0050	0.050
delta-BHC	8081(3550)	1/2	32-140	<=50	0.0040	0.050
Technical Chlordane	8081(3550)	1/2	41-177	<=50	0.11	0.50
alpha Chlordane	8081(3550)	1/2	40-139	<=50	0.0037	0.050
gamma Chlordane	8081(3550)	1/2	39-143	<=50	0.0043	0.050
4,4'-DDD	8081(3550)	1/2	37-149	<=50	0.012	0.10
4,4'-DDE	8081(3550)	1/2	33-139	<=50	0.018	0.10
4,4'-DDT (MS)	8081(3550)	1/2	46-156	<=50	0.010	0.10
Dieldrin (MS)	8081(3550)	1/2	40-133	<=50	0.010	0.10
Endosulfan I	8081(3550)	1/2	31-133	<=50	0.0057	0.050
Endosulfan II	8081(3550)	1/2	34-150	<=50	0.0073	0.10
Endosulfan sulfate	8081(3550)	1/2	45-163	<=50	0.015	0.10
Endrin (MS)	8081(3550)	1/2	42-137	<=50	0.014	0.10
Endrin aldehyde	8081(3550)	1/2	37-152	<=50	0.010	0.10
Endrin ketone	8081(3550)	1/2	44-165	<=50	0.013	0.10
Heptachlor (MS)	8081(3550)	1/2	31-142	<=50	0.0093	0.050
Heptachlor epoxide	8081(3550)	1/2	29-133	<=50	0.0057	0.050
Methoxychlor	8081(3550)	1/2	37-185	<=50	0.0067	0.50
Toxaphene	8081(3550)	1/2	36-159	<=50	1.1	5.0
Surrogates						
Tetrachloro-m-xylene	8081(3550)	1/2	30-150	NA	NA	NA
Decachlorobiphenyl	8081(3550)	1/2	30-150	NA	NA	NA
RL and MDL are based on soil values with a final extract volume of 10mL per wipe.						
Polychlorinated Biphenyls as Aroclors by GC/EC						
PCB-1016	8082(3550)	1/2	24-132	<=50	0.13	1.0
PCB 1221	8082(3550)	1/2	30-130	<=50	0.57	2.0
PCB 1232	8082(3550)	1/2	30-130	<=50	0.22	1.0
PCB-1242	8082(3550)	1/2	30-130	<=50	0.22	1.0
PCB-1248	8082(3550)	1/2	30-150	<=50	0.22	1.0
PCB-1254	8082(3550)	1/2	30-150	<=50	0.22	1.0
PCB-1260	8082(3550)	1/2	28-153	<=50	0.15	1.0
PCB-1268	8082(3550)	1/2	30-150	<=50	0.080	1.0
Surrogates						
2,4,5,6-Tetrachloro-m-xylene	8082(3550)	1/2	30-150	NA	NA	NA
Decachlorobiphenyl	8082(3550)	1/2	30-150	NA	NA	NA
RL and MDL are based on soil values with a final extract volume of 10mL per wipe.						

SEVERN TRENT STL

Wipe Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/wipe)	RL (mg/wipe)
Volatiles by GC/MS						
Acetone	8260(5035ext)	1/2	30-195	<=100	5.1	20
Benzene (MS)	8260(5035ext)	1/2	65-130	<=50	0.46	2.0
Bromodichloromethane	8260(5035ext)	1/2	71-120	<=50	0.86	2.0
Bromoform	8260(5035ext)	1/2	58-134	<=50	0.45	2.0
Bromomethane	8260(5035ext)	1/2	22-184	<=100	1.0	2.0
2-Butanone (Methyl Ethyl Ketone-MEK)	8260(5035ext)	1/2	30-185	<=50	1.7	10
Carbon disulfide	8260(5035ext)	1/2	43-143	<=50	0.78	2.0
Carbon tetrachloride	8260(5035ext)	1/2	66-128	<=50	1.2	2.0
Chlorobenzene (MS)	8260(5035ext)	1/2	69-128	<=50	0.62	2.0
Chloroethane	8260(5035ext)	1/2	46-152	<=100	1.0	2.0
Chloroform	8260(5035ext)	1/2	70-124	<=50	0.39	2.0
Chloromethane	8260(5035ext)	1/2	42-143	<=100	1.0	2.0
Dibromochloromethane	8260(5035ext)	1/2	70-124	<=50	0.66	2.0
1,1-Dichloroethane	8260(5035ext)	1/2	34-166	<=50	0.35	2.0
1,2-Dichloroethane	8260(5035ext)	1/2	39-158	<=50	1.0	2.0
cis-1,2-Dichloroethene	8260(5035ext)	1/2	33-150	<=50	0.58	2.0
trans-1,2-Dichloroethene	8260(5035ext)	1/2	23-159	<=50	0.52	2.0
1,1-Dichloroethene (MS)	8260(5035ext)	1/2	46-142	<=50	0.82	2.0
1,2-Dichloropropane	8260(5035ext)	1/2	72-118	<=50	0.96	2.0
cis-1,3-Dichloropropene	8260(5035ext)	1/2	71-123	<=50	1.0	2.0
trans-1,3-Dichloropropene	8260(5035ext)	1/2	66-128	<=50	0.59	2.0
Ethylbenzene	8260(5035ext)	1/2	71-120	<=50	0.50	2.0
2-Hexanone	8260(5035ext)	1/2	46-163	<=50	5.0	10
Methylene chloride	8260(5035ext)	1/2	29-153	<=100	0.51	2.0
4-Methyl-2-pentanone (MIBK)	8260(5035ext)	1/2	47-160	<=50	1.4	10
Styrene	8260(5035ext)	1/2	73-121	<=50	1.3	2.0
1,1,2,2-Tetrachloroethane	8260(5035ext)	1/2	59-138	<=50	0.79	2.0
Tetrachloroethene	8260(5035ext)	1/2	64-134	<=50	0.89	2.0
Toluene (MS)	8260(5035ext)	1/2	63-133	<=50	0.63	2.0
1,1,1-Trichloroethane	8260(5035ext)	1/2	70-123	<=50	1.1	2.0
1,1,2-Trichloroethane	8260(5035ext)	1/2	66-127	<=50	0.41	2.0
Trichloroethene (MS)	8260(5035ext)	1/2	64-126	<=50	1.0	2.0
Vinyl chloride	8260(5035ext)	1/2	38-151	<=100	1.0	2.0
Xylenes (total)	8260(5035ext)	1/2	74-122	<=50	1.4	4.0
o-Xylene	8260(5035ext)	1/2	74-122	<=50	0.56	2.0
m&p-Xylene	8260(5035ext)	1/2	74-121	<=50	0.96	2.0
Surrogates						
p-Bromofluorobenzene	8260(5035ext)	1/2	68-121	NA	NA	NA
Dibromofluoromethane	8260(5035ext)	1/2	66-127	NA	NA	NA
Toluene-d8	8260(5035ext)	1/2	65-128	NA	NA	NA

RL and MDL are based on soil values with a final extract volume of 10mL per wipe and analysis of 25ul (0.025mL) of the extract.

SEVERN TRENT STL

Wipe Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/wipe)	RL (mg/wipe)
Semivolatiles (Base-Neutrals/Acids) by GC/MS						
Acenaphthene (MS)	8270(3550)	1/2	39-104	<=50	1.0	10
Acenaphthylene	8270(3550)	1/2	37-112	<=50	0.76	10
Anthracene	8270(3550)	1/2	34-120	<=50	0.97	10
Benzo(a)anthracene	8270(3550)	1/2	28-134	<=50	1.1	10
Benzo(b)fluoranthene	8270(3550)	1/2	29-128	<=50	1.0	10
Benzo(k)fluoranthene	8270(3550)	1/2	25-127	<=50	0.39	10
Benzo(g,h,i)perylene	8270(3550)	1/2	33-122	<=50	0.70	10
Benzo(a)pyrene	8270(3550)	1/2	30-128	<=50	0.97	10
Benzyl alcohol	8270(3550)	1/2	21-110	<=50	1.2	10
Bis(2-chloroethoxy) methane	8270(3550)	1/2	34-102	<=50	0.97	10
Bis(2-chloroethyl) ether	8270(3550)	1/2	27-96	<=50	1.1	10
Bis(2-chloroisopropyl) ether	8270(3550)	1/2	30-94	<=50	0.97	10
Bis(2-ethylhexyl) phthalate	8270(3550)	1/2	39-122	<=50	1.3	10
4-Bromophenyl phenyl ether	8270(3550)	1/2	33-94	<=50	0.91	10
Butyl benzyl phthalate	8270(3550)	1/2	44-121	<=50	0.97	10
4-Chloroaniline	8270(3550)	1/2	18-94	<=50	0.88	20
4-Chloro-3-methylphenol (MS)	8270(3550)	1/2	22-124	<=50	1.2	10
2-Chloronaphthalene	8270(3550)	1/2	42-96	<=50	1.1	10
2-Chlorophenol (MS)	8270(3550)	1/2	22-109	<=50	1.2	10
4-Chlorophenylphenyl ether	8270(3550)	1/2	38-101	<=50	0.79	10
Chrysene	8270(3550)	1/2	35-130	<=50	0.94	10
Dibenz(a,h)anthracene	8270(3550)	1/2	29-126	<=50	0.94	10
Dibenzofuran	8270(3550)	1/2	34-112	<=50	1.0	10
Di-n-butylphthalate	8270(3550)	1/2	39-116	<=50	1.2	10
1,2-Dichlorobenzene	8270(3550)	1/2	31-86	<=50	0.70	10
1,3-Dichlorobenzene	8270(3550)	1/2	33-81	<=50	0.70	10
1,4-Dichlorobenzene (MS)	8270(3550)	1/2	25-93	<=50	0.73	10
3,3'-Dichlorobenzidine	8270(3550)	1/2	10-98	<=50	0.79	20
2,4-Dichlorophenol	8270(3550)	1/2	37-103	<=50	0.88	10
Diethylphthalate	8270(3550)	1/2	37-112	<=50	1.1	10
2,4-Dimethylphenol	8270(3550)	1/2	45-99	<=50	0.85	10
Dimethylphthalate	8270(3550)	1/2	40-106	<=50	1.1	10
4,6-Dinitro-2-methylphenol	8270(3550)	1/2	24-128	<=50	0.94	50
2,4-Dinitrophenol	8270(3550)	1/2	19-126	<=50	10	50
2,4-Dinitrotoluene (MS)	8270(3550)	1/2	18-125	<=50	0.67	10
2,6-Dinitrotoluene	8270(3550)	1/2	42-109	<=50	0.88	10
Di-n-octylphthalate	8270(3550)	1/2	38-126	<=50	0.97	10
Fluoranthene	8270(3550)	1/2	18-137	<=50	0.91	10
Fluorene	8270(3550)	1/2	35-112	<=50	0.67	10
Hexachlorobenzene	8270(3550)	1/2	34-103	<=50	1.2	10
Hexachlorobutadiene	8270(3550)	1/2	35-98	<=50	0.82	10
Hexachlorocyclopentadiene	8270(3550)	1/2	19-107	<=50	8.2	10
Hexachloroethane	8270(3550)	1/2	29-84	<=50	0.58	10
Indeno(1,2,3-cd)pyrene	8270(3550)	1/2	24-136	<=50	0.52	10
Isophorone	8270(3550)	1/2	34-103	<=50	0.79	10
2-Methylnaphthalene	8270(3550)	1/2	37-108	<=50	0.88	10
2-Methyl phenol (o-Cresol)	8270(3550)	1/2	34-108	<=50	1.4	10
3- and 4-Methyl phenol	8270(3550)	1/2	35-102	<=50	1.2	10
Naphthalene	8270(3550)	1/2	36-94	<=50	0.94	10
2-Nitroaniline	8270(3550)	1/2	35-113	<=50	0.76	50
3-Nitroanline	8270(3550)	1/2	22-99	<=50	0.91	50
4-Nitroaniline	8270(3550)	1/2	32-111	<=50	0.79	50
Nitrobenzene	8270(3550)	1/2	24-110	<=50	0.94	10

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Wipe Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/wipe)	RL (mg/wipe)
2-Nitrophenol	8270(3550)	1/2	33-102	<=50	0.79	10
4-Nitrophenol(MS)	8270(3550)	1/2	13-133	<=50	0.76	50
N-Nitrosodiphenylamine/ Diphenylamine	8270(3550)	1/2	16-113	<=50	0.91	10
N-Nitrosos-di-N-propylamine (MS)	8270(3550)	1/2	17-110	<=50	0.91	10
Pentachlorophenol (MS)	8270(3550)	1/2	17-140	<=50	1.0	50
Phenanthrene	8270(3550)	1/2	34-123	<=50	1.0	10
Phenol (MS)	8270(3550)	1/2	20-108	<=50	1.2	10
Pyrene (MS)	8270(3550)	1/2	36-132	<=50	0.45	10
1,2,4-Trichlorobenzene (MS)	8270(3550)	1/2	26-102	<=50	1.2	10
2,4,5-Trichlorophenol	8270(3550)	1/2	44-110	<=50	0.94	10
2,4,6-Trichlorophenol	8270(3550)	1/2	43-110	<=50	0.97	10
Surrogates						
2-Fluorobiphenyl	8270(3550)	1/2	37-106	NA	NA	NA
2-Fluorophenol	8270(3550)	1/2	31-105	NA	NA	NA
Nitrobenzene-d5	8270(3550)	1/2	31-99	NA	NA	NA
Phenol-d5	8270(3550)	1/2	31-105	NA	NA	NA
p-Terphenyl-d14	8270(3550)	1/2	38-120	NA	NA	NA
2,4,6- Tribromophenol	8270(3550)	1/2	26-127	NA	NA	NA

RL and MDL are based on soil values with a final extract volume of 1.0mL per wipe.

REFERENCES AND NOTES FOR APPENDIX F

The MDL for wipe samples is based on the soil MDL extrapolated to the wipe prepration parameters.

Accuracy data are presented as recoveries for spikes or surrogates. For routine analysis of organics using SW-846 methods, percent recoveries are evaluated only on the subset spike compound lists specified by the methods unless noted in a pre-project plan or QAPP. An (MS) following the parameter name designates the routine matrix and laboratory control spike compounds. Precision data are presented as relative percent difference (% RPD) and are advisory; i.e., not used for laboratory control. Since reportable levels (above detection limit) for most of the organic parameters may not be detected in all environmental samples, precision is usually based on duplicate spike data and evaluated according to method requirements.

Accuracy and precision control limits are primarily derived from in-house laboratory data for soils. Some accuracy and precision limits have been rounded to the nearest "5". In some cases, method limits may be used in lieu of in-house limits because in-house limits are broader than the method limits or are too broad to be usable.

ABBREVIATIONS USED IN THE APPENDIX

PARAMETER-refers to the compound, analyte, or measurement being tested or performed (the field of test)

METHOD-refers to the reference method used to measure the parameter

REF-a number designation that corresponds to the method references and citations listed below

ACC-accuracy control limits measured as percent recovery

PREC-precision measured as relative percent difference

RL-reporting limit

MDL-method detection limit

REF #	REFERENCE
1	Test Methods for Evaluating Solid Waste, Third Edition, SW-846 (Including Update III) USEPA Office of Solid Waste and Emergency Response, Washington, DC.
2	Laboratory SOP CU16:Wipe Test: Sampling and Analysis

SEVERN TRENT STL

Waste and Oil Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/kg)	RL (mg/kg)
Metals						
Aluminum (ICP)	6010(3050)	1	75-125	<=20	1.4	20
Antimony (ICP)	6010(3050)	1	75-125	<=20	0.66	2.0
Antimony (GFAA)	7041(3050)	1	80-120	<=20	0.21	1.0
Arsenic (ICP)	6010(3050)	1	75-125	<=20	0.74	1.0
Arsenic (GFAA)	7060(3050)	1	80-120	<=20	0.12	1.0
Barium (ICP)	6010(3050)	1	75-125	<=20	0.10	1.0
Beryllium (ICP)	6010(3050)	1	75-125	<=20	0.040	0.40
Cadmium (ICP)	6010(3050)	1	75-125	<=20	0.056	0.50
Cadmium (GFAA)	7131 (3050)	1	80-120	<=20	0.012	0.10
Calcium (ICP)	6010(3050)	1	75-125	<=20	5.0	50
Chromium (ICP)	6010(3050)	1	75-125	<=20	0.11	1.0
Chromium (GFAA)	7191(3050)	1	80-120	<=20	0.059	1.0
Cobalt (ICP)	6010 (3050)	1	75-125	<=20	0.16	1.0
Copper (ICP)	6010 (3050)	1	75-125	<=20	0.20	2.0
Copper (GFAA)	7211(3050)	1	80-120	<=20	0.085	1.0
Iron (ICP)	6010 (3050)	1	75-125	<=20	1.6	5.0
Lead (ICP)	6010 (3050)	1	75-125	<=20	0.34	0.50
Lead (GFAA)	7421(3050)	1	80-120	<=20	0.062	0.50
Magnesium (ICP)	6010 (3050)	1	75-125	<=20	5.0	50
Manganese (ICP)	6010(3050)	1	75-125	<=20	0.10	1.0
Mercury (CVAA)	7471	1	80-120	<=20	0.0043	0.020
Molybdenum (ICP)	6010(3050)	1	75-125	<=20	0.35	1.0
Nickel (ICP)	6010(3050)	1	75-125	<=20	0.24	4.0
Potassium (ICP)	6010(3050)	1	75-125	<=20	10	100
Selenium (ICP)	6010(3050)	1	75-125	<=20	0.78	1.0
Selenium (GFAA)	7740(3050)	1	80-120	<=20	0.13	1.0
Silver (ICP)	6010(3050)	1	75-125	<=20	0.12	1.0
Silver (GFAA)	7761 (3050)	1	80-120	<=20	0.011	0.10
Sodium (ICP)	6010(3050)	1	75-125	<=20	17	50
Strontium(ICP)	6010(3050)	1	75-125	<=20	0.10	1.0
Thallium (ICP)	6010(3050)	1	75-125	<=20	0.93	1.0
Thallium (GFAA)	7841 (3050)	1	80-120	<=20	0.051	1.0
Tin (ICP)	6010(3050)	1	75-125	<=20	0.84	5.0
Titanium(ICP)	6010(3050)	1	70-130	<=20	0.10	1.0
Vanadium (ICP)	6010 (3050)	1	75-125	<=20	0.12	1.0
Zinc (ICP)	6010 (3050)	1	75-125	<=20	0.13	2.0
RL and MDL are based on soil values with a final digest volume of 100mL per gram of sample.						
Cyanide, reactive	7.3.3.2/9014	1	NA	<=50	100mg HCN/ Kg Waste	100mg HCN/ Kg Waste
Cyanide, total	9012	1	75-125	<=30	0.25	0.50
Cyanide, total extractable	9012(9013)	1	75-125	<=30	0.25	0.50

SEVERN TRENT STL

Waste and Oil Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Chlorinated Pesticides by GC/EC						
Aldrin (MS)	8081(3550)	1	34-124	<=50	3.3	50
alpha-BHC	8081(3550)	1	22-125	<=50	7.2	50
beta-BHC	8081(3550)	1	36-144	<=50	8.7	50
gamma-BHC (Lindane) (MS)	8081(3550)	1	35-132	<=50	4.5	50
delta-BHC	8081(3550)	1	32-140	<=50	3.6	50
Technical Chlordane	8081(3550)	1	41-177	<=50	99	500
alpha Chlordane	8081(3550)	1	40-139	<=50	3.3	50
gamma Chlordane	8081(3550)	1	39-143	<=50	3.9	50
4,4'-DDD	8081(3550)	1	37-149	<=50	11	100
4,4'-DDE	8081(3550)	1	33-139	<=50	16	100
4,4'-DDT (MS)	8081(3550)	1	46-156	<=50	9.3	100
Dieldrin (MS)	8081(3550)	1	40-133	<=50	9.3	100
Endosulfan I	8081(3550)	1	31-133	<=50	5.1	50
Endosulfan II	8081(3550)	1	34-150	<=50	6.6	100
Endosulfan sulfate	8081(3550)	1	45-163	<=50	13	100
Endrin (MS)	8081(3550)	1	42-137	<=50	13	100
Endrin aldehyde	8081(3550)	1	37-152	<=50	9.3	100
Endrin ketone	8081(3550)	1	44-165	<=50	11	100
Heptachlor (MS)	8081(3550)	1	31-142	<=50	8.4	50
Heptachlor epoxide	8081(3550)	1	29-133	<=50	5.1	50
Methoxychlor	8081(3550)	1	37-185	<=50	6.0	500
Toxaphene	8081(3550)	1	36-159	<=50	990	5000
Surrogates						
Tetrachloro-m-xylene	8081(3550)	1	30-150	NA	NA	NA
Decachlorobiphenyl	8081(3550)	1	30-150	NA	NA	NA
RL and MDL are based on soil values with a final extract volume of 10mL per gram of sample.						
Polychlorinated Biphenyls as Aroclors by GC/EC						
PCB-1016	8082(3550)	1	24-132	<=50	120	1000
PCB 1221	8082(3550)	1	30-130	<=50	510	2000
PCB 1232	8082(3550)	1	30-130	<=50	200	1000
PCB-1242	8082(3550)	1	30-130	<=50	200	1000
PCB-1248	8082(3550)	1	30-150	<=50	200	1000
PCB-1254	8082(3550)	1	30-150	<=50	200	1000
PCB-1260	8082(3550)	1	28-153	<=50	130	1000
PCB-1268	8082(3550)	1	30-150	<=50	72	1000
Surrogates						
2,4,5,6-Tetrachloro-m-xylene	8082(3550)	1	30-150	NA	NA	NA
Decachlorobiphenyl	8082(3550)	1	30-150	NA	NA	NA
RL and MDL are based on soil values with a final extract volume of 10mL per gram of sample.						

SEVERN TRENT STL

Waste and Oil Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Volatiles by GC/MS						
Acetone	8260(5035ext)	1	30-195	<=100	5100	20000
Benzene (MS)	8260(5035ext)	1	65-130	<=50	460	2000
Bromodichloromethane	8260(5035ext)	1	71-120	<=50	860	2000
Bromoform	8260(5035ext)	1	58-134	<=50	450	2000
Bromomethane	8260(5035ext)	1	22-184	<=100	1000	2000
2-Butanone (Methyl Ethyl Ketone-MEK)	8260(5035ext)	1	30-185	<=50	1700	10000
Carbon disulfide	8260(5035ext)	1	43-143	<=50	780	2000
Carbon tetrachloride	8260(5035ext)	1	66-128	<=50	1200	2000
Chlorobenzene (MS)	8260(5035ext)	1	69-128	<=50	620	2000
Chloroethane	8260(5035ext)	1	46-152	<=100	1000	2000
Chloroform	8260(5035ext)	1	70-124	<=50	390	2000
Chloromethane	8260(5035ext)	1	42-143	<=100	1000	2000
Dibromochloromethane	8260(5035ext)	1	70-124	<=50	660	2000
1,1-Dichloroethane	8260(5035ext)	1	34-166	<=50	350	2000
1,2-Dichloroethane	8260(5035ext)	1	39-158	<=50	1000	2000
cis-1,2-Dichloroethene	8260(5035ext)	1	33-150	<=50	580	2000
trans-1,2-Dichloroethene	8260(5035ext)	1	23-159	<=50	520	2000
1,1-Dichloroethene (MS)	8260(5035ext)	1	46-142	<=50	820	2000
1,2-Dichloropropane	8260(5035ext)	1	72-118	<=50	960	2000
cis-1,3-Dichloropropene	8260(5035ext)	1	71-123	<=50	1000	2000
trans-1,3-Dichloropropene	8260(5035ext)	1	66-128	<=50	590	2000
Ethylbenzene	8260(5035ext)	1	71-120	<=50	500	2000
2-Hexanone	8260(5035ext)	1	46-163	<=50	5000	10000
Methylene chloride	8260(5035ext)	1	29-153	<=100	510	2000
4-Methyl-2-pentanone (MIBK)	8260(5035ext)	1	47-160	<=50	1400	10000
Styrene	8260(5035ext)	1	73-121	<=50	1300	2000
1,1,2,2-Tetrachloroethane	8260(5035ext)	1	59-138	<=50	790	2000
Tetrachloroethene	8260(5035ext)	1	64-134	<=50	890	2000
Toluene (MS)	8260(5035ext)	1	63-133	<=50	630	2000
1,1,1-Trichloroethane	8260(5035ext)	1	70-123	<=50	1100	2000
1,1,2-Trichloroethane	8260(5035ext)	1	66-127	<=50	410	2000
Trichloroethene (MS)	8260(5035ext)	1	64-126	<=50	1000	2000
Vinyl chloride	8260(5035ext)	1	38-151	<=100	1000	2000
Xylenes (total)	8260(5035ext)	1	74-122	<=50	1400	4000
o-Xylene	8260(5035ext)	1	74-122	<=50	560	2000
m+p-Xylene	8260(5035ext)	1	74-121	<=50	960	2000
Surrogates						
p-Bromofluorobenzene	8260(5035ext)	1	68-121	NA	NA	NA
Dibromofluoromethane	8260(5035ext)	1	66-127	NA	NA	NA
Toluene-d8	8260(5035ext)	1	65-128	NA	NA	NA

RL and MDL are based on soil values with a final extract volume of 10mL per 1g of sample and analysis of 25ul (0.025mL) of the extract.

SEVERN TRENT STL

Waste and Oil Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
Semivolatiles (Base-Neutrals/Acids) by GC/MS						
Acenaphthene (MS)	8270(3550)	1	39-104	<=50	10000	100000
Acenaphthylene	8270(3550)	1	37-112	<=50	7500	100000
Anthracene	8270(3550)	1	34-120	<=50	9600	100000
Benzo(a)anthracene	8270(3550)	1	28-134	<=50	10800	100000
Benzo(b)fluoranthene	8270(3550)	1	29-128	<=50	9900	100000
Benzo(k)fluoranthene	8270(3550)	1	25-127	<=50	3900	100000
Benzo(g,h,i)perylene	8270(3550)	1	33-122	<=50	6900	100000
Benzo(a)pyrene	8270(3550)	1	30-128	<=50	9600	100000
Benzyl alcohol	8270(3550)	1	21-110	<=50	11000	100000
Bis(2-chloroethoxy) methane	8270(3550)	1	34-102	<=50	9600	100000
Bis(2-chloroethyl) ether	8270(3550)	1	27-96	<=50	11000	100000
Bis(2-chloroisopropyl) ether	8270(3550)	1	30-94	<=50	9600	100000
Bis(2-ethylhexyl) phthalate	8270(3550)	1	39-122	<=50	13000	100000
4-Bromophenyl phenyl ether	8270(3550)	1	33-94	<=50	9000	100000
Butyl benzyl phthalate	8270(3550)	1	44-121	<=50	9600	100000
4-Chloroaniline	8270(3550)	1	18-94	<=50	8700	200000
4-Chloro-3-methylphenol (MS)	8270(3550)	1	22-124	<=50	12000	100000
2-Chloronaphthalene	8270(3550)	1	42-96	<=50	11000	100000
2-Chlorophenol (MS)	8270(3550)	1	22-109	<=50	12000	100000
4-Chlorophenylphenyl ether	8270(3550)	1	38-101	<=50	7800	100000
Chrysene	8270(3550)	1	35-130	<=50	9300	100000
Dibenz(a,h)anthracene	8270(3550)	1	29-126	<=50	9300	100000
Dibenzofuran	8270(3550)	1	34-112	<=50	10000	100000
Di-n-butylphthalate	8270(3550)	1	39-116	<=50	12000	100000
1,2-Dichlorobenzene	8270(3550)	1	31-86	<=50	6900	100000
1,3-Dichlorobenzene	8270(3550)	1	33-81	<=50	6900	100000
1,4-Dichlorobenzene (MS)	8270(3550)	1	25-93	<=50	7200	100000
3,3'-Dichlorobenzidine	8270(3550)	1	10-98	<=50	7800	200000
2,4-Dichlorophenol	8270(3550)	1	37-103	<=50	8700	100000
Diethylphthalate	8270(3550)	1	37-112	<=50	10000	100000
2,4-Dimethylphenol	8270(3550)	1	45-99	<=50	8400	100000
Dimethylphthalate	8270(3550)	1	40-106	<=50	10000	100000
4,6-Dinitro-2-methylphenol	8270(3550)	1	24-128	<=50	9300	500000
2,4-Dinitrophenol	8270(3550)	1	19-126	<=50	100000	500000
2,4-Dinitrotoluene (MS)	8270(3550)	1	18-125	<=50	6600	100000
2,6-Dinitrotoluene	8270(3550)	1	42-109	<=50	8700	100000
Di-n-octylphthalate	8270(3550)	1	38-126	<=50	9600	100000
Fluoranthene	8270(3550)	1	18-137	<=50	9000	100000
Fluorene	8270(3550)	1	35-112	<=50	6600	100000
Hexachlorobenzene	8270(3550)	1	34-103	<=50	11000	100000
Hexachlorobutadiene	8270(3550)	1	35-98	<=50	8100	100000
Hexachlorocyclopentadiene	8270(3550)	1	19-107	<=50	81000	100000
Hexachloroethane	8270(3550)	1	29-84	<=50	5700	100000
Indeno(1,2,3-cd)pyrene	8270(3550)	1	24-136	<=50	5100	100000
Isophorone	8270(3550)	1	34-103	<=50	7800	100000
2-Methylnaphthalene	8270(3550)	1	37-108	<=50	8700	100000
2-Methyl phenol (o-Cresol)	8270(3550)	1	34-108	<=50	14000	100000
3- and 4-Methyl phenol	8270(3550)	1	35-102	<=50	12000	100000
Naphthalene	8270(3550)	1	36-94	<=50	9300	100000
2-Nitroaniline	8270(3550)	1	35-113	<=50	7500	500000
3-Nitroanline	8270(3550)	1	22-99	<=50	9000	500000
4-Nitroaniline	8270(3550)	1	32-111	<=50	7800	500000
Nitrobenzene	8270(3550)	1	24-110	<=50	9300	100000

SEVERN TRENT STL

Waste and Oil Samples

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/kg)	RL (ug/kg)
2-Nitrophenol	8270(3550)	1	33-102	<=50	7800	100000
4-Nitrophenol(MS)	8270(3550)	1	13-133	<=50	7500	500000
N-Nitrosodiphenylamine/ Diphenylamine	8270(3550)	1	16-113	<=50	9000	100000
N-Nitrosos-di-N-propylamine (MS)	8270(3550)	1	17-110	<=50	9000	100000
Pentachlorophenol (MS)	8270(3550)	1	17-140	<=50	10000	500000
Phenanthrene	8270(3550)	1	34-123	<=50	10000	100000
Phenol (MS)	8270(3550)	1	20-108	<=50	12000	100000
Pyrene (MS)	8270(3550)	1	36-132	<=50	4500	100000
1,2,4-Trichlorobenzene (MS)	8270(3550)	1	26-102	<=50	11000	100000
2,4,5-Trichlorophenol	8270(3550)	1	44-110	<=50	9300	100000
2,4,6-Trichlorophenol	8270(3550)	1	43-110	<=50	9600	100000
Surrogates						
2-Fluorobiphenyl	8270(3550)	1	37-106	NA	NA	NA
2-Fluorophenol	8270(3550)	1	31-105	NA	NA	NA
Nitrobenzene-d5	8270(3550)	1	31-99	NA	NA	NA
Phenol-d5	8270(3550)	1	31-105	NA	NA	NA
p-Terphenyl-d14	8270(3550)	1	38-120	NA	NA	NA
2,4,6- Tnbromophenol	8270(3550)	1	26-127	NA	NA	NA

RL and MDL are based on soil values with a final extract volume of 10mL per gram of sample.

SEVERN TRENT STL

REFERENCES AND NOTES FOR APPENDIX G

The MDL for wastes and oils is based on the soil MDL extrapolated to the extraction weight used for wastes and oils. tissues.

Accuracy data are presented as recoveries for spikes or surrogates. For routine analysis of organics using SW-846 methods, percent recoveries are evaluated only on the subset spike compound lists specified by the methods unless noted in a pre-project plan or QAPP. An (MS) following the parameter name designates the routine matrix and laboratory control spike compounds. Precision data are presented as relative percent difference (% RPD) and are advisory; i.e., not used for laboratory control. Since reportable levels (above detection limit) for most of the organic parameters may not be detected in all environmental samples, precision is usually based on duplicate spike data and evaluated according to method requirements.

Accuracy and precision control limits are primarily derived from in-house laboratory data for soils. Some accuracy and precision limits have been rounded to the nearest "5". In some cases, method limits may be used in lieu of in-house limits because in-house limits are broader than the method limits or are too broad to be usable.

The RL for waste and oil samples are based on the sample weight and fial volume of the extract. Samples extracts often require further dilution because of matrix problems, especially for petroleum-based wastes. No routine cleanups are effective for waste/oil matrices with the exception of the acid cleanup for PCB analyses.

ABBREVIATIONS USED IN THE APPENDICES

PARAMETER-refers to the compound, analyte or measurement being tested; the field of testing

METHOD-refers to the reference method used to measure the parameter

REF-a number designation that corresponds to the method references and citations

ACC-accuracy measured as percent recovery

PREC-precision measured as relative percent difference

RL-reporting limit

REF #	REFERENCE
1	Test Methods for Evaluating Solid Waste, Third Edition, SW-846 (including Update III) USEPA Office of Solid Waste and Emergency Response, Washington, DC.
2	Method 680: Determination of Pesticides and PCBs in Water and Soil/Sediment by GC/MS U.S. EPA, Washington, D.C..

SEVERN TRENT STL

Drinking Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)	MCL (ug/L)
Metals							
Aluminum (ICP)	200.7(DW)	1	70-130	<=20	17	200	
Aluminum (ICP/MS)	200.8	2	85-115	<=20	3.6	50	
Antimony(ICP/MS)	200.8	2	85-115	<=20	0.16	2.5	6
Antimony (GFAA)	200.9	3	80-120	<=20	0.98	5.0	6
Arsenic (ICP/MS)	200.8	2	85-115	<=20	1.4	5.0	50
Arsenic (GFAA)	200.9	3	80-120	<=20	1.0	5.0	50
Barium (ICP)	200.7(DW)	1	70-130	<=20	1.0	10	2000
Barium (ICP/MS)	200.8	2	85-115	<=20	0.20	5.0	2000
Beryllium (ICP)	200.7(DW)	1	70-130	<=20	0.40	4.0	4
Beryllium (ICP/MS)	200.8	2	85-115	<=20	0.062	0.50	4
Boron (ICP/MS)	200.8	2	85-115	<=20	4.9	25	
Cadmium (ICP)	200.7(DW)	1	70-130	<=20	0.86	5.0	5
Cadmium (ICP/MS)	200.8	2	85-115	<=20	0.13	2.5	5
Calcium (ICP)	200.7(DW)	1	70-130	<=20	50	500	
Calcium (ICP/MS)	200.8	2	85-115	<=20	7.8	250	
Chromium (ICP)	200.7(DW)	1	70-130	<=20	1.1	10	100
Chromium (ICP/MS)	200.8	2	85-115	<=20	0.71	5.0	100
Chromium, hexavalent	3500-Cr-D	4	90-110	<=20	2.0	10	
Cobalt (ICP)	200.7(DW)	1	70-130	<=20	1.4	10	
Cobalt (ICP/MS)	200.8	2	85-115	<=20	0.024	5.0	
Copper (ICP)	200.7(DW)	1	70-130	<=20	2.7	20	AL[2]=1300
Copper (ICP/MS)	200.8	2	85-115	<=20	0.24	5.0	AL[2]=1300
Iron (ICP)	200.7(DW)	1	70-130	<=20	22	50	
Iron (ICP/MS)	200.8	2	85-115	<=20	1.2	25	
Lead (ICP/MS)	200.8	2	85-115	<=20	0.068	1.5	AL[2]=15
Lead (GFAA)	200.9	3	80-120	<=20	0.58	2.0	AL[2]=15
Magnesium (ICP)	200.7(DW)	1	70-130	<=20	50	500	
Magnesium (ICP/MS)	200.8	2	85-115	<=20	0.44	250	
Manganese (ICP)	200.7(DW)	1	70-130	<=20	1.0	10	
Manganese (ICP/MS)	200.8	2	85-115	<=20	0.10	5.0	
Mercury (CVAA)	245.1	5	85-115	<=20	0.037	0.20	2
Molybdenum (ICP)	200.7(DW)	1	70-130	<=20	1.7	10	
Molybdenum (ICP/MS)	200.8	2	85-115	<=20	0.16	5.0	
Nickel (ICP)	200.7(DW)	1	70-130	<=20	2.2	40	
Nickel (ICP/MS)	200.8	2	85-115	<=20	0.064	5.0	
Potassium (ICP)	200.7(DW)	1	70-130	<=20	100	1000	
Potassium (ICP/MS)	200.8	2	85-115	<=20	12	250	
Selenium (ICP/MS)	200.8	2	85-115	<=20	0.14	2.5	50
Selenium (GFAA)	200.9	3	80-120	<=20	0.91	10	50
Silica, dissolved (ICP)	200.7(DW)	1	70-130	<=20	100	500	
Silver (ICP)	200.7(DW)	1	70-130	<=20	2.0	10	
Silver (ICP/MS)	200.8	2	85-115	<=20	0.059	5.0	
Sodium (ICP)	200.7(DW)	1	70-130	<=20	180	500	
Sodium (ICP/MS)	200.8	2	85-115	<=20	15	250	
Strontium (ICP)	200.7(DW)	1	70-130	<=20	1.0	10	
Strontium (ICP/MS)	200.8	2	85-115	<=20	0.040	5.0	
Thallium (ICP/MS)	200.8	2	85-115	<=20	0.16	1.0	2
Thallium (GFAA)	200.9	3	80-120	<=20	1.2	2.0	2
Tin (ICP)	200.7(DW)	1	70-130	<=20	7.0	50	

SEVERN TRENT STL

Drinking Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)	MCL (ug/L)
Tin (ICP/MS)	200.8	2	85-115	<=20	0.15	5.0	
Titanium (ICP)	200.7(DW)	1	70-130	<=20	1.0	10	
Titanium (ICP/MS)	200.8	2	85-115	<=20	2.1	5.0	
Vanadium (ICP)	200.7(DW)	1	70-130	<=20	0.70	10	
Vanadium (ICP/MS)	200.8	2	85-115	<=20	1.5	5.0	
Zinc (ICP)	200.7(DW)	1	70-130	<=20	1.3	20	
Zinc (ICP/MS)	200.8	2	85-115	<=20	3.7	10	

[1]-Maximum Contaminant Level

[2]-AL (Action Level)

SEVERN TRENT STL

Drinking Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/L)	RL (mg/L)	MCL[1] (mg/L)
General Chemistry							
Alkalinity, total, as CaCO3	2320B/310.1	5	80-120	<=30	1.0	1.0	
Bromate	300.1B	6	90-110	<=30	0.0031	0.010	0.01
Bromide	300.0A	7	90-110	<=30	0.068	1.0	
Bromide	300.1B	6	90-110	<=30	0.068	1.0	
Carbon, total organic (TOC)	415.1	5	80-120	<=25	0.50	1.0	
Chlorate	300.1B	6	90-110	<=30	0.0020	0.010	
Chloride	300.0A	7	90-110	<=30	0.034	1.0	
Chloride	325.2/4500-Cl-E	5/4	85-115	<=30	0.24	1.0	
Chlorite	300.1B	6	90-110	<=30	0.0040	0.020	1
Color (apparent)	2120B/110.1	4/5	NA	<=40	NA	5 PCU	
Conductivity (specific conductance)	2510B/120.1	4/5	90-110	<=10	NA	5.0 uS/cm	
Corrosivity-Saturation Index	2330B	4	NA	NA	NA	NA	
Cyanide, free	335.4/4500-CN-E	5/4	85-115	<=20	0.0050	0.010	0.2
Fluoride	300.0A	7	90-110	<=30	0.010	0.10	4
Fluoride	4500-F-C/340.2 (undistilled)	4/5	85-115	<=30	0.10	0.20	4
Foaming agents (MBAS, surfactants)	425.1/5540C	5/4	70-130	<=30	0.050	0.10	
Hardness, total,as CaCO3 (calculation)	2340B	4	NA	NA	NA	3.3	
Hardness, total, as as CaCO3 (titrimetric)	2340C/130.2	4/5	75-125	<=30	10	10	
Hydrogen ion (pH)	150.1	5	63-158	<=40	NA	NA	
Nitrate(as N) (ion chromatography)	300.0A	7	90-110	<=30	0.0090	0.10	10
Nitrate(as N)(colorimetric)	353.2 /4500-NO3-F	5/4	80-120	<=30	0.010	0.050	10
Nitrite(as N) (ion chromatography)	300.0A	7	90-110	<=30	0.0080	0.050	1
Nitrite(as N)(colorimetric)	353.2 /4500-NO3-	5/4	80-120	<=30	0.0033	0.050	1
Odor	140.1/2150B	5/4	NA	NA	NA	1 TON	
Oil & Grease	1664 (HEM)/9071	8	78-114	<=18	0.85	5.0	
Oil & Grease	413.2	5	60-140	<=30	0.13	1.0	
Oxygen, dissolved	360.1 /4500 O-G	5/4	NA	<=30	NA	0.10	
Oxygen, dissolved	360.2 /4500 O-C	5/4	NA	<=30	NA	0.10	
Perchlorate	314.0	9	90-110	<=30	0.00043	0.0020	
pH (hydrogen ion)	150.1	5	63-158	<=40	NA	NA	
Phenolics, total recoverable	420.1	5/4	75-125	<=30	0.0090	0.050	
Phosphorus,Orthophosphate (as P)	365.2/4500-P-E	5/4	90-110	<=30	0.0090	0.050	
Phosphorus, total (as P)	365.4 /4500P-F	5/4	60-140	<=40	0.034	0.10	
Residue, dissolved (Total Dissolved Solids-TDS)	160.1/2540C	4/5	80-120	<=25	NA	5.0	
Specific conductance	2510B/120.1	5/4	90-110	<=10	NA	5.0 uS/cm	
Specific gravity	2710F	4	NA	<=20	NA	NA	
Sulfate (ion chromatrography)	300.0A	7	90-110	<=30	0.081	1.0	
Sulfate (turbidimetric)	4500-SO4-E/ 375.4	4/5	75-125	<=30	2.4	5.0	
Surfactants (MBAS)	425.1/5540C	5/4	70-130	<=30	0.050	0.10	

SEVERN TRENT STL

Drinking Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (mg/L)	RL (mg/L)	MCL[1] (mg/L)
Total Organic Carbon (TOC)	415.1	5	80-120	<=25	0.50	1.0	
Turbidity	180.1/2130B	5/4	90-110	<=30	0.10 NTU	0.10 NTU	
UV-254 Absorbing Substances	5910B	4	80-120	<=30	0.003 absorbance units	0.009 absorbance units	
Microbiological Parameters							
Coliform, total MF	9222B	4	NA	<=200	NA	1 col/100 mL	
Plate count, heterotrophic	9215B	4	NA	NA	NA	1000 CFU/L	
[1]-Maximum Contaminant Level							

SEVERN TRENT STL

Drinking Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)	MCL[1] (ug/L)
Microextractables in Drinking Water by GC/EC							
Dibromochloropropane (DBCP)	504.1	10	70-130	<=30	0.0055	0.020	0.2
Ethylene dibromide (EDB)	504.1	10	70-130	<=30	0.0082	0.020	0.05
1,2,3-trichloropropane (TCP)	504.1	10	70-130	<=30	0.057	0.20	
Chloral Hydrate	551.1	11	80-120	<=20	0.18	0.50	
Monochloroacetic acid (MCAA)	552.2	12	80-120	<=20	0.98	2.3	60(*)
Monobromoacetic acid (MBAA)	552.2	12	80-120	<=20	0.59	1.5	
Dichloroacetic acid (DCAA)	552.2	12	80-120	<=20	0.81	2.3	
Trichloroacetic acid (TCAA)	552.2	12	80-120	<=20	0.35	0.75	
Dibromoacetic acid (DBAA)	552.2	12	80-120	<=20	0.38	0.75	

(*) MCL is for sum of five haloacetic acids (HAA5)

[1]-Maximum Contaminant Level

SEVERN TRENT STL

Drinking Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)	MCL[1] (ug/L)
Chlorinated Pesticides and PCBs as Aroclors in Drinking Water by GC/EC							
Technical Chlordane	508/508.1	13	70-130	<=30	0.068	0.25	2
Toxaphene	508/508.1	13	70-130	<=30	0.38	2.5	3
PCB 1016	508/508.1	13	70-130	<=30	0.16	0.50	0.5
PCB 1221	508/508.1	13	70-130	<=30	0.13	0.50	0.5
PCB 1232	508/508.1	13	70-130	<=30	0.12	0.50	0.5
PCB 1242	508/508.1	13	70-130	<=30	0.060	0.50	0.5
PCB 1248	508/508.1	13	70-130	<=30	0.11	0.50	0.5
PCB 1254	508/508.1	13	70-130	<=30	0.13	0.50	0.5
PCB 1260	508/508.1	13	70-130	<=30	0.11	0.50	0.5
Non-Routine (These targets are routinely analyzed by 525.2)							
Gamma BHC (Lindane)	508/508.1	13	70-130	<=30	0.0056	0.025	0.2
Endrin	508/508.1	13	70-130	<=30	0.010	0.050	2
Heptachlor	508/508.1	13	70-130	<=30	0.0068	0.025	0.4
Heptachlor epoxide	508/508.1	13	70-130	<=30	0.0048	0.025	0.2
Methoxychlor	508/508.1	13	70-130	<=30	0.014	0.25	40
Aldrin	508/508.1	13	70-130	<=30	0.0057	0.025	
Alpha BHC	508/508.1	13	70-130	<=30	0.0047	0.025	
Beta BHC	508/508.1	13	70-130	<=30	0.0048	0.025	
Delta BHC	508/508.1	13	70-130	<=30	0.0039	0.025	
4,4'-DDD	508/508.1	13	70-130	<=30	0.0065	0.050	
4,4'-DDE	508/508.1	13	70-130	<=30	0.0094	0.050	
4,4'-DDT	508/508.1	13	70-130	<=30	0.0082	0.050	
Dieldrin	508/508.1	13	70-130	<=30	0.0070	0.050	
Endosulfan I	508/508.1	13	70-130	<=30	0.0048	0.025	
Endosulfan II	508/508.1	13	70-130	<=30	0.010	0.050	
Endosulfan sulfate	508/508.1	13	70-130	<=30	0.0083	0.050	
Endrin aldehyde	508/508.1	13	70-130	<=30	0.0088	0.050	
Surrogates							
2,4,5,6-Tetrachloro-m-xylene	508/508.1	13	70-130	<=30	NA	NA	
Decachlorobiphenyl	508/508.1	13	70-130	<=30	NA	NA	

[1]-Maximum Contaminant Level

SEVERN TRENT STL

Drinking Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)	MCL[1] (ug/L)
Chlorinated Herbicides in Drinking Water by GC/EC							
2,4-D	515.1	14	70-130	<=30	0.12	0.50	70
2,4-DB	515.1	14	30-130	<=30	0.086	0.50	
2,4,5-T	515.1	14	70-130	<=30	0.036	0.50	
2,4,5-TP (Silvex)	515.1	14	70-130	<=30	0.030	0.50	50
Dalapon	515.1	14	70-130	<=30	0.89	10	200
Dicamba	515.1	14	70-130	<=30	0.059	0.50	
Dinoseb	515.1	14	30-130	<=30	0.034	3.0	7
Pentachlorophenol	515.1	14	70-130	<=30	0.090	1.0	1
Picloram	515.1	14	70-130	<=30	0.096	0.50	500
Surrogate							
2,4-Dichlorophenylacetic Acid	515.1	14	70-130	NA	NA	NA	

[1]-Maximum Contaminant Level

SEVERN TRENT STL

Drinking Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)	MCL[1] (ug/L)
HPLC and Endothall							
Aldicarb (MS)	531.1	15	80-120	<=20	1.0	2.5	
Aldicarb sulfone	531.1	15	80-120	<=20	1.0	2.5	
Aldicarb sulfoxide	531.1	15	80-120	<=20	1.0	2.5	
Carbaryl	531.1	15	80-120	<=20	1.0	2.5	
Carbofuran (MS)	531.1	15	80-120	<=20	1.0	2.5	40
3-Hydroxycarbofuran	531.1	15	80-120	<=20	1.0	2.5	
Methiocarb	531.1	15	80-120	<=20	1.0	2.5	
Methomyl	531.1	15	80-120	<=20	1.0	2.5	
Oxamyl (MS)	531.1	15	80-120	<=20	1.0	2.5	200
Propoxur (Baygon)	531.1	15	80-120	<=20	1.0	2.5	
Glyphosate	547	16	70-130	<=30	10	25	700
Diquat	549.2	17	70-130	<=30	1.6	5.0	20
Paraquat	549.2	17	70-130	<=30	1.8	5.0	
Endothall	548.1	18	80-120	<=30	2.5	10	100

[1]-Maximum Contaminant Level

SEVERN TRENT STL

Drinking Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)	MCL[1] (ug/L)
Semivolatiles							
Acenaphthylene	525.2	19	70-130	<=30	0.043	0.20	
Acetochlor	525.2	19	70-130	<=30	0.19	0.50	
Alachlor	525.2	19	70-130	<=30	0.076	0.20	2
Aldrin	525.2	19	70-130	<=30	0.1	0.20	
Ametryn	525.2	19	70-130	<=30	0.32	0.50	
Anthracene	525.2	19	70-130	<=30	0.03	0.20	
Atrazine	525.2	19	70-130	<=30	0.087	0.20	3
benz[a]anthracene	525.2	19	70-130	<=30	0.043	0.20	
Benzo[b]fluoranthene	525.2	19	70-130	<=30	0.056	0.20	
Benzo[k]fluoranthene	525.2	19	70-130	<=30	0.096	0.20	
Benzo[g,h,i]perylene	525.2	19	70-130	<=30	0.057	0.20	
Benzo[a]pyrene	525.2	19	70-130	<=30	0.038	0.20	0.2
Bromacil	525.2	19	70-130	<=30	0.15	0.50	
Butachlor	525.2	19	70-130	<=30	0.084	0.50	
Butylate	525.2	19	70-130	<=30	0.045	0.20	
Butylbenzylphthalate	525.2	19	70-130	<=30	0.099	0.50	
Chlordane, (alpha-chlordane)	525.2	19	70-130	<=30	0.066	0.50	2
Chlordane, (gamma-chlordane)	525.2	19	70-130	<=30	0.056	0.20	2
Chlordane, (trans-nonachlor)	525.2	19	70-130	<=30	0.067	0.50	2
Chlorneb	525.2	19	70-130	<=30	0.12	0.50	
Chlorobenzilate	525.2	19	70-130	<=30	2.6	5.0	
2-Chlorobiphenyl	525.2	19	70-130	<=30	0.033	0.50	
Chlorpropham	525.2	19	70-130	<=30	0.13	0.20	
Chlorpyrifos	525.2	19	70-130	<=30	0.095	0.50	
Chlorthalonil	525.2	19	70-130	<=30	0.082	0.20	
Chrysene	525.2	19	70-130	<=30	0.057	0.20	
Cycloate	525.2	19	70-130	<=30	0.082	0.20	
DCPA (Dacthal)	525.2	19	70-130	<=30	0.054	0.20	
4,4-DDD	525.2	19	70-130	<=30	0.078	0.50	
4,4'-DDT	525.2	19	70-130	<=30	0.097	0.50	
4,4'-DDE	525.2	19	70-130	<=30	0.054	0.20	
Dibenzo[a,h]anthracene	525.2	19	70-130	<=30	0.06	0.20	
Di-n-butylphthalate	525.2	19	70-130	<=30	0.33	1.0	
2,3-dichlorobiphenyl	525.2	19	70-130	<=30	0.061	0.20	
Dichlorvos	525.2	19	70-130	<=30	0.094	0.20	
Dieldrin	525.2	19	70-130	<=30	0.13	0.50	
di(2-ethylhexyl)adipate	525.2	19	70-130	<=30	0.094	0.50	400
di(2-ethylhexyl)phthalate	525.2	19	70-130	<=30	0.56	2.0	6
Diethylphthalate	525.2	19	70-130	<=30	0.12	0.50	
Dimethylphthalate	525.2	19	70-130	<=30	0.081	0.50	
2,4-dinitrotoluene	525.2	19	70-130	<=30	0.059	0.20	
2,6-dinitrotoluene	525.2	19	70-130	<=30	0.09	0.20	

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Drinking Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)	MCL[1] (ug/L)
Diphenamid	525.2	19	70-130	<=30	0.084	0.20	
Endosulfan I	525.2	19	70-130	<=30	0.1	0.50	
Endosulfan II	525.2	19	70-130	<=30	0.14	0.50	
Endosulfan sulfate	525.2	19	70-130	<=30	0.074	0.50	
Endrin	525.2	19	70-130	<=30	0.14	0.50	2
Endrin aldehyde	525.2	19	70-130	<=30	0.25	1.0	
EPTC	525.2	19	70-130	<=30	0.053	0.20	
Ethoprop	525.2	19	70-130	<=30	0.11	0.50	
Etridiazole	525.2	19	70-130	<=30	0.079	0.20	
Fenarimol	525.2	19	70-130	<=30	0.35	1.0	
Fluorene	525.2	19	70-130	<=30	0.053	0.20	
Fluridone	525.2	19	70-130	<=30	0.087	0.50	
HCH, alpha (a-BHC)	525.2	19	70-130	<=30	0.074	0.20	
HCH, beta (b-BHC)	525.2	19	70-130	<=30	0.093	0.20	
HCH, delta (d-BHC)	525.2	19	70-130	<=30	0.093	0.20	
HCH, gamma (Lindane) (g-BHC)	525.2	19	70-130	<=30	0.057	0.20	0.2
Heptachlor	525.2	19	70-130	<=30	0.087	0.20	0.4
Heptachlor epoxide	525.2	19	70-130	<=30	0.064	0.20	0.2
2,2',3,3',4,4',6-heptachlorobiphenyl	525.2	19	70-130	<=30	0.057	0.20	
Hexachlorobenzene	525.2	19	70-130	<=30	0.058	0.20	1
2,2',4,4',5,6'-hexachlorobiphenyl	525.2	19	70-130	<=30	0.05	0.20	
Hexachlorocyclopentadiene	525.2	19	70-130	<=30	0.5	2.0	50
Hexazinone	525.2	19	70-130	<=30	0.078	0.50	
Indeno [1,2,3-c,d] pyrene	525.2	19	70-130	<=30	0.059	0.20	
Isophorone	525.2	19	70-130	<=30	0.076	0.20	
Metolachlor	525.2	19	70-130	<=30	0.065	0.20	
Methoxychlor	525.2	19	70-130	<=30	0.069	0.50	40
Methyl paraoxon	525.2	19	70-130	<=30	0.11	0.50	
Metribuzin	525.2	19	70-130	<=30	0.085	0.20	
Mevinphos	525.2	19	70-130	<=30	0.13	0.50	
MGK 264 – isomer a	525.2	19	70-130	<=30	0.042	0.20	
MGK 264 – isomer b	525.2	19	70-130	<=30	0.015	0.20	
Molinate	525.2	19	70-130	<=30	0.072	0.20	
Napropamide	525.2	19	70-130	<=30	0.084	0.50	
Norflurazon	525.2	19	70-130	<=30	0.083	0.50	
2,2',3',4,6-octachlorobiphenyl	525.2	19	70-130	<=30	0.063	0.20	
Pebulate (Tillam)	525.2	19	70-130	<=30	0.089	0.20	
2,2',3',4,6-pentachlorobiphenyl	525.2	19	70-130	<=30	0.038	0.20	
Permethrin, cis	525.2	19	70-130	<=30	0.11	0.50	
Permethrin, trans	525.2	19	70-130	<=30	0.015	0.50	
Phenanthrene	525.2	19	70-130	<=30	0.045	0.20	
Prometryn	525.2	19	70-130	<=30	0.26	1.0	
Pronamide	525.2	19	70-130	<=30	0.094	0.20	
Propachlor	525.2	19	70-130	<=30	0.096	0.20	

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Drinking Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)	MCL[1] (ug/L)
Propazine	525.2	19	70-130	<=30	0.092	0.20	
Pyrene	525.2	19	70-130	<=30	0.041	0.20	
Simazine	525.2	19	70-130	<=30	0.11	0.50	4
Simetryn	525.2	19	70-130	<=30	0.31	1.0	
Stirofos	525.2	19	70-130	<=30	0.074	0.50	
Tebuthiuron	525.2	19	70-130	<=30	0.47	2.0	
Terbacil	525.2	19	70-130	<=30	0.15	0.50	
Terbutryn	525.2	19	70-130	<=30	0.3	1.0	
2,2',4,4'-tetrachlorobiphenyl	525.2	19	70-130	<=30	0.048	0.50	
Triademefon	525.2	19	70-130	<=30	0.21	1.0	
2,4,5-trichlorobiphenyl	525.2	19	70-130	<=30	0.048	0.20	
Tricyclazole	525.2	19	70-130	<=30	0.16	0.50	
Trifluralin	525.2	19	70-130	<=30	0.08	0.20	
Vernolate	525.2	19	70-130	<=30	0.08	0.20	
Internal Standards							
Acenaphthene-d10	525.2	19	70-130	NA	NA	NA	
Chrysene-d12	525.2	19	70-130	NA	NA	NA	
Phenanthrene-d10	525.2	19	70-130	NA	NA	NA	
Surrogates							
1,3-dimethyl-2-nitrobenzene	525.2	19	70-130	NA	NA	NA	
Perylene-d12	525.2	19	70-130	NA	NA	NA	
Triphenylphosphate	525.2	19	70-130	NA	NA	NA	
[1]-Maximum Contaminant Level							

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Drinking Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)	MCL[1] (ug/L)
Volatiles in Drinking Water by GC/MS							
Benzene	524.2	20	70-130	<=30	0.20	1.0	5
Carbon tetrachloride	524.2	20	70-130	<=30	0.14	1.0	5
Chlorobenzene	524.2	20	70-130	<=30	0.22	1.0	100
1,2-Dichlorobenzene	524.2	20	70-130	<=30	0.092	1.0	600
1,4-Dichlorobenzene	524.2	20	70-130	<=30	0.078	1.0	75
1,2-Dichloroethane	524.2	20	70-130	<=30	0.16	1.0	5
1,1-Dichloroethene	524.2	20	70-130	<=30	0.20	1.0	7
Cis-1,2-Dichloroethene	524.2	20	70-130	<=30	0.11	1.0	70
Trans-1,2-Dichloroethene	524.2	20	70-130	<=30	0.18	1.0	100
1,2-Dichloropropane	524.2	20	70-130	<=30	0.14	1.0	5
Ethylbenzene	524.2	20	70-130	<=30	0.12	1.0	700
Methylene chloride	524.2	20	70-130	<=30	0.15	1.0	5
Styrene	524.2	20	70-130	<=30	0.074	1.0	100
Tetrachloroethene	524.2	20	70-130	<=30	0.11	1.0	5
Toluene	524.2	20	70-130	<=30	0.18	1.0	1000
1,2,4-Trichlorobenzene	524.2	20	70-130	<=30	0.23	1.0	70
1,1,1-Trichloroethane	524.2	20	70-130	<=30	0.15	1.0	200
1,1,2-Trichloroethane	524.2	20	70-130	<=30	0.16	1.0	5
Trichloroethene	524.2	20	70-130	<=30	0.22	1.0	5
Vinyl chloride	524.2	20	70-130	<=30	0.10	1.0	2
Total Xylenes[2]	524.2	20	70-130	<=30	0.44	2.0	10000
Trihalomethanes (total)[3]	524.2	20	70-130	<=30	0.68	4.0	100
Chloroform	524.2	20	70-130	<=30	0.32	1.0	
Bromodichloromethane	524.2	20	70-130	<=30	0.085	1.0	
Bromoform	524.2	20	70-130	<=30	0.18	1.0	
Dibromochloromethane	524.2	20	70-130	<=30	0.10	1.0	
Bromobenzene	524.2	20	70-130	<=30	0.15	1.0	
Bromochloromethane	524.2	20	70-130	<=30	0.090	1.0	
Bromomethane	524.2	20	70-130	<=30	0.35	1.0	
n-Butylbenzene	524.2	20	70-130	<=30	0.094	1.0	
Sec-Butylbenzene	524.2	20	70-130	<=30	0.13	1.0	
Tert-Butylbenzene	524.2	20	70-130	<=30	0.13	1.0	
Chloroethane	524.2	20	70-130	<=30	0.14	1.0	
Chloromethane	524.2	20	70-130	<=30	0.31	1.0	
2-Chlorotoluene	524.2	20	70-130	<=30	0.14	1.0	
4-Chlorotoluene	524.2	20	70-130	<=30	0.12	1.0	
1,2-Dibromo-3-chloropropane	524.2	20	70-130	<=30	0.19	1.0	
1,2-Dibromoethane	524.2	20	70-130	<=30	0.11	1.0	
Dibromomethane	524.2	20	70-130	<=30	0.20	1.0	
1,3-Dichlorobenzene	524.2	20	70-130	<=30	0.11	1.0	

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Drinking Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)	MCL[1] (ug/L)
Volatiles in Drinking Water by GC/MS							
Dichlorodifluoromethane	524.2	20	70-130	<=30	0.062	1.0	
1,1-Dichloroethane	524.2	20	70-130	<=30	0.15	1.0	
1,3-Dichloropropane	524.2	20	70-130	<=30	0.15	1.0	
2,2-Dichloropropane	524.2	20	70-130	<=30	0.22	1.0	
1,1-Dichloropropene	524.2	20	70-130	<=30	0.17	1.0	
Cis-1,3-Dichloropropene	524.2	20	70-130	<=30	0.11	1.0	
trans-1,3-Dichloropropene	524.2	20	70-130	<=30	0.10	1.0	
Hexachlorobutadiene	524.2	20	70-130	<=30	0.22	1.0	
Isopropylbenzene	524.2	20	70-130	<=30	0.015	1.0	
4-Isopropyltoluene	524.2	20	70-130	<=30	0.075	1.0	
Methyl t-butyl ether (MTBE)	524.2	20	70-130	<=30	0.092	2	
Naphthalene	524.2	20	70-130	<=30	0.29	1.0	
n-Propylbenzene	524.2	20	70-130	<=30	0.12	1.0	
1,1,1,2-Tetrachloroethane	524.2	20	70-130	<=30	0.11	1.0	
1,1,2,2-Tetrachloroethane	524.2	20	70-130	<=30	0.090	1.0	
1,2,3-Trichlorobenzene	524.2	20	70-130	<=30	0.15	1.0	
Trichlorofluoromethane	524.2	20	70-130	<=30	0.10	1.0	
1,2,3-Trichloropropane	524.2	20	70-130	<=30	0.18	1.0	
1,2,4-Trimethylbenzene	524.2	20	70-130	<=30	0.12	1.0	
1,3,5-Trimethylbenzene	524.2	20	70-130	<=30	0.11	1.0	
o-Xylene	524.2	20	70-130	<=30	0.15	1.0	
m-Xylene and p-Xylene	524.2	20	70-130	<=30	0.28	1.0	
Surrogates							
p-Bromofluorobenzene	524.2	20	70-130	<=30	NA	NA	
1,2-Dichlorobenzene-d4	524.2	20	70-130	<=30	NA	NA	

1-MCL Maximum contamination level

2- total Xylenes is sum of o and m&p isomers

3-total THM is sum of chloroform, dichlorobromomethane, dibromochloromethane, and bromoform

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Drinking Water Parameters

PARAMETER	METHOD	REF	ACC (%REC)	PREC (%RPD)	MDL (ug/L)	RL (ug/L)	MRL (ug/L)
UCMR List 1							
DCPA mono- acid degradate	515.1	14	*	*	*	*	*
DCPA di- acid degradate	515.1	14	70-130	<=30	0.22	1.0	1
MTBE	524.2	20	70-130	<=30	0.22	2.0	5
Nitrobenzene	524.2	20	70-130	<=30	1.4	10	10
Acetochlor	525.2	19	70-130	<=30	0.19	0.50	2
2,4-Dintrotoluene	525.2	19	70-130	<=30	0.059	0.20	2
2,6-Dintrotoluene	525.2	19	70-130	<=30	0.09	0.20	2
4,4'-DDE	525.2	19	70-130	<=30	0.054	0.20	0.8
EPTC	525.2	19	70-130	<=30	0.053	0.20	1
Molinate	525.2	19	70-130	<=30	0.072	0.20	0.9
Terbacil	525.2	19	70-130	<=30	0.15	0.50	2
Perchlorate	314.0	9	85-115	<=15	0.43	2.0	4

(*) The mono- acid degradate of DCPA is not currently available; only the di-acid degradate is reported.

MRL is the minimum reporting limit

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REFERENCES AND NOTES FOR APPENDIX J

Accuracy and precision control limits are primarily derived from method-specific criteria.

ABBREVIATIONS USED IN THE APPENDICES

PARAMETER-refers to the compound, analyte or measurement being tested; the field of testing

METHOD-refers to the reference method used to measure the parameter

REF-a number designation that corresponds to the method references and citations

ACC-accuracy measured as percent recovery

PREC-precision measured as relative percent difference

RL-reporting limit

MDL-method detection limit

MCL-maximum contamination level

MRL-minimum reporting limit (UCMR list)

ICP-inductively coupled (argon) plasma

ICP-inductively coupled (argon) plasma coupled to a mass spectrometer

GFAA -graphite furnace atomic absorption

CVAA - cold vapor atomic absorption

IC - ion chromatography

GC/HECD - gas chromatograph equipped with a Hall electrolytic conductivity detector

GC/PID- gas chromatograph equipped with a photoionization detector

GC/FID - gas chromatograph equipped with a flame ionization detector

GC/EC - gas chromatograph equipped with an electron capture detector

GC/NPD - gas chromatograph equipped with a nitrogen-phosphorus detector

GC/MS - gas chromatrograph equipped with a mass spectrometer

HPLC -high performance liquid chromatography

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REFERENCES AND NOTES FOR APPENDIX J

REF #	REFERENCE
1	EPA 600/R-94/111: "Methods for the Determination of Metals in Environmental Samples" May 1994, Supplement 1.
2	Method 200.8: Determination of Trace Elements in Water and Wastes by ICP/MS. Revision 5.4 (EMMC Version). USEPA Office of Research and Development (1994).
3	EPA 200.9: Determination of Trace Elements by Stabilized Temperature Graphite Furnace Atomic Adsorption Spectrometry; Revision 1.2, April 1991; EPA-EMSL
4	Standard Methods for the Examination of Water and Wastewater, 18th Edition, American Public Health Association, Washington, DC.
5	EPA 600/4-79-020: Methods for Chemical Analysis of Water and Wastes ; U.S. EPA Office of Reseach and Development, Cincinatti, OH, March 1983.
6	NATIONAL EXPOSURE RESEARCH LABORATORY OFFICE OF RESEARCH AND DEVELOPMENT U.S. ENVIRONMENTAL PROTECTION AGENCY CINCINNATI, OHIO 45268.ERRATA COVER SHEET Revision 1.0 John D. Pfaff (USEPA, ORD, NERL) - Method 300.0, (1993) Daniel P. Hautman (USEPA, Office of Water) and David J. Munch (USEPA, Office of Water) - Method 300.1, (1997)
7	Method 300.0 Determination of Inorganic Anions by Ion Chromatography; Revision 2.1, Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
8	Method 1664:N-Hexane Extractable Material (HEM) and Silica Gel Treated N-Hexane Extractable Material (SGT-HEM) by Extraction and Gravimetry (Oil and Grease and Total Petroleum Hydrocarbons), EPA-821-B-94-004b, April 1995.
9	Method 314.0: Determination of Perchlorate in Drinking Water Using Ion Chromatography, Revision 1.0, November 1999. USEPA Office of Water.
10	Methods for the Determination of Organic Compounds in Drinking Water: EPA Method 504.1, Revision 1.1, Munch, J.W. 1995
11	METHOD 551.1 DETERMINATION OF CHLORINATION DISINFECTION BYPRODUCTS, CHLORINATED SOLVENTS, AND HALOGENATED PESTICIDES/HERBICIDES IN DRINKING WATER BY LIQUID-LIQUID EXTRACTION AND GAS CHROMATOGRAPHY WITH ELECTRON-CAPTURE DETECTION Revision 1.0 J.W. Hodgeson, A.L. Cohen - Method 551, (1990) D.J. Munch (USEPA, Office of Water) and D.P. Hautman (International Consultants, Inc.) - Method 551.1, (1995) NATIONAL EXPOSURE RESEARCH LABORATORY OFFICE OF RESEARCH AND DEVELOPMENT U.S. ENVIRONMENTAL PROTECTION AGENCY CINCINNATI, OHIO 45268
12	METHOD 552.2 DETERMINATION OF HALOACETIC ACIDS AND DALAPON IN DRINKING WATER BY LIQUID-LIQUID EXTRACTION, DERIVATIZATION AND GAS CHROMATOGRAPHY WITH ELECTRON CAPTURE DETECTION Revision 1.0 J.W. Hodgeson (USEPA), J. Collins and R.E. Barth (Technology Applications Inc.) –Method 552.0, (1990) J.W. Hodgeson (USEPA), D. Becker (Technology Applications Inc.) - Method 552.1, (1992) D.J. Munch, J.W. Munch (USEPA) and A.M. Pawlecki (International Consultants, Inc.), Method 552.2, Rev. 1.0, (1995) NATIONAL EXPOSURE RESEARCH LABORATORY OFFICE OF RESEARCH AND DEVELOPMENT U.S. ENVIRONMENTAL PROTECTION AGENCY CINCINNATI, OHIO 45268.
13	METHOD 508.1: DETERMINATION OF CHLORINATED PESTICIDES, HERBICIDES, AND ORGANOHALIDES BY LIQUID-SOLID EXTRACTION AND ELECTRON CAPTURE GAS CHROMATOGRAPHY; Revision 2.0; James W. Eichelberger - Revision 1.0, 1994; Jean W. Munch - Revision 2.0, 1995; NATIONAL EXPOSURE RESEARCH LABORATORY OFFICE OF RESEARCH AND DEVELOPMENT U.S. ENVIRONMENTAL PROTECTION AGENCY CINCINNATI, OHIO 45268

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REFERENCES AND NOTES FOR APPENDIX J

14	METHOD 515.1: DETERMINATION OF CHLORINATED ACIDS IN WATER BY GAS CHROMATOGRAPHY WITH AN ELECTRON CAPTURE DETECTOR Revision 4.1 Edited by J.W. Munch (1995) R.C. Dressman and J.J. Lichtenberg - EPA 600/4-81-053, Revision 1.0 (1981) J.W. Hodgeson - Method 515, Revision 2.0 (1986) D. J. Munch (USEPA, Office of Water) and T. Engel (Battelle Columbus Laboratories) - National Pesticide Survey Method 3, Revision 3.0 (1987) R.L. Graves - Method 515.1, Revision 4.0 (1989) NATIONAL EXPOSURE RESEARCH LABORATORY OFFICE OF RESEARCH AND DEVELOPMENT U.S. ENVIRONMENTAL PROTECTION AGENCY CINCINNATI, OHIO 45268
15	METHOD 531.1 MEASUREMENT OF N-METHYLCARBAMOYLOXIMES AND N-METHYL-CARBAMATES IN WATER BY DIRECT AQUEOUS INJECTION HPLC WITH POST COLUMN DERIVATIZATION Revision 3.1 Edited by J.W. Munch (1995) D.L. Foerst - Method 531, Revision 1.0 (1985) T. Engel (Battelle Columbus Laboratories) - National Pesticide Survey Method 5, Revision 2.0 (1987) R.L. Graves - Method 531.1, Revision 3.0 (1989) NATIONAL EXPOSURE RESEARCH LABORATORY OFFICE OF RESEARCH AND DEVELOPMENT U.S. ENVIRONMENTAL PROTECTION AGENCY CINCINNATI, OHIO 45268.531.1-2
16	DETERMINATION OF GLYPHOSATE IN DRINKING WATER BY DIRECT-AQUEOUS-INJECTION HPLC, POST-COLUMN DERIVATIZATION, AND FLUORESCENCE DETECTION July 1990 T.W. Winfield W.J. Bashe (Technology Applications Inc.) T.V. Baker (Technology Applications Inc.) ENVIRONMENTAL MONITORING SYSTEMS LABORATORY OFFICE OF RESEARCH AND DEVELOPMENT U.S. ENVIRONMENTAL PROTECTION AGENCY CINCINNATI, OHIO 45268.METHOD 547
17	METHOD 549.2: DETERMINATION OF DIQUAT AND PARAQUAT IN DRINKING WATER BY LIQUID-SOLID EXTRACTION AND HIGH PERFORMANCE LIQUID CHROMATOGRAPHY WITH ULTRAVIOLET DETECTION; Revision 1.0, June 1997; J.W. Hodgeson (USEPA), W.J. Bashe (Technology Applications Inc.), and J.W. Eichelberger (USEPA) Method 549.1, Revision 1.0 (1992) J.W. Munch (USEPA) and W.J. Bashe (DynCorp/TAI) - Method 549.2, Revision 1.0 (1997) NATIONAL EXPOSURE RESEARCH LABORATORY OFFICE OF RESEARCH AND DEVELOPMENT U.S. ENVIRONMENTAL PROTECTION AGENCY CINCINNATI, OHIO 45268.
18	METHOD 548.1 DETERMINATION OF ENDOTHALL IN DRINKING WATER BY ION EXCHANGE EXTRACTION, ACIDIC METHANOL METHYLATION AND GAS CHROMATOGRAPHY/MASS SPECTROMETRY Revision 1.0 August 1992 Jimmie W. Hodgeson Jeffrey Collins (Technology Applications, Incorporated) W.J. Bashe (Technology Applications, Incorporated) ENVIRONMENTAL MONITORING SYSTEMS LABORATORY OFFICE OF RESEARCH AND DEVELOPMENT U.S. ENVIRONMENTAL PROTECTION AGENCY CINCINNATI, OHIO 45268.548.1-2
19	METHOD 525.2: DETERMINATION OF ORGANIC COMPOUNDS IN DRINKING WATER BY LIQUID-SOLID EXTRACTION AND CAPILLARY COLUMN GAS CHROMATOGRAPHY/MASS SPECTROMETRY Revision 1.0 March 1994; J.W. Eichelberger, T.D. Behymer, W.L. Budde – Method 525, Revision 1.0, 2.0, 2.1 (1988), J.W. Eichelberger, T.D. Behymer, and W.L. Budde – Method 525.1, Revision 2.2 (July 1991), J.W. Eichelberger, J.W. Munch, and J.A. Shoemaker Method 525.2 -- Revision 1.0 (February, 1994). ENVIRONMENTAL MONITORING SYSTEMS LABORATORY OFFICE OF RESEARCH AND DEVELOPMENT U.S. ENVIRONMENTAL PROTECTION AGENCY CINCINNATI, OHIO 45268
20	METHOD 524.2: MEASUREMENT OF PURGEABLE ORGANIC COMPOUNDS IN WATER BY CAPILLARY COLUMN GAS CHROMATOGRAPHY/MASS SPECTROMETRY Revision 4.1 Edited by J.W. Munch (1995) A. Alford-Stevens, J.W. Eichelberger, W.L. Budde - Method 524, Rev. 1.0 (1983) R.W. Slater, Jr. - Revision 2.0 (1986) J.W. Eichelberger, and W.L. Budde - Revision 3.0 (1989) J.W. Eichelberger, J.W. Munch, and T.A. Bellar - Revision 4.0 (1992) NATIONAL EXPOSURE RESEARCH LABORATORY OFFICE OF RESEARCH AND DEVELOPMENT U.S. ENVIRONMENTAL PROTECTION AGENCY CINCINNATI, OHIO 45268

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Appendix H
Routine Target Lists and Parameters

	STL Savannah Routine Target List	Target Analyte/Compound List	Priority Pollutant List	Appendix IX List	Page
Analytes/Compounds on Target Lists[1] Table of Contents					
Metals	X	X	X	X	2
Pesticides and PCBs	X	X	X	X	3-4
Volatiles	X	X	X	X	5-7
Semivolatiles	X	X	X	X	8-11
Dioxins and Furans	X		X	X	12
Chlorinated Herbicides	X			X	13
Phosphorus Pesticides	X			X	14

[1] The RL, MDL, and accuracy and precision criteria for aqueous samples are in Appendix A; the RL, MDL, and Accuracy and precision criteria for soils is in Appendix B.

Target Analytes/Compounds, RL, and Accuracy and Precision Criteria for CLP Statements of Work					
SOW ILMO4.1		Metals/Cyanide			15
SOW OLMO3.2		Pesticides/PCBs			16
SOW OLMO3.2		Volatiles			17
SOW OLMO3.2		Semivoltiles			18-19
SOW OLCO2.1 (low level)		Pesticides/PCBs			20
SOW OLCO2.1 (low level)		Volatiles			21-22
SOW OLCO2.1 (low level)		Semivolatiles			23-24
SOW OLMO.2		Pesticides/PCBs			25
SOW OLMO.2		Volatiles			26-27
SOW OLMO.2		Semivolatiles			28-29

The purpose of this appendix is to define the routine target lists and the CLP Statements of Work target lists supported by STL Savannah. The reporting limits, method detection limits, and QC criteria for non-CLP methods are listed in the appendix appropriate to the sample matrix. The CLP contract required detection limits (CRDL) and QC criteria are listed in this appendix.

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Appendix H
Routine Target Lists and Parameters

PARAMETERS	Routine Target List Methods 6010/7470/ 9012	Target Analyte List CLP SOW ILM04.1	Priority Pollutant List[1] Methods 200.7/ 245.1/ 335.4	Appendix IX List[2] Methods 6010/ 7470/ 9012
Metals				
Aluminum	X	X		
Antimony	X	X	X	X
Arsenic	X	X	X	X
Barium	X	X		X
Beryllium	X	X	X	X
Boron	*			
Cadmium	X	X	X	X
Calcium	X	X		
Chromium	X	X	X	X
Cobalt	X	X		X
Copper	X	X	X	X
Iron	X	X		
Lead	X	X	X	X
Magnesium	X	X		
Manganese	X	X		
Mercury	X	X	X	X
Molybdenum	*			
Nickel	X	X	X	X
Potassium	X	X		
Selenium	X	X	X	X
Silver	X	X	X	X
Sodium	X	X		
Strontium	*			
Thallium	X	X	X	X
Tin	*			X
Titanium	*			
Vanadium	X	X		X
Zinc	X	X	X	X
(*) target analyte may be added to routine 6010 targets				
Cyanide	X	X	X	

Source of Lists:
[1]Priority Pollutant List: 40 CFR 423, Appendix A, 7/1/97
[2]Appendix IX List: 40 CFR 264, Appendix IX, 7/1/97

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Routine Target Lists and Parameters

	Routine Targets	Target Compound List			Priority Pollutant List[1]	Appendix IX List[2]
PARAMETERS	Method 8081	CLP SOW OLM03.2	CLP SOW OLC02.1	CLP SOW OLM04.2	Method 608	Method 8081
Chlorinated Pesticides and PCBs as Aroclors						
Aldrin	X	X	X	X	X	X
alpha-BHC	X	X	X	X	X	X
beta-BHC	X	X	X	X	X	X
gamma-BHC (Lindane)	X	X	X	X	X	X
delta-BHC	X	X	X	X	X	X
Chlordane (technical)					X	X
alpha-Chlordane	X	X	X	X		
gamma-Chlordane	X	X	X	X		
Chlorobenzilate						X
4,4'-DDD	X	X	X	X	X	X
4,4'-DDE	X	X	X	X	X	X
4,4'-DDT	X	X	X	X	X	X
Dieldrin	X	X	X	X	X	X
Endosulfan I	X	X	X	X	X	X
Endosulfan II	X	X	X	X	X	X
Endosulfan sulfate	X	X	X	X	X	X
Endrin	X	X	X	X	X	X
Endrin aldehyde	X	X	X	X	X	X
Endrin ketone	X	X	X	X		
Heptachlor	X	X	X	X	X	X
Heptachlor epoxide	X	X	X	X	X	X
Isodrin						X
Kepone						X
Methoxychlor	X	X	X	X		X
Toxaphene	X	X	X	X	X	X
Surrogates:						
Decachlorobiphenyl	X	X	X	X	X	X
Tetrachloro-m-xylene	X	X	X	X	X	X

Source of Lists:

[1]Priority Pollutant List: 40 CFR 423, Appendix A, 7/1/97

[2]Appendix IX List: 40 CFR 264, Appendix IX, 7/1/97

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Routine Target Lists and Parameters

	Routine Targets	Target Compound List			Priority Pollutant List[1]	Appendix IX List[2]
	Method 8082	CLP SOW OLM03.2	CLP SOW OLC02.1	CLP SOW OLM04.2	Method 608 or 8082	Method 8082
Aroclor-1016	X	X	X	X	X	X
Aroclor-1221	X	X	X	X	X	X
Aroclor-1232	X	X	X	X	X	X
Aroclor-1242	X	X	X	X	X	X
Aroclor-1248	X	X	X	X	X	X
Aroclor-1254	X	X	X	X	X	X
Aroclor-1260	X	X	X	X	X	X
Surrogates:						
Decachlorobiphenyl	X	X	X	X	X	X
Tetrachloro-m-xylene	X	X	X	X	X	X

Source of Lists:

[1]Priority Pollutant List: 40 CFR 423, Appendix A, 7/1/97

[2]Appendix IX List: 40 CFR 264, Appendix IX, 7/1/97

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Appendix H
Routine Target Lists and Parameters

	Routine Targets	Target Compound List[1]			Priority Pollutant List[1]	Appendix IX List[2]
PARAMETERS	Method 8260	CLP SOW OLM03.2	CLP SOW OLC02.1	CLP SOW OLM04.2	Method 624 or 8260	Method 8260
Volatiles						
Acetone	X	X	X	X		X
Acetonitrile						X
Acrolein (Propenal)					X	X
Acrylonitrile					X	X
Benzene	X	X	X	X	X	X
Bromochloromethane			X			
Bromodichloromethane	X	X	X	X	X	X
Bromoform	X	X	X	X	X	X
Bromomethane (Methyl bromide)	X	X	X	X	X	X
2-Butanone (MEK)	X	X	X	X		X
Carbon disulfide	X	X	X	X		X
Carbon tetrachloride	X	X	X	X	X	X
Chlorobenzene	X	X	X	X	X	X
Chloroethane	X	X	X	X	X	X
2-Chloroethylvinyl ether					X	
Chloroform	X	X	X	X	X	X
Chloromethane (Methyl chloride)	X	X	X	X	X	X
3-Chloro-1-propene (Allyl chloride)						X
Cyclohexane				X		
Dibromochloromethane	X	X	X	X	X	X
1,2-Dibromo-3-chloropropane			X	X		X
1,2-Dibromoethane (EDB)			X	X		X
Dibromomethane (Methylene bromide)						X
1,2-Dichlorobenzene	SV**	SV**	X	X	X	SV**
1,3-Dichlorobenzene	SV**	SV**	X	X	X	SV**
1,4-Dichlorobenzene	SV**	SV**	X	X	X	SV**
trans-1,4-Dichloro-2-butene						X
Dichlorodifluoromethane				X		X
1,1-Dichloroethane	X	X	X	X	X	X
1,2-Dichloroethane	X	X	X	X	X	X
1,1-Dichloroethene	X	X	X	X	X	X
cis-1,2- Dichloroethene	(*)	(*)	X	X	(*)	(*)
trans-1-2-Dichloroethene	(*)	(*)	X	X	X	X
1,2-Dichloroethene(total)	X	X				
1,2-Dichloropropane	X	X	X	X	X	X
cis-1-3-Dichloropropene	X	X	X	X	X	X
trans-1-3-Dichloropropene	X	X	X	X	X	

(*) These isomers are not on the referenced list, but are routinely reported when EPA Method 8260 or EPA Method 624 is used.

(**) SV-Dichlorobenzenes are routinely analyzed as semivolatiles employing EPA Method 8270 or EPA Method 625.

Source of Lists:

[1]Priority Pollutant List: 40 CFR 423, Appendix A, 7/1/97

[2]Appendix IX List: 40 CFR 264, Appendix IX, 7/1/97

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Appendix H
Routine Target Lists and Parameters

	Routine Targets	Target Compound List[1]			Priority Pollutant List[1]	Appendix IX List[2]
PARAMETERS	Method 8260	CLP SOW OLM03.2	CLP SOW OLC02.1	CLP SOW OLM04.2	Method 624 or 8260	Method 8260
Ethylbenzene	X	X	X	X	X	X
Ethyl methacrylate						X
2-Hexanone	X	X	X	X		X
Iodomethane (Methyl iodide)						X
Isobutanol (Isobutyl alcohol)						X
Isopropylbenzene				X		
Methacrylonitrile						X
Methyl acetate				X		
Methylcyclohexane				X		
Methylene chloride (Dichloromethane)	X	X	X	X	X	X
Methyl methacrylate						X
4-Methyl-2-pentanone (MIBK)	X	X	X	X		X
Methyl-t-butyl ether (MTBE)				X		
Pentachloroethane						X
Propionitrile						X
Styrene	X	X	X	X		X
1,1,1,2-Tetrachloroethane						X
1,1,2,2-Tetrachloroethane	X	X	X	X	X	X
Tetrachloroethene	X	X	X	X	X	X
Toluene	X	X	X	X	X	X
1,2,3-Trichlorobenzne						
1,2,4-Trichlorobenzne			X	X		
1,1,1-Trichloroethane	X	X	X	X	X	X
1,1,2-Trichloroethane	X	X	X	X	X	X
Trichloroethene	X	X	X	X	X	X
Trichlorofluoromethane				X		X
1,2,3-Trichloropropane						X
1,1,2-Trichloro-1,2,2-trifluoroethane				X		
Vinyl acetate						X
Vinyl chloride	X	X	X	X	X	X
o-Xylene	(*)	(*)			(*)	(*)
m&p-Xylene	(*)	(*)			(*)	(*)
Xylenes (Total)	X	X	X	X	(*)	X

(*) These isomers are not on the referenced list, but are routinely reported when EPA Method 8260 or EPA Method 624 is used.

Source of Lists:

[1]Priority Pollutant List: 40 CFR 423, Appendix A, 7/1/97

[2]Appendix IX List: 40 CFR 264, Appendix IX, 7/1/97

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Routine Target Lists and Parameters

	Routine Targets	Target Compound List[1]			Priority Pollutant List[1]	Appendix IX List[2]
PARAMETERS	Method 8260	CLP SOW OLM03.2	CLP SOW OLC02.1	CLP SOW OLM04.2	Method 624 or 8260	Method 8260
Surrogates and Deuterated Monitoring Compounds:						
p-Bromofluorobenzene	X	X	X	X	X	X
Dibromofluoromethane	X	X			X	X
1,2-Dichlorobenzene-d4						
1,2-Dichloroethane-d4 (CLP only)		X		X		
Toluene-d8	X	X		X	X	X
Vinyl chloride-d3						
Chlorethane-d3						
1,1-Dichloroethene-d2						
Chloroform-d						
benzene=d6						
1,2-Dichloropropane-d6						
trans-1,3-Dichloropropene-d4						
Bromoform-d						
1,1,2,2-Tetrachloroethane-d2						

Source of Lists:

[1]Priority Pollutant List: 40 CFR 423, Appendix A, 7/1/97

[2]Appendix IX List: 40 CFR 264, Appendix IX, 7/1/97

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Appendix H
Routine Target Lists and Parameters

	Routine Targets	Target Compound List			Priority Pollutant List[1]	Appendix IX List[2]
PARAMETERS	Method 8270	CLP SOW OLM03.2	CLP SOW OLC02.1	CLP SOW OLM04.2	Method 625 or 8270	Method 8270
Semivolatiles						
Acenaphthene	X	X	X	X	X	X
Acenaphthylene	X	X	X	X	X	X
Acetophenone				X		X
2-Acetylaminofluorene						X
4-Aminobiphenyl						X
Aniline						X
Anthracene	X	X	X	X	X	X
Aramite (total)						X
Atrazine				X		
Benzaldehyde				X		
Benzidine					X	
Benzo(a)anthracene	X	X	X	X	X	X
Benzo(b)fluoranthene	X	X	X	X	X	X
Benzo(k)fluoranthene	X	X	X	X	X	X
Benzo(g,h,i)perylene	X	X	X	X	X	X
Benzo(a)pyrene	X	X	X	X	X	X
Benzyl alcohol						X
1,1-Biphenyl				X		
4-Bromophenylphenyl ether	X	X	X	X	X	X
Butylbenzylphthalate	X	X	X	X	X	X
Caprolactam				X		
Carbazole	X	X		X		
4-Chloroaniline (p-Chloroaniline)	X	X	X	X		X
bis(2-Chloroethoxy)methane	X	X	X	X	X	X
bis(2-Chloroethyl)ether	X	X	X	X	X	X
4-Chloro-3-methylphenol (p-Chloro-m-cresol)	X	X	X	X	X	X
2-Chloronaphthalene	X	X	X	X	X	X
2-Chlorophenol	X	X	X	X	X	X
4-Chlorophenylphenyl ether	X	X	X	X	X	X
Chrysene	X	X	X	X	X	X
Diallate (total)						X
Dibenzo(a,h)anthracene	X	X	X	X	X	X
Dibenzofuran	X	X	X	X		X
Di-n-butylphthalate	X	X	X	X	X	X

Source of Lists:

[1]Priority Pollutant List: 40 CFR 423, Appendix A, 7/1/97

[2]Appendix IX List: 40 CFR 264, Appendix IX, 7/1/97

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Appendix H
Routine Target Lists and Parameters

	Routine Targets	Target Compound List			Priority Pollutant List[1]	Appendix IX List[2]
PARAMETERS	Method 8270	CLP SOW OLM03.2	CLP SOW OLC02.1	CLP SOW OLM04.2	Method 625 or 8270	Method 8270
1,2-Dichlorobenzene (o-Dichlorobenzene)	X	X			VOA**	X
1,3-Dichlorobenzene (m-Dichlorobenzene)	X	X			VOA**	X
1,4-Dichlorobenzene (p-Dichlorobenzene)	X	X			VOA**	X
3,3'-Dichlorobenzidine	X	X	X	X	X	X
2,4-Dichlorophenol	X	X	X	X	X	X
2,6-Dichlorophenol						X
Diethylphthalate	X	X	X	X	X	X
Dimethoate						X
p-(Dimethylamino)azobenzene						X
7,12-Dimethylbenz(a)anthracene						X
3,3'-Dimethylbenzidine						X
alpha,alpha-Dimethylphenethylamine						X
2,4-Dimethylphenol	X	X	X	X	X	X
Dimethylphthalate	X	X	X	X	X	X
m-Dinitrobenzene						X
4,6-Dinitro-2-methylphenol (4,6-Dinitro-o-cresol)	X	X	X	X	X	X
2,4-Dinitrophenol	X	X	X	X	X	X
2,4-Dinitrotoluene	X	X	X	X	X	X
2,6-Dinitrotoluene	X	X	X	X	X	X
Dinoseb						X
1,4-Dioxane						X
1,2-Diphenylhydrazine					X	
Di-n-octylphthalate	X	X	X	X	X	X
Disulfoton						X
bis(2-Ethylhexyl)phthalate	X	X	X	X	X	X
Ethyl methanesulfonate						X
Ethyl parathion						X
Famphur						X
Fluoranthene	X	X	X	X	X	X
Fluorene	X	X	X	X	X	X
Hexachlorobenzene	X	X	X	X	X	X
Hexachlorobutadiene	X	X	X	X	X	X
Hexachlorocyclopentadiene	X	X	X	X	X	X
Hexachloroethane	X	X	X	X	X	X
Hexachlorophene						X

**VOA - For Priority Pollutants, Dichlorobenzenes are routinely analyzed as volatiles by EPA Method 8260 or EPA Method 624.

Source of Lists:

[1]Priority Pollutant List: 40 CFR 423, Appendix A, 7/1/97

[2]Appendix IX List: 40 CFR 264, Appendix IX, 7/1/97

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Routine Target Lists and Parameters

	Routine Targets	Target Compound List			Priority Pollutant List[1]	Appendix IX List[2]
PARAMETERS	Method 8270	CLP SOW OLM03.2	CLP SOW OLC02.1	CLP SOW OLM04.2	Method 625 or 8270	Method 8270
Hexachloropropene						X
Indeno(1,2,3-cd)pyrene	X	X	X	X	X	X
Isophorone	X	X	X	X	X	X
Isosafrole						X
Methapyrilene						X
3-Methylcholanthrene						X
Methyl methanesulfonate						X
2-Methylnaphthalene	X	X	X	X		X
Methyl parathion						X
2-Methylphenol (o-Cresol)	X	X	X	X		X
3-Methylphenol (m-Cresol)						X
4-Methylphenol (p-Cresol)	X	X	X	X		X
Naphthalene	X	X	X	X	X	X
1,4-Naphthoquinone						X
1-Naphthylamine						X
2-Naphthylamine						X
2-Nitroaniline (o-Nitroaniline)	X	X	X	X		X
3-Nitroaniline (m-Nitroaniline)	X	X	X	X		X
4-Nitroaniline (p-Nitroaniline)	X	X	X	X		X
Nitrobenzene	X	X	X	X	X	X
2-Nitrophenol (o-Nitrophenol)	X	X	X	X	X	X
4-Nitrophenol (p-Nitrophenol)	X	X	X	X	X	X
5-Nitro-o-toluidine						X
4-Nitroquinoline-1-oxide						X
N-Nitrosodi-n-butylamine						X
N-Nitrosodiethylamine						X
N-Nitrosodimethylamine					X	X
N-Nitrosomethylethylamine						X
N-Nitrosodiphenylamine	X	X	X	X	X	X
N-Nitrosodi-n-propylamine	X	X	X	X	X	X
N-Nitrosomorpholine						X
N-Nitrosopiperidine						X
N-Nitrosopyrrolidine						X
2,2'-Oxybis(1-chloropropane) [bis(2-Chloroisopropyl)ether]	X	X	X	X	X	X
Pentachlorobenzene						X
Pentachloronitrobenzene						X
Pentachlorophenol	X	X	X	X	X	X
Phenacetin						X
Phenanthrene	X	X	X	X	X	X

Source of Lists:

[1]Priority Pollutant List: 40 CFR 423, Appendix A, 7/1/97

[2]Appendix IX List: 40 CFR 264, Appendix IX, 7/1/97

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Routine Target Lists and Parameters

	Routine Targets	Target Compound List			Priority Pollutant List[1]	Appendix IX List[2]
PARAMETERS	Method 8270	CLP SOW OLM03.2	CLP SOW OLC02.1	CLP SOW OLM04.2	Method 625 or 8270	Method 8270
Phenol	X	X	X	X	X	X
1,4-Phenylenediamine (p-Phenylenediamine)						X
Phorate						X
2-Picoline						X
Pronamide						X
Pyrene	X	X	X	X	X	X
Pyridine						X
Safrole						X
Sulfotepp						X
1,2,4,5-Tetrachlorobenzene						X
2,3,4,6-Tetrachlorophenol						X
Thionazin						X
o-Toluidine						X
1,2,4-Trichlorobenzene	X	X			X	X
2,4,5-Trichlorophenol	X	X	X	X		X
2,4,6-Trichlorophenol	X	X	X	X	X	X
1,3,5-Trinitrobenzene						X
O,O,O-Triethyl phosphorothioate						X
Surrogates and Deuterated Monitoring Compounds						
2-Fluorobiphenyl	X	X			X	X
2-Fluorophenol	X	X			X	X
Nitrobenzene-d5	X	X			X	X
Phenol-d5	X	X			X	X
Terphenyl-d14	X	X			X	X
2,4,6-Tribromophenol	X	X			X	X
2-Chlorophenol-d4		X				
1,2-Dichlorobenzene-d4		X				
Bis(2-chloroethyl) ether-d8						
2-Methylphenol-d4						
4-methylphenol-d8						
2-Nitrophenol-d4						
2,4-Dichlorophenol-d3						
4-Chloroananiline-d4						
Dimethylphthalate-d6						
Acenaphthylene-d8						
4-Nitrophenol-d4						
Fluoranthene-d10						
4,6-Dintro-2-methylphenol-d2						
Pyrene-d10						
Benzo(a) pyrene-d12						

Source of Lists:

[1]Priority Pollutant List: 40 CFR 423, Appendix A, 7/1/97

[2]Appendix IX List: 40 CFR 264, Appendix IX, 7/1/97

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Routine Target Lists and Parameters

PARAMETERS	Routine Targets Method 8280	Priority Pollutant List[1] Method 613	Appendix IX List[2] Method 8280
Dioxins and Furans			
Tetrachlorodibenzo-p-dioxins	X		X
Tetrachlorodibenzofurans	X		X
Pentachlorodibenzo-p-dioxins	X		X
Pentachlorodibenzofurans	X		X
Hexachlorodibenzo-p-dioxins	X		X
Hexachlorodibenzofurans	X		X
Heptachlorodibenzo-p-dioxins	X		
Heptachlorodibenzofurans	X		
Octachlorodibenzo-p-dioxins	X		
Octachlorodibenzofurans	X		
2,3,7,8-Tetrachlorodibenzo-p-dioxin	X	X	X

Source of Lists:

[1]Priority Pollutant List: 40 CFR 423, Appendix A, 7/1/97

[2]Appendix IX List: 40 CFR 264, Appendix IX, 7/1/97

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Appendix H
Routine Target Lists and Parameters

PARAMETERS	Routine Targets Method 8151	Appendix IX List[1] Method 8151
Chlorinated Herbicides		
2,4-D	X	X
2,4-DB	X	
2,4,5-T	X	X
2,4,5-TP (Silvex)	X	X
Dalapon	X	
Dicamba	X	
Dichloroprop	X	
Dinoseb	X	
MCPA [(4-chloro-2-methylphenoxy)- acetic acid]	X	
MCPP [2- (4-chloro-2-methylphenoxy)- propanoic acid]	X	
Pentachlorophenol	X	
Surrogate:		
2,4-Dichlorophenyl acetic acid (DCAA)	X	X

Source of Lists:
[1]Appendix IX List: 40 CFR 264, Appendix IX, 7/1/97

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Routine Target Lists and Parameters

PARAMETERS	Routine Targets Method 8141	Appendix IX List[1] Method 8141
Phosphorus-containing Pesticides		
Azinphos methyl	X	
Bolstar (sulprofos)	X	
Chlorpyrifos	X	
Coumaphos	X	
Demeton-O	X	
Demeton-S	X	
Diazinon	X	
Dichlorvos	X	
Dimethoate	X	X[2]
Disulfoton	X	X[2]
EPN	X	
Ethoprop	X	
Ethyl parathion (Parathion)	X	X[2]
Famphur	X	X[2]
Fensulfothion	X	
Fenthion	X	
Malathion	X	
Merphos	X	
Methyl parathion	X	X[2]
Mevinphos	X	
Monochrotophos	X	
Naled	X	
Phorate	X	X[2]
Ronnel	X	
Stirophos	X	
Sulfotepp (Tetraethyl dithiopyrophosphate)	X	X[2]
Thionazin (O,O-Diethyl-O-pyrazinyl phosphorothioate)	X	X[2]
Tokuthion	X	
Trichloronate	X	
Surrogates:		
Triphenylphosphate	X	X

Source of Lists:
[1]Appendix IX List: 40 CFR 264, Appendix IX, 7/1/97
[2] Appendix IX list is routinely analyzed as 8270

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Appendix H
Routine Target Lists and Parameters

PARAMETERS	Aqueous			Soils/Sediments		
	CRDL (ug/L)	%REC	%RPD	CRDL (mg/kg)	%REC	%RPD
Metals - CLP SOW ILMO4.1						
Aluminum	200	80-120	<=20	40	75-125	<=20
Antimony	60	80-120	<=20	12	75-125	<=20
Arsenic	10	80-120	<=20	2.0	75-125	<=20
Barium	200	80-120	<=20	40	75-125	<=20
Beryllium	5.0	80-120	<=20	1.0	75-125	<=20
Cadmium	5.0	80-120	<=20	1.0	75-125	<=20
Calcium	5000	80-120	<=20	1000	75-125	<=20
Chromium	10	80-120	<=20	2.0	75-125	<=20
Cobalt	50	80-120	<=20	10	75-125	<=20
Copper	25	80-120	<=20	5.0	75-125	<=20
Iron	100	80-120	<=20	20	75-125	<=20
Lead	3.0	80-120	<=20	0.60	75-125	<=20
Magnesium	5000	80-120	<=20	1000	75-125	<=20
Manganese	15	80-120	<=20	3.0	75-125	<=20
Mercury	0.20	80-120	<=20	0.050	75-125	<=20
Nickel	40	80-120	<=20	8.0	75-125	<=20
Potassium	5000	80-120	<=20	1000	75-125	<=20
Selenium	5.0	80-120	<=20	1.0	75-125	<=20
Silver	10	80-120	<=20	2.0	75-125	<=20
Sodium	5000	80-120	<=20	1000	75-125	<=20
Thallium	10	80-120	<=20	2.0	75-125	<=20
Vanadium	50	80-120	<=20	10	75-125	<=20
Zinc	20	80-120	<=20	4.0	75-125	<=20
Cyanide, total	10	85-115	<=20	0.50	85-115	<=25

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Appendix H
Routine Target Lists and Parameters

PARAMETERS	Aqueous			Soils/Sediments		
	CRDL (ug/L)	%REC	%RPD	CRDL (ug/kg)	%REC	%RPD
Pesticides and PCBs - CLP SOW OLM3.2						
alpha-BHC	0.05			1.7		
beta-BHC	0.05			1.7		
delta-BHC	0.05			1.7		
gamma-BHC (Lindane)	0.05	56-123	<=15	1.7	46-127	<=50
Heptachlor	0.05	40-131	<=20	1.7	35-130	<=31
Aldrin	0.05	40-120	<=22	1.7	34-132	<=43
Heptachlor epoxide	0.05			1.7		
Endosulfan I	0.05			1.7		
Dieldrin	0.1	52-126	<=18	3.3	31-134	<=38
4,4'-DDE	0.1			3.3		
Endrin	0.1	56-121	<=21	3.3	42-139	<=45
Endosulfan II	0.1			3.3		
4,4'-DDD	0.1			3.3		
Endosulfan sulfate	0.1			3.3		
4,4'-DDT	0.1	38-127	<=27	3.3	23-134	<=50
Methoxychlor	0.5			17		
Endrin ketone	0.1			3.3		
Endrin aldehyde	0.1			3.3		
alpha-Chlordane	0.05			1.7		
gamma-Chlordane	0.05			1.7		
Toxaphene	5			170		
Aroclor 1016	1			33		
Aroclor 1221	2			67		
Aroclor 1232	1			33		
Aroclor 1242	1			33		
Aroclor 1248	1			33		
Aroclor 1254	1			33		
Aroclor 1260	1			33		
System Monitoring Compounds						
2,3,4,5-Tetrachloro-m-xylene		30-150			30-150	
Decachlorobiphenyl		30-150			30-150	

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Routine Target Lists and Parameters

PARAMETERS	Aqueous			Soils/Sediments		
	CRDL (ug/L)	%REC	%RPD	CRDL (ug/kg)	%REC	%RPD
Volatiles - CLP SOW OLMO3.2						
Chloromethane	10			10		
Vinyl chloride	10			10		
Bromomethane	10			10		
Chloroethane	10			10		
1,1-Dichloroethene	10	61-145	<=14	10	59-172	<=22
Acetone	10			10		
Carbon disulfide	10			10		
Methylene chloride	10			10		
trans-1,2-Dichloroethene	10			10		
1,1-Dichloroethane	10			10		
cis-1,2-Dichloroethene	10			10		
2-Butanone	10			10		
Chloroform	10			10		
1,1,1-Trichloroethane	10			10		
Carbon tetrachloride	10			10		
Benzene	10	76-127	<=11	10	66-142	<=21
1,2-Dichloroethane	10			10		
Trichloroethene	10	71-120	<=14	10	62-137	<=24
1,2-Dichloropropane	10			10		
Bromodichloromethnae	10			10		
cis-1,3-Dichloropropene	10			10		
4-Methyl-2-pentanone	10			10		
Toluene	10	76-125	<=13	10	59-139	<=21
trans-1,3-Dichloropropene	10			10		
1,1,2-Trichloroethane	10			10		
Tetrachloroethene	10			10		
2-Hexanone	10			10		
Dibromochloromethane	10			10		
1,2-Dibromoethane	10			10		
Chlorobenzene	10	75-130	<=13	10	60-133	<=21
Ethylbenzene	10			10		
Xylenes (total)	10			10		
Styrene	10			10		
Bromoform	10			10		
1,1,2,2-Tetrachloroethane	10			10		
System Monitoring Compounds						
Toluene-d8		88-110			84-138	
4-Bromofuorobenzene		86-115			59-113	
1,2-Dichloroethane-d4		76-114			70-121	

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Appendix H
Routine Target Lists and Parameters

PARAMETERS	Aqueous			Soils/Sediments		
	CRDL (ug/L)	%REC	%RPD	CRDL (ug/kg)	%REC	%RPD
Semivolatiles - CLP SOW OLMO3.2						
Phenol	10	12-110	<=42	330	26-90	<=35
Bis(2-Chloroethyl)ether	10			330		
2-Chlorophenol	10	27-123	<=40	330	25-102	<=50
1,3-Dichlorobenzene	10			330		
1,4-Dichlorobenzene	10	36-97	<28	330	28-104	<27
1,2-Dichlorobenzene	10			330		
2-Methylphenol	10			330		
2,2'-oxybis(1-Chloropropane)	10			330		
4-Methylphenol	10			330		
N-Nitroso-di-n-propylamine	10	41-116	<=38	330	41-126	<=38
Hexachloroethane	10			330		
Nitrobenzene	10			330		
Isophorone	10			330		
2-Nitrophenol	10			330		
2,4-Dimethylphenol	10			330		
Bis(2-Chloroethoxy)methane	10			330		
2,4-Dichlorophenol	10			330		
1,2,4-Trichlorobenzene	10	39-98	<=28	330	38-107	<=23
Naphthalene	10			330		
4-Chloroaniline	10			330		
Hexachlorobutadiene	10			330		
4-Chloro-3-methylphenol	10	23-97	<=42	330	26-103	<=33
2-Methylnaphthalene	10			330		
Hexachlorocyclopentadiene	10			330		
2,4,6-Trichlorophenol	10			330		
2,4,5-Trichlorophenol	25			830		
2-Chloronaphthalene	10			330		
2-Nitroaniline	25			830		
Dimethylphthalate	10			330		
2,6-Dinitrotoluene	10			330		
Acenaphthylene	10			330		
3-Nitroaniline	25			830		
Acenaphthene	10	46-118	<=31	330	31-137	<=19
2,4-Dinitrophenol	25			830		
4-Nitrophenol	25	10-80	<=50	830	11-114	<=50
Dibenzofuran	10			330		
2,4-Dintrotoluene	10	24-96	<=38	330	28-89	<=47
Diethylphthalate	10			330		
Fluorene	10			330		
4-Chlorophenyl phenyl ether	10			330		

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PARAMETERS	Aqueous			Soils/Sediments		
	CRDL (ug/L)	%REC	%RPD	CRDL (ug/kg)	%REC	%RPD
4-Nitroaniline	25			830		
4,6-Dintro-2-methylphenol	25			830		
N-Nitrosodiphenylamine	10			330		
4-Bromophenyl phenyl ether	10			330		
Hexachlorobenzene	10			330		
Pentachlorophenol	25	9-103	<=50	830	17-109	<=47
Phenathrene	10			330		
Anthracene	10			330		
Carbazole	10			330		
Di-n-butylphthalate	10			330		
Fluoranthene	10			330		
Pyrene	10	26-127	<=31	330	35-142	<=36
Butylbenzylphthalate	10			330		
3,3'-Dichlorobenzidine	10			330		
Benzo(a)anthracene	10			330		
Chrysene	10			330		
Bis(2-ethylhexyl)phthalate	10			330		
Di-n-octylphthalate	10			330		
Benzo(b)fluoranthene	10			330		
Benzo(k)fluoranthene	10			330		
Benzo(a)pyrene	10			330		
Indeno(1,2,3-cd)pyrene	10			330		
Dibenz(a,h)anthracene	10			330		
Benzo(g,h,i)perylene	10			330		
System Monitoring Compounds						
2-Fluorophenol		21-110			25-121	
Phenol-d6		10-110			24-113	
2,4,6-Tribromphenol		10-123			19-122	
Nitrobenzene-d5		35-114			23-120	
2-Fluorobiphenyl		43-116			30-115	
Terphenyl-d14		33-141			18-137	
2-Chlorophenol-d4 (advisory)		33-110			20-130	
1,2-Dichlorobenzene-d4 (advisory)		16-110			20-130	

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PARAMETERS	CRDL(ug/L)	%REC
Pesticides and PCBs - OLCO2.1		
alpha-BHC	0.01	
beta-BHC	0.01	
delta-BHC	0.01	
gamma-BHC (Lindane)	0.01	50-120
Heptaclor	0.01	
Aldrin	0.01	
Heptachlor epoxide	0.01	50-150
Endosulfan I	0.01	
Dieldrin	0.02	30-130
4,4'-DDE	0.02	50-150
Endrin	0.02	50-120
Endosulfan II	0.02	
4,4'-DDD	0.02	
Endosulfan sulfate	0.02	50-120
4,4'-DDT	0.02	
Methoxychlor	0.1	
Endrin ketone	0.02	
Endrin aldehyde	0.02	
alpha-Chlordane	0.01	
gamma-Chlordane	0.01	30-130
Toxaphene	1	
Aroclor 1016	0.2	
Aroclor 1221	0.4	
Aroclor 1232	0.2	
Aroclor 1242	0.2	
Aroclor 1248	0.2	
Aroclor 1254	0.2	
Aroclor 1260	0.2	
System Monitoring Compounds		
2,3,4,5-Tetrachloro-m-xylene		30-150
Decachlorobiphenyl		30-150

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PARAMETERS	CRDL(ug/L)	%REC
Volatiles - OLCO2.1		
Chloromethane	1	
Vinyl chloride	1	60-140
Bromomethane	1	
Chloroethane	1	
1,1-Dichloroethene	1	
Acetone	5	
Carbon disulfide	1	
Methylene chloride	2	
trans-1,2-Dichloroethene	1	
1,1-Dichloroethane	1	
cis-1,2-Dichloroethene	1	
2-Butanone	5	
Bromochloromethane	1	
Chloroform	1	
1,1,1-Trichloroethane	1	
Carbon tetrachloride	1	60-140
Benzene	1	60-140
1,2-Dichloroethane	1	60-140
Trichloroethene	1	60-140
1,2-Dichloropropane	1	
Bromodichloromethnae	1	
cis-1,3-Dichloropropene	1	60-140
4-Methyl-2-pentanone	5	
Toluene	1	
trans-1,3-Dichloropropene	1	
1,1,2-Trichloroethane	1	60-140
Tetrachloroethene	1	60-140
2-Hexanone	5	
Dibromochloromethane	1	
1,2-Dibromoethane	1	60-140
Chlorobenzene	1	
Ethylbenzene	1	
Xylenes (total)	1	
Styrene	1	
Bromoform	1	60-140

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PARAMETERS	CRDL(ug/L)	%REC
1,1,2,2-Tetrachloroethane	1	
1,3-Dichlorobenzene	1	
1,4-Dichlorobenzene	1	60-140
1,2-Dichlorobenzene	1	
1,2-Dibromo-3-chloropropane	1	
1,2,4-Trichlorobenzene	1	
System Monitoring Compound(s)-		
Toluene-d8		
4-Bromofuorobenzene		80-120
1,2-Dichloroethane-d4		

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PARAMETERS	CRDL(ug/L)	%REC
Semivolatiles - OLCO2.1		
Phenol	5	40-120
Bis(2-Chloroethyl)ether	5	50-110
2-Chlorophenol	5	50-110
2-Methylphenol	5	
2,2'-oxybis(1-Chloropropane)	5	
4-Methylphenol	5	
N-Nitroso-di-n-propylamine	5	30-110
Hexachloroethane	5	20-110
Nitrobenzene	5	
Isophorone	5	50-110
2-Nitrophenol	5	
2,4-Dimethylphenol	5	
Bis(2-Chloroethoxy)methane	5	
2,4-Dichlorophenol	5	
Naphthalene	5	
4-Chloroaniline	5	30-110
Hexachlorobutadiene	5	
4-Chloro-3-methylphenol	5	
2-Methylnaphthalene	5	
Hexachlorocyclopentadiene	5	
2,4,6-Trichlorophenol	5	40-120
2,4,5-Trichlorophenol	20	
2-Chloronaphthalene	5	
2-Nitroaniline	20	
Dimethylphthalate	5	
2,6-Dinitrotoluene	5	
Acenaphthylene	5	
3-Nitroaniline	20	
Acenaphthene	5	
2,4-Dinitrophenol	20	
4-Nitrophenol	20	
Dibenzofuran	5	
2,4-Dintrotoluene	5	30-120
Diethylphthalate	5	50-120
Fluorene	5	
4-Chlorophenyl phenyl ether	5	
4-Nitroaniline	20	
4,6-Dintro-2-methylphenol	20	
N-Nitrosodiphenylamine	5	30-110
4-Bromophenyl phenyl ether	5	
Hexachlorobenzene	5	40-120
Pentachlorophenol	20	

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PARAMETERS	CRDL(ug/L)	%REC
Phenathrene	5	
Anthracene	5	
Di-n-butylphthalate	5	
Fluoranthene	5	
Pyrene	5	
Butylbenzylphthalate	5	
3,3'-Dichlorobenzidine	5	
Benzo(a)anthracene	5	
Chrysene	5	
Bis(2-ethylhexyl)phthalate	5	
Di-n-octylphthalate	5	
Benzo(b)fluoranthene	5	
Benzo(k)fluoranthene	5	
Benzo(a)pyrene	5	50-120
Indeno(1,2,3-cd)pyrene	6	
Dibenz(a,h)anthracene	5	
Benzo(g,h,i)perylene	5	
System Monitoring Compounds		
2-Fluorophenol		15-121
Phenol-d6		15-115
2,4,6-Tribromphenol		15-130
Nitrobenzene-d5		23-120
2-Fluorobiphenyl		30-115
Terphenyl-d14		18-140
2-Chlorophenol-d4 (advisory)		
1,2-Dichlorobenzene-d4 (advisory)		

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Routine Target Lists and Parameters

PARAMETERS	Aqueous			Soils/Sediments		
	CRDL (ug/L)	%REC	%RPD	CRDL (ug/kg)	%REC	%RPD
Pesticides and PCBs - CLP SOW OLMO4.2						
alpha-BHC	0.05			1.7		
beta-BHC	0.05			1.7		
delta-BHC	0.05			1.7		
gamma-BHC (Lindane)	0.05	56-123	<=15	1.7	46-127	<=50
Heptaclor	0.05	40-131	<=20	1.7	35-130	<=31
Aldrin	0.05	40-120	<=22	1.7	34-132	<=43
Heptachlor epoxide	0.05			1.7		
Endosulfan I	0.05			1.7		
Dieldrin	0.1	52-126	<=18	3.3	31-134	<=38
4,4'-DDE	0.1			3.3		
Endrin	0.1	56-121	<=21	3.3	42-139	<=45
Endosulfan II	0.1			3.3		
4,4'-DDD	0.1			3.3		
Endosulfan sulfate	0.1			3.3		
4,4'-DDT	0.1	38-127	<=27	3.3	23-134	<=50
Methoxychlor	0.5			17		
Endrin ketone	0.1			3.3		
Endrin aldehyde	0.1			3.3		
alpha-Chlordane	0.05			1.7		
gamma-Chlordane	0.05			1.7		
Toxaphene	5			170		
Aroclor 1016	1			33		
Aroclor 1221	2			67		
Aroclor 1232	1			33		
Aroclor 1242	1			33		
Aroclor 1248	1			33		
Aroclor 1254	1			33		
Aroclor 1260	1			33		
System Monitoring Compounds						
2,3,4,5-Tetrachloro-m-xylene		30-150			30-150	
Decachlorobiphenyl		30-150			30-150	

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Routine Target Lists and Parameters

PARAMETERS	Aqueous			Soils/Sediments		
	CRDL (ug/L)	%REC	%RPD	CRDL (ug/kg)	%REC	%RPD
Volatiles - CLP SOW OLMO4.2						
Dichlorodifluoromethane	10			10		
Chloromethane	10			10		
Vinyl chloride	10			10		
Bromomethane	10			10		
Chloroethane	10			10		
Trichorofluoromethane	10			10		
1,1-Dichloroethene	10	61-145	<=14	10	59-172	<=22
1,1,2-Trichloro-1,2,2-trifluoroethane	10			10		
Acetone	10			10		
Carbon disulfide	10			10		
Methyl acetate	10			10		
Methylene chloride	10			10		
trans-1,2-Dichloroethene	10			10		
Methyl tert-Butyl ether	10			10		
1,1-Dichloroethane	10			10		
cis-1,2-Dichloroethene	10			10		
2-Butanone	10			10		
Chloroform	10			10		
1,1,1-Trichloroethane	10			10		
Cyclohexane	10			10		
Carbon tetrachloride	10			10		
Benzene	10	76-127	<=11	10	66-142	<=21
1,2-Dichloroethane	10			10		
Trichloroethene	10	71-120	<=14	10	62-137	<=24
Methylcyclohexane	10			10		
1,2-Dichloropropane	10			10		
Bromodichloromethnae	10			10		
cis-1,3-Dichloropropene	10			10		
4-Methyl-2-pentanone	10			10		
Toluene	10	76-125	<=13	10	59-139	<=21
trans-1,3-Dichloropropene	10			10		
1,1,2-Trichloroethane	10			10		
Tetrachloroethene	10			10		
2-Hexanone	10			10		
Dibromochloromethane	10			10		
1,2-Dibromoethane	10			10		
Chlorobenzene	10	75-130	<=13	10	60-133	<=21
Ethylbenzene	10			10		
Xylenes (total)	10			10		

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PARAMETERS	Aqueous			Soils/Sediments		
	CRDL (ug/L)	%REC	%RPD	CRDL (ug/kg)	%REC	%RPD
Styrene	10			10		
Bromoform	10			10		
Isopropylbenzene	10			10		
1,1,2,2-Tetrachloroethane	10			10		
1,3-Dichlorobenzene	10			10		
1,4-Dichlorobenzene	10			10		
1,2-Dichlorobenzene	10			10		
1,2-Dibromo-3-chloropropane	10			10		
1,2,4-Trichlorobenzene	10			10		
System Monitoring Compound(s)-						
Toluene-d8		88-110			84-138	
4-Bromofuorobenzene		86-115			59-113	
1,2-Dichloroethane-d4		76-114			70-121	

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PARAMETERS	Aqueous			Soils/Sediments		
	CRDL (ug/L)	%REC	%RPD	CRDL (ug/kg)	%REC	%RPD
Semivolatiles - CLP SOW OLMO4.2						
Benzaldehyde	10			330		
Phenol	10	12-110	<=42	330	26-90	<=35
Bis(2-Chloroethyl)ether	10			330		
2-Chlorophenol	10	27-123	<=40	330	25-102	<=50
2-Methylphenol	10			330		
2,2'-oxybis(1-Chloropropane)	10			330		
Acetophenone	10			330		
4-Methylphenol	10			330		
N-Nitroso-di-n-propylamine	10	41-116	<=38	330	41-126	<=38
Hexachloroethane	10			330		
Nitrobenzene	10			330		
Isophorone	10			330		
2-Nitrophenol	10			330		
2,4-Dimethylphenol	10			330		
Bis(2-Chloroethoxy)methane	10			330		
2,4-Dichlorophenol	10			330		
Naphthalene	10			330		
4-Chloroaniline	10			330		
Hexachlorobutadiene	10			330		
Caprolactam	10			330		
4-Chloro-3-methylphenol	10	23-97	<=42	330	26-103	<=33
2-Methylnaphthalene	10			330		
Hexachlorocyclopentadiene	10			330		
2,4,6-Trichlorophenol	10			330		
2,4,5-Trichlorophenol	25			830		
1,1'-Biphenyl	10			330		
2-Chloronaphthalene	10			330		
2-Nitroaniline	25			830		
Dimethylphthalate	10			330		
2,6-Dinitrotoluene	10			330		
Acenaphthylene	10			330		
3-Nitroaniline	25			830		
Acenaphthene	10	46-118	<=31	330	31-137	<=19
2,4-Dinitrophenol	25			830		
4-Nitrophenol	25	10-80	<=50	830	11-114	<=50
Dibenzofuran	10			330		
2,4-Dintrotoluene	10	24-96	<=38	330	28-89	<=47
Diethylphthalate	10			330		
Fluorene	10			330		
4-Chlorophenyl phenyl ether	10			330		

SEVERN TRENT STL

Appendix H
Routine Target Lists and Parameters

PARAMETERS	Aqueous			Soils/Sediments		
	CRDL (ug/L)	%REC	%RPD	CRDL (ug/kg)	%REC	%RPD
4-Nitroaniline	25			830		
4,6-Dintro-2-methylphenol	25			830		
N-Nitrosodiphenylamine	10			330		
4-Bromophenyl phenyl ether	10			330		
Hexachlorobenzene	10			330		
Atrazine	10			330		
Pentachlorophenol	25	9-103	<=50	830	17-109	<=47
Phenathrene	10			330		
Anthracene	10			330		
Carbazole	10			330		
Di-n-butylphthalate	10			330		
Fluoranthene	10			330		
Pyrene	10	26-127	<=31	330	35-142	<=36
Butylbenzylphthalate	10			330		
3,3'-Dichlorobenzidine	10			330		
Benzo(a)anthracene	10			330		
Chrysene	10			330		
Bis(2-ethylhexyl)phthalate	10			330		
Di-n-octylphthalate	10			330		
Benzo(b)fluoranthene	10			330		
Benzo(k)fluoranthene	10			330		
Benzo(a)pyrene	10			330		
Indeno(1,2,3-cd)pyrene	10			330		
Dibenz(a,h)anthracene	10			330		
Benzo(g,h,i)perylene	10			330		
System Monitoring Compounds						
2-Fluorophenol		21-110			25-121	
Phenol-d6		10-110			24-113	
2,4,6-Tribromphenol		10-123			19-122	
Nitrobenzene-d5		35-114			23-120	
2-Fluorobiphenyl		43-116			30-115	
Terphenyl-d14		33-141			18-137	
2-Chlorophenol-d4 (advisory)		33-110			20-130	
1,2-Dichlorobenzene-d4 (advisory)		16-110			20-130	

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APPENDIX D

ARCADIS

Infrastructure, environment, buildings

APPENDIX D
HEALTH AND SAFETY PLAN

LAKE CALUMET CLUSTER SITE
CHICAGO, ILLINOIS

ORIGINAL: MAY 2005
REVISION NO. 1: AUGUST 2005

Part of a bigger picture

ARCADIS

Health and Safety Plan

Lake Calumet Cluster Site
Chicago, Illinois

Prepared for:
Lake Calumet Cluster Site Group

Prepared by:
ARCADIS G&M, Inc.
35 E. Wacker Drive
Chicago, IL 60601
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Our Ref.:
CI001286.0004

Date:
Original: May 2005
Revision No. 1: August 2005

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Review and Approval

Site Name: **Lake Calumet Cluster**

Jack Kratzmeyer Project Manager	Signature	08/26/2005 Date
Ali Senn Task Manager/ Site Health and Safety Officer	Signature	08/26/2005 Date
P. T. Srinivasan Designated HASP Writer	Signature	8/26/05 Date
Michelle Voss Project Health and Safety Manager	Signature	8/26/05 Date
Todd O'Brien Designated HASP Reviewer	Signature	8/26/05 Date

Employee Acknowledgement

The employee's signature below indicates his/her understanding, acceptance, and compliance with the requirements of this Health and Safety Plan ("HASP").

Site Name: **Lake Calumet Cluster**

Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date
Name	Signature	Date

ARCADIS

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Introduction

The provisions of this Site Health and Safety Plan (HASP) are mandatory for all ARCADIS site personnel involved in the Lake Calumet Cluster site. Chemical and physical hazards known to be associated with the project activities are also addressed in this document.

A copy of this HASP is to be provided to all subcontractors prior to the start of work so that the subcontractor is informed of the hazards at the site. While the ARCADIS HASP will be the minimum H&S requirements for the work completed by ARCADIS and its subcontractors, each subcontractor, in coordination with ARCADIS H&S personnel, is expected to perform its operations in accordance with its own HASP, policies and procedures unique to the subcontractor's work to ensure that hazards associated with the performance of the work activities are properly controlled. Copies of any required safety documentation for a subcontractor's work activities will be provided to ARCADIS for review prior to the start of on-site activities.

In the event that the subcontractor's procedures/requirements conflict with requirements specified in this HASP, the more stringent guidance will be adopted after discussion and agreement between the subcontractor and ARCADIS project H&S personnel. Hazards not listed in this HASP, but known to the subcontractor or known to be associated with the subcontractor's services, must be identified and addressed to the ARCADIS Project or Task Manager and SSO prior to beginning work operations.

Operational changes to this HASP that could affect the health or safety of personnel, the community, or the environment will not be made without prior approval of the ARCADIS Project Manager and the cognizant ARCADIS Project Health and Safety Manager (PHSM). This plan meets the requirements for health and safety protection and planning as required by Occupational Safety and Health Administration (OSHA) requirements in Title 29 Code of Federal Regulation, Part 1910 and 1926 as applicable.

ARCADIS claims no responsibility for the use of this HASP by others although visitors to the Site may use this HASP as a guidance document. In any event, ARCADIS does not guarantee the health and/or safety of any person entering this Site. Strict adherence to the health and safety guidelines provided herein will reduce, but not eliminate, the potential for injury at this Site. To this end, health and safety becomes the inherent responsibility of personnel working at the Site.

ARCADIS Policy

As a company, we will operate in compliance with Federal, State, and local regulations regarding health and safety. Senior management is responsible for ensuring that adequate resources are available to comply with health and safety regulations. Senior management is responsible for developing health and safety programs that comply with health and safety regulations.

Regional and local management is responsible for implementing and fostering a positive and proactive regard for company health and safety programs and policies. Employees are responsible for complying with company health and safety policies and programs to ensure their own safety as well as the safety of their coworkers.

A. Emergency Planning

Emergency and Project Telephone Numbers

In the event of a situation or unplanned occurrence requiring assistance, the appropriate contact(s) should be made from the list on the following pages. The Site Health and Safety Officer (SSO) will post the Emergency Contact page at the Site as a ready reference. Where mobile telephones are used for emergency communications, active cellular service will be confirmed from the Site before the initiation of daily work activities.

In the event of any emergency situation, Site personnel will immediately notify the SSO who will initiate emergency response actions. The SSO will determine the need for off-site emergency response assistance. If the SSO determines that on-site personnel can adequately respond and control the situation, the SSO will oversee the response and ensure Site personnel are properly protected and use proper procedures. If not, the SSO will contact appropriate emergency response personnel per the phone list and other personnel as required by the client for assistance. Personal injury or heat/cold exposure requiring immediate medical help, personal medical emergency, or hazardous chemical exposure situations will require the SSO to immediately call the appropriate emergency number for medical assistance (See the emergency phone list).

Potential emergencies may include:

- Personal injury
- Personal exposure
- Fire

- Vehicle accidents
- Severe weather

The SSO will conduct regular site inspections to identify any potential emergency situations for the purposes of avoiding those emergency situations.

First-Aid Kits

The Site personnel will have access to first-aid kits that are protected from the weather, available at all times. First-aid kits will be inspected and restocked, as necessary.

Fire Extinguisher

At a minimum, a 10-pound fire extinguisher capable of extinguishing Class A, B, and C fires will be available for use at the Site. The actual number, size, and type of fire extinguishers will be determined by the SSO. Project personnel will be readily aware of the location of the fire extinguisher and will be trained on when and how to use a fire extinguisher.

POST THIS PAGE IN APPROPRIATE LOCATIONS ON SITE

The SSO will coordinate the entry and exit of response personnel during an emergency and make emergency contacts as necessary from the following list. After immediate notifications are made, the SSO will contact the Project Manager.

Local Police	911
Local Ambulance	911
Local Fire Department	911
Local Hospital – Advocate Trinity Hospital	773.967.2000
Poison Control	800.222.1222
National Response Center (all spills in reportable quantities)	800.424.8802
Project Manager – Jack Kratzmeyer	312.263.6703 (O) 312.339.8475 (C)
Client Contact – Susan Kratzmeyer	[illegible]

Hospital Route

Hospital Name: See Map to Advocate Trinity – Figure 1

Head North on S Torrence Ave for approximately 2.7 miles. Turn slight left onto S Colfax Ave for 0.4 miles. Turn Left onto E 93rd St for 0.3 miles. Follow signs to Emergency Room. **Advocate Trinity Hospital is located at 2320 E 93rd Street, Chicago, Illinois, Illinois.**

First Aid, Fire Protection, and Response Equipment Locations

First Aid Kit: ARCADIS field vehicle

Fire Extinguisher: ARCADIS field vehicle

The Project Manager will make the following notifications:

Corporate Health & Safety Director – Mike Thomas	720.344.3835 (O) 720.308.2147 (C)
Corporate Health & Safety Manager – Pat Vollertsen	720.344.3779 (O)
Regional Health & Safety Manager – Mija Coppola	614.764.2310 (O) 614.554.0401 (C)
Area Health & Safety Representative – Michelle Voss	312.263.6703

B. Organization and Responsibilities

ARCADIS Personnel

The following personnel are designated to carry out Health and Safety (H&S) job functions on the Site. Their responsibilities and the tasks they will be carrying out on the Site are listed below. The same person may fill more than one role.

ARCADIS Project Team	Responsibility and Tasks
Jack Kratzmeyer	**Project Manager** ▪ Initiates HASP development, and reviews and signs the HASP. ▪ Obtains Site-specific health and safety information. ▪ Communicates with the SSO on Site health and safety issues. ▪ Allocates resources for correction of identified unsafe work conditions. ▪ Communicates with the client on health and safety issues. ▪ Ensures ARCADIS Site workers have all training necessary for the project ▪ Finalizes PM Checklist. ▪ Reports all injuries, illnesses and near-misses to the Corporate H&S Manager and Area H&S Representative, assists with incident investigation, and ensures that any recommendations made are implemented. ▪ Communicates H&S program and a copy of the ARCADIS HASP to all subcontractors and receives their acknowledgement of the receipt of such information.
Ali Senn	**Site Health and Safety Officer (SSO)** ▪ Reviews and works in accordance with the components of this HASP. ▪ Ensures that the HASP is available to and reviewed by all Site personnel and reviews that subcontractors have appropriately communicated H&S information. ▪ Ensures that necessary Site-specific training is performed (both initial and "tailgate" safety briefings – Use tailgate form in Attachment 3.) ▪ Ensures that site visitors have been informed of the hazards related to ARCADIS work and precautions to take, and have signed the Site Visitors Log found in Attachment 2. ▪ Ensures that work is performed in a safe manner and has authority to stop work when necessary to protect workers and/or the public. ▪ Coordinates activities during emergency situations. ▪ Ensures that all necessary permits and safety information provided by

ARCADIS Project Team	Responsibility and Tasks
	the client is disseminated to other Site personnel and is maintained in an organized manner. ▪ Communicates with the PM and the PHSM on health and safety issues. ▪ Report all injuries, illnesses and near-misses to the PM and PHSM. ▪ Maintains injury/illness reports and other H&S data as required by the client or regulatory agency (e.g., MSHA Quarterly Report). ▪ Ensures that necessary safety equipment is maintained and used at the Site.
P. T. Srinivasan	**Site Workers** ▪ Read and work in accordance with the components of this HASP. ▪ Report all unsafe working conditions to the SSO. ▪ Report all injuries, no matter how trivial, to the SSO. ▪ Work in a safe manner. ▪ Sign the acceptance log at the beginning of this HASP.
Michelle Voss	**Project Health and Safety Manager (PHSM)** The designated PHSM is responsible for overseeing all aspects of the Site safety program, and preparing any Site-specific health and safety guidance documents or addenda to this plan. The PHSM does not report to the Project Manager, and is separately accountable to the ARCADIS project team senior management for Site health and safety. The PHSM acts as the sole contact to regulatory agencies on matters of safety and health. Other responsibilities include: ▪ Overall authority for Health and Safety compliance and HASP conformance for the project. ▪ General health and safety program administration. ▪ Conducts project health and safety audits as warranted. ▪ Determines the level of personnel protection required. ▪ Updates equipment or procedures based on information obtained during Site operations. ▪ Establishes air-monitoring parameters based on expected contaminants. ▪ Assists in injury, illness and near-miss investigation and follow-up.

C. Project Description

Project Types and Activities

X	Type	Start Date	X	Activities	Start Date
	Remediation			Geophysical Survey	
	Site Assessment/Investigation			Site Visit	
	Phase I Site Assessment			Drum Sampling	
	Regulatory Compliance Audit		X	Topographic Surveying	05/30/2005
	Compliance Program		X	Excavation Trenching	
	Property Decommission			Soil Sampling	
	Demolition		X	Groundwater Sampling	05/30/2005
	Decontamination			Surface Water Sampling	
	Industrial Hygiene Study			Sediment Sampling	
	Construction			Air Sampling	
	Phase 2 Site Assessment		X	Drilling	05/25/2005
	Risk Assessment			Desk Work	
	Site Observations and Inspections		X	Surface Water Sampling from Trench	05/30/2005
X	Hydrogeologic evaluation	05/30/2005			

Scope of Work

ARCADIS was retained by the Site Response Group to remedial investigation activities as documented in Tasks 1 through 5

List of Project Tasks

- Task 1 – Drilling and installation of Monitoring wells
- Task 2 – Perform groundwater sampling event

- Task 3 – Conduct site topographic survey
- Task 4 – Perform trench sampling
- Task 5 – Conduct hydrogeologic evaluation

D. Site Information

Site Name: Lake Calumet Cluster

Client Safety and Health Contact: N/A

Site Contact Name: N/A

Operational Description of Site: (Attach site map if possible) Former manufacturing facility

Current Site Status: ____ Active X ____ Inactive X ____ Industrial

(check all that apply) ____ Commercial ____ Retail ____ Undeveloped

____ Other (describe) ____

Topography and General Environmental Setting: Generally flat.

Accessible by: ____ Major Highway X Main Road ____ 2-Lane Road ____ Dirt Road

Description of the Work Area: (See Figure 2) Industrial facilities.

E. Hazard Evaluation and Control

Project Hazard Analysis

The Project Hazard Analysis below identifies the hazards that are anticipated to be encountered by the project team.

Physical Hazards Present: ☐ None	☒ Heat ☐ Cold ☒ Noise ☐ Walking/working surfaces (includes stairs/rail & floor/wall openings) ☐ Visible dust ☐ LASER ☐ Other:	☒ Holes/Pits ☐ Ionizing radiation ☐ Non-ionizing radiation ☐ Electricity ☒ Severe Weather ☐ Poor lighting ☐ Overhead Hazards ☐ Other:
Chemical Hazards Present: ☐ None	☐ Flammable/combustible ☐ Compressed gas ☐ Explosive ☐ Organic peroxide ☐ Oxidizer ☐ Water reactive ☐ Unstable reactive ☐ Dust/Fumes/Airborne Particulates	☐ Corrosive ☒ Toxic ☐ Highly toxic ☒ Irritant ☐ Sensitizer ☒ Carcinogen ☐ Mutagen ☐ Other:
Mechanical/Equipment Hazards Present: ☐ None	☒ Heavy machinery ☐ Trench/excavation ☐ Boats/Marine operations ☐ Diving operations ☐ Drilling ☐ Forklifts ☐ Water operations (work over water) ☐ Confined space (work in confined space) ☐ Work in underground utilities ☐ Confined space	☒ Power tools ☐ Cranes/Hoists/Rigging ☐ Ladders ☐ Scaffolding ☐ Manlifts ☒ Welding ☐ Gas cylinders ☐ Roadway work ☐ Railroad work ☐ Energized equipment (LOTO) ☐ Drums and containers ☐ Other:
Biological Hazards Present: ☐ None	☐ Animal/human fluids or blood ☐ Animal/human tissue(s) ☒ Poisonous/irritating plants ☐ Other:	☐ Contaminated needles ☐ Live bacterial cultures ☒ Insects/rodents/snakes ☐ Other:
Ergonomic Hazards Present: ☐ None	☐ Repetitive motion ☐ Awkward posture ☐ Lifting ☐ Pushing/pulling ☐ Other:	☒ Limited movement ☐ Forceful exertions ☒ Vibration ☐ Other: ☐ Other:
Personal Safety/Security: ☐ None	☒ Personal safety ☐ Security issue ☐ Project site in isolated area ☒ Employees working alone ☐ Other:	☒ Employees working early/late ☐ Potentially dangerous wildlife ☐ Guard or stray dogs in area ☐ No/limited cell phone service ☐ Other:

Training Required:	☒ 40-hour HAZWOPER ☐ 24-hour HAZWOPER ☐ HAZWOPER site supervisor ☐ OSHA 30-hour Construction ☐ OSHA 10-hour Construction ☒ PPE ☐ Respiratory protection ☐ Chemical hygiene ☐ Hazard communication ☐ Hazardous waste ☐ First aid/CPR ☐ DOT/IATA hazmat transportation ☐ Diving ☐ Other:	☐ Bloodborne pathogens ☐ Confined space ☐ Lockout/tagout ☐ Electricity ☒ Fire extinguishers ☐ Fall protection ☒ Noise exposure ☐ Forklifts ☐ Asbestos ☐ Lead ☐ Cadmium ☐ SPCC ☐ Radiation safety ☐ Client specific
Medical Screening	☒ Medical Surveillance Exam (HAZWOPER) ☐ Client required drug and/or alcohol testing	☐ Blood and/or urine screening for other hazardous substances

Hazard Information

[illegible]	[illegible]	Health Effects	TLV/PEL 8hr TWA	Ionization Potential	Physical Properties	Special Precautions
Benzene	Colorless liquid with aromatic odor	Carcinogen, Fatigue, dermatitis, Irritation in eyes, nose, respiratory systems	0.5 pm	9.25 eV	Please see the MSDS (in Attachment D-6)	Avoid inhalation; work upwind to minimize potential exposure
Toluene	Colorless liquid with aromatic odor like benzene	Fatigue, weakness, dizziness, headache, insomnia, dermatitis	50 ppm	8.82 eV	Please see the MSDS (in Attachment D-6)	Avoid inhalation; work upwind to minimize potential exposure
Ethylbenzene	Colorless liquid with aromatic odor	Irritation to eyes, mucous membranes, headache, dermatitis, narcotic, coma	100 ppm	8.76 eV	Please see the MSDS (in Attachment D-6)	Avoid inhalation; work upwind to minimize potential exposure

Name	Physical Description	Health Effects	TLV/PEL* 8-hr TWA	Ionization Potential	Physical Properties	Special Precautions
Xylenes	Colorless liquid with aromatic odor	Dizziness, excitement, drowsiness, irritation to eyes, nose, throat, nausea, dermatitis	100 ppm	8.44 eV	Please see the MSDS (in Attachment D-6)	Avoid inhalation; work upwind to minimize potential exposure
Methylene Chloride	Colorless liquid with a chloroform-like odor	Fatigue, weakness, sleepiness, light-headedness, dermatitis	25 ppm	11.32 eV	Please see the MSDS (in Attachment D-6)	Avoid inhalation; work upwind to minimize potential exposure

*The TLV (Threshold Limit Value) from the American Conference of Governmental Industrial Hygienists is listed unless the PEL (Permissible Exposure Limit), designated by OSHA, is lower.

eV: Electron-volt

Task Hazards and Control

A general summary of the hazards and an evaluation of those hazards are presented below. Please review the Safety Modules included in Attachment D-2 for additional hazard information.

Task	Hazards	Attachment	Risk Rating (Low, Medium, High)
Task 1	Slip, trip, and fall	D-2	Medium
	Chemical	D-2	Low
	Vibration	D-2	Low
	Noise	D-2	Medium
Task 2	Slip, trip, and fall	D-2	Medium
	Chemical	D-2	Medium
Task 3	Slip, trip and fall	D-2	Medium
	Chemical	D-2	Low

Task	Hazards	Attachment	Relative Hazard Rating* (Low, Medium, High)
Task 4	Slip, trip and fall	D-2	Medium
	Chemical	D-2	Low
	Holes/Pits	D-2	Medium
Task 5	Slip, trip and fall	D-2	Medium
	Chemical	D-2	Low
	Holes/Pits	D-2	Medium

***Relative Hazard Rating Scale**

Hazard is/has	Minimal health effects	Moderate health effects	Severe health effects
Rarely present	LOW	LOW	MED
Sometimes present	LOW	MED	HIGH
Constantly present	MED	HIGH	HIGH

F. Air Monitoring

This section specifies the monitoring equipment to be used on Site and the action levels to upgrade to higher levels of personal protection. All monitoring equipment will be maintained and calibrated in accordance with manufacturer recommendations. All pertinent monitoring data will be logged on the Real Time Air Monitoring Data Form (Attachment 5) and maintained on Site for the duration of project activities. Calibration of all monitoring equipment will be conducted daily and logged on the same form.

A photoionization detector (PID) will be used to monitor the ambient air quality continuously during the field activities. If the PID value shows 10 ppm or higher value for a continuous period of 10 minutes, a Dräger tube will be used to test the ambient air for benzene, and if the benzene value from the Dräger tube analysis shows 1 ppm or more, all field work will be stopped immediately. The SSO shall decide when to resume to the field activity after allowing time for benzene to equilibrate with ambient air and retesting the air quality for benzene.

G. General Site Safety

The following requirements apply to all on-site activities.

Site Access and Control

The SSO will coordinate access and control security at the work Site. The SSO will establish a work area perimeter. Only authorized personnel will be allowed beyond the perimeter. Other site workers and visitors to the Site should be kept out of the work Site. If visitors need access to the Site, the SSO, or his/her designee, will escort the visitor at all times. All visitors will log in and out with the SSO. Visitor log sheets are included in Attachment 2.

If Level C PPE or greater is required on-site, the SSO will establish control boundaries for the Exclusion Zone, Contamination Reduction Zone, and the Support Zone. See Figure 2. The zones will be designated by traffic cones, barricades, signs, caution tape, or other means effective in identifying the different areas. The zones will be identified by the SSO during tailgate meetings. Entrance and exit to the Exclusion Zone will only be through controlled access points established for each work area.

Hazard Communication (HazCom)

All project required chemicals will be handled in accordance with OSHA 29 CFR 1910.1200 and ARCADIS-required procedures. The SSO will act as the HazCom Program Coordinator for the Site and will maintain the Master Inventory List (MIL) of hazardous chemicals kept on the job Site. The SSO will maintain Material Safety Data Sheets (MSDS) on Site for all chemicals. MSDS will be located in the SSO field vehicle. The SSO will communicate the location of the MSDS and the hazards associated with these chemicals to all project Site ARCADIS employees and subcontractors during the safety orientation. This information will be reviewed during tailgate briefings, especially if new chemicals or materials are introduced on Site.

The SSO will ensure that all containers of chemicals (including drums, bags, pails, tanks, vessels, etc.), are labeled appropriately: The contents of the container, the proper name of the chemical, associated hazards and appropriate hazard warnings, and the name and address of the manufacturer/importer. Chemicals will not be accepted or allowed on Site that are not properly labeled. If transferred to a secondary container, the new container will be labeled as described.

The SSO will ensure that the PPE necessary for work around the particular chemical is available and that project Site employees have been trained in its use.

The Project Manager will ensure that all project personnel have received Hazard Communication training as required in OSHA 29 CFR 1910.1200 (h).

Personal Hygiene

Field personnel and Site visitors should avoid contact with potentially contaminated substances, such as puddles, pools, mud, etc. Smoking, eating and drinking will not be permitted within any controlled work area at any time. Field workers and Site visitors should wash their hands and face after leaving the Site prior to eating or drinking. Consumption of alcoholic beverages is prohibited at the Site.

Site Awareness

All field personnel and Site visitors should remain alert for any indications of potentially dangerous situations, (e.g., strong, irritating, or nauseating odors; heavy equipment; conditions of an excavation; etc.).

Field personnel will be familiar with the physical characteristics and requirements of the work Site, including:

- Accessibility to equipment and vehicles
- Communication (i.e., methods, restrictions, or limitations)
- Site access
- Emergency procedures and evacuation assembly points
- Location of protective and emergency equipment and relevant first-aid procedures.

Personnel Ratio Requirements

All on-site personnel will operate using the buddy system whenever possible. If ARCADIS personnel must work alone, refer to the Personal Safety Module in Attachment D-2.

Communication

Effective communication is essential to safe working conditions and the successful completion of field projects. During on-site activities, cellular phones will be used by ARCADIS Site personnel to maximize communications with emergency response units. Active cellular telephone service will be confirmed from the Site prior to the initiation of work activities. In the event of a catastrophic event, any notice to evacuate will be given verbally by the SSO and via air horn or radio as appropriate. Communication details will be provided at the Site safety orientation.

Personnel will attempt to remain in communication or within sight of the ARCADIS SSO or designee. The ARCADIS SSO will indicate the need to evacuate the Site by verbal command or through radio or telephone communication.

H. Personal Protective Equipment

This section lists the equipment that must be present on the Site and used during the specified protection level. This checklist is used when preparing for the field, and is completed with the type of equipment to be worn based on the hazards present. **R** = Equipment required to be present on the Site. **O** = Optional equipment. Site work will be conducted in Level D. If it is determined that an upgrade to Level C or B is necessary, site work will cease until a modification can be made to this HASP.

Description (Put Specific Material or Type in Box)	Site Personnel		
	D	C	B
Body			
Coveralls	O		
Chemical Protective Suit (include type in cell, e.g., Tyvek, Saranex, PVC, etc.)			
Splash Apron			
Rain Suit	O		
Traffic Safety Vest (reflective)	O		
Head			
Hard Hat (if does not create other hazard)	R		
Head Warmer (depends on temperature and weather conditions)			
Eyes & Face			
Safety Glasses (incorporate sun protection as necessary)	R		
Goggles (based on hazard)			
Splash Guard (based on hazard)			
Ears			
Ear Plugs			
Ear Muffs			
Hands and Arms			
Outer Chemical Resistant Gloves	R		
Inner Chemical Resistant Gloves	O		
Insulated Gloves			
Work Gloves	O		
Foot			
Safety Boots (steel toe and shank)	R		
Rubber, Chemical Resistant Boots	O		
Rubber Boots	O		
Disposable Boot Covers	O		
Respiratory Protection (indicate cartridge type where applicable)			
1/2 Mask APR			
Full Face APR – Organic Vapor			
Dust Protection	O		

Description (Put Specific Material or Type in Box)	Site Personnel		
	D	C	B
Full Face Canister APR			
Powered APR			
Air Line/SCBA			
Other Supplies			
First Aid Kit	R		
Fire Extinguisher	R		
Mobile Phone	R		
Walkie Talkies	O		
Water or Other Fluid Replenishment	R		
Eye Wash Station	O		
Eye Wash Bottle	R		
Wash and Dry Novelettes	O		
Sunscreen (SPF 15 or higher)	O		
Insect Repellant	O		

I. Decontamination Procedures

Personnel and equipment leaving the Exclusion Zone will be decontaminated. Level D decontamination protocol will be used with the following decontamination stations

		Level D Decontamination Steps	
		1	Equipment Drop
		2	Glove and Boot Wash and Rinse
		3	Disposable Garment, Outer Boot, and Glove Removal
		4	Field Wash

Place an X by all decontamination equipment that is required at the Site.

	Decontamination Equipment Checklist		
	Scrub Brushes	X	Garbage Bags
X	Waste Containers	X	Paper Towels
X	Soap		Isopropyl Alcohol
	Plastic Tubs		Pump Spray Bottles
	Plastic Drop Cloths		Pump Spray Bottles (water)

FIGURES

Figure 1. Map to Advocate Trinity Hospital

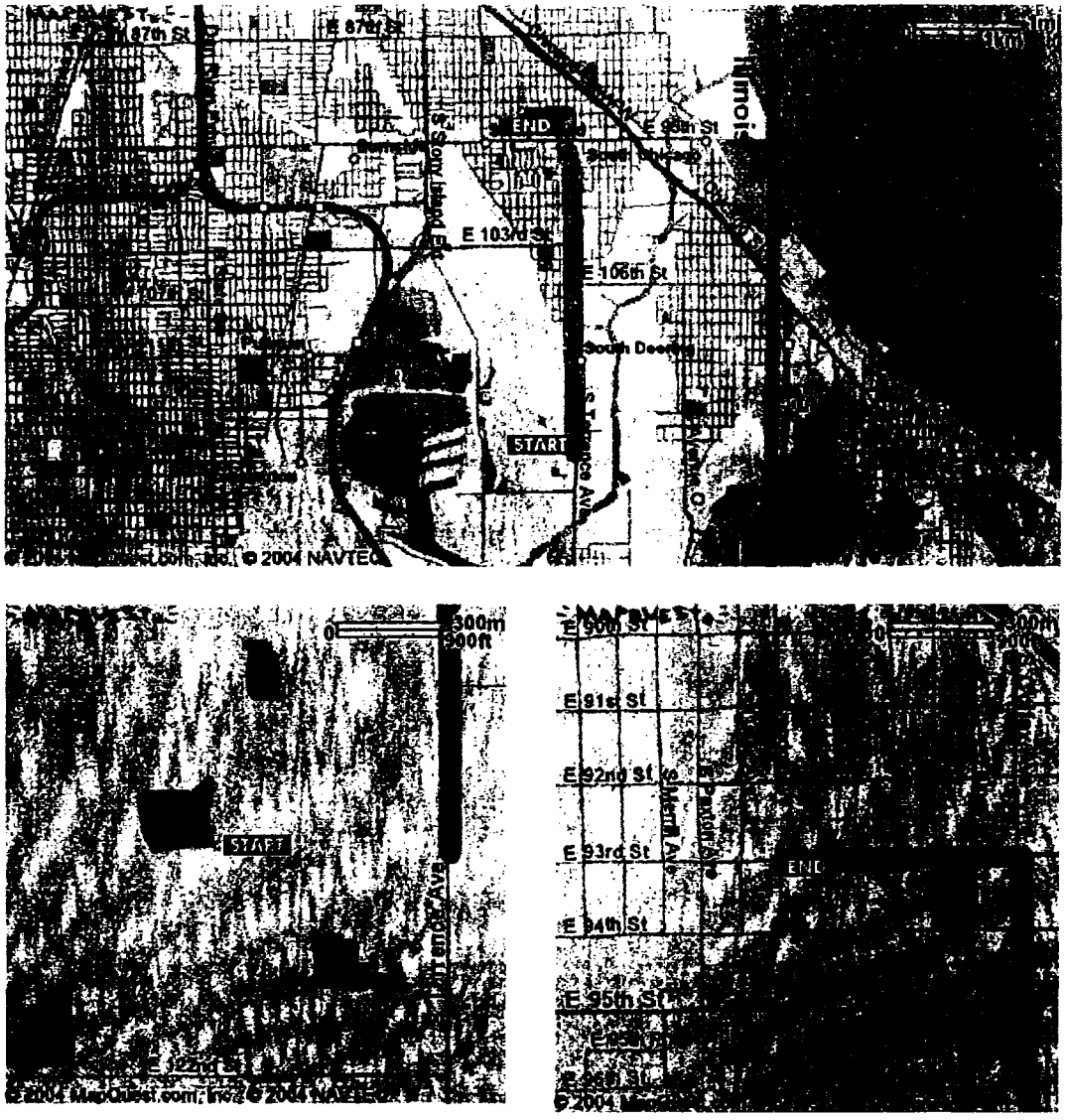
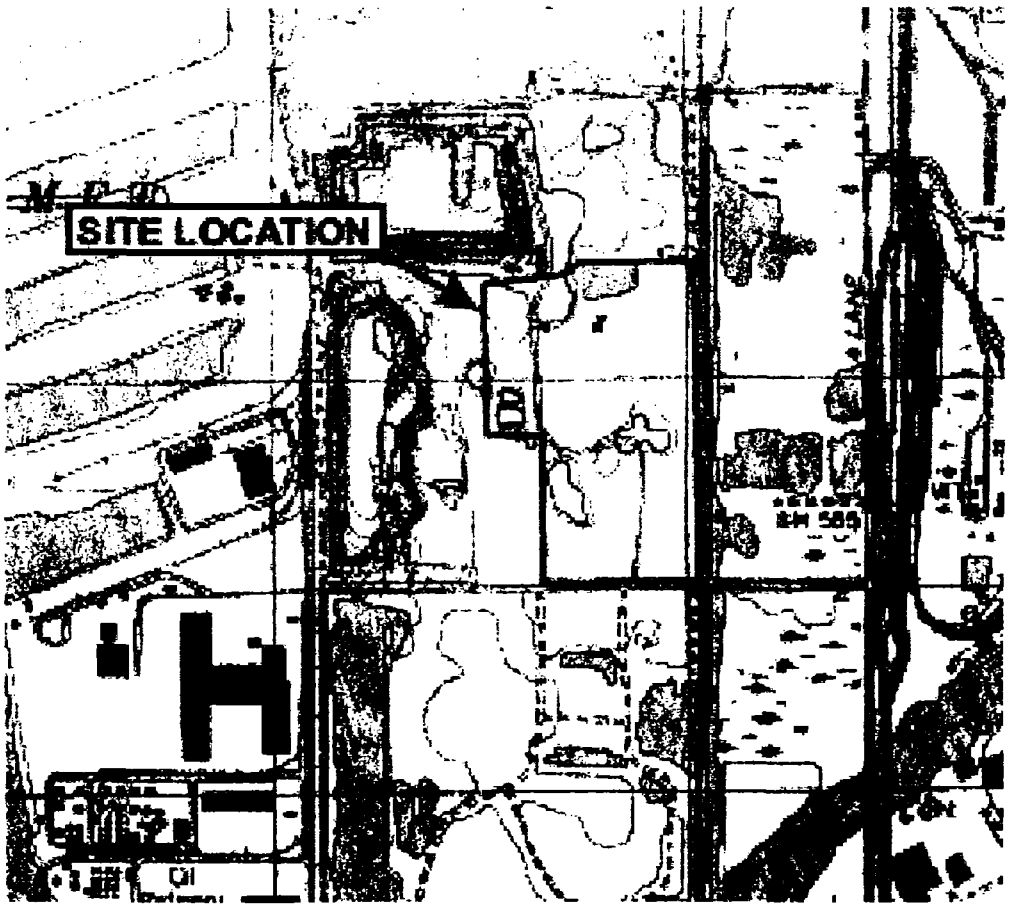


Figure 2. Site Layout and Description of Work Area for: Lake Calumet Cluster, 2400 East 119th Street, Chicago, Illinois



ATTACHMENTS

ARCADIS

Attachment D-1

Definitions

Term or Acronym	Definition
Confined space	Any enclosed area not designed for human occupancy that has a limited means of entry and egress.
DOT	Department of Transportation – specifies the proper and legal methods of shipping and transporting hazardous materials by highway, railway, and by sea in the USA.
HASP	Health and Safety Plan
IATA	International Air Transportation Association - specifies the proper shipment of hazardous materials by air internationally. Many of these regulations are incorporated by reference in the US DOT regulations.
Ionizing radiation	Any one of several types of particles and rays given off by radioactive material, high-voltage equipment, and nuclear reactions. The types that are normally important to your health are alpha particles, beta particles, x rays, and gamma rays.
Level B	A level of protection that requires personal protective equipment including chemically resistant body coverings and supplied air respiratory protective equipment
Level C	A higher level of protection than Level D, requiring some sort of air purifying respirator
Level D	The minimum amount of personal protective equipment ensemble to be worn on a project Site. It does not include respiratory protection.
LO/TO	Lockout/Tagout – a procedure which isolates equipment from energy sources, such as electricity or stored pneumatic energy, by locking and tagging out energy isolating devices.
Mutagen	A chemical that causes changes in the genetic material of living cells.
Nonionizing Radiation	Electromagnetic energy such as ultraviolet, laser, infrared, microwave, and radio.
Oxidizer	A material that releases oxygen and supports combustion.
PEL	Permissible Exposure Limit – an airborne exposure limit set by the U.S. Occupational Safety and Health Administration
PHSM	Project Health and Safety Manager
PPE	Personal Protective Equipment
Sensitizer	A material which, upon exposure, causes a bodily response (i.e. irritation) that increases in severity upon each subsequent exposure.
SPCC	Spill Prevention, Control, and Countermeasures – EPA rule that attempts to prevent oil from entering the national waterways.
SSO	Site Safety Officer
TLV	Threshold Limit Value – an airborne exposure limit set by the American Conference of Governmental Industrial Hygienists

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Attachment D-2

Safety Modules:

Biological Hazards
Confined Spaces
Cold Stress
Decontamination
Heat Stress
Heavy Machinery
Holes and Pits
Medical Screening/Surveillance
Noise
Personal Safety
Severe Weather
Trenching/Excavation
Walking/Working Surfaces

Biological Hazards

Biological hazards are any virus, bacteria, fungus, parasite or any living organism that can cause disease in human beings. Diseases can be transmitted from animals and insects to humans and from exposure to contaminated water and people. The biological hazards present at the site are common for all work tasks and may include the following:

Insects

Care will be taken by all site workers to avoid stinging or biting insects such as ticks, spiders, bees, wasps, hornets, and yellow jackets. Workers allergic to any particular insect sting or bite should seek medical attention if stung or bitten and may need to carry emergency medicine prescribed by their doctor.

Care should always be taken to avoid these insects and increased vigilance is necessary:

- During high infestation seasons;
- When opening protective casings of monitor wells; and
- When walking through areas of heavy vegetation or areas known to be infested.

To minimize the chance of bites/stings:

- Wear appropriate PPE:
  - Light colored clothing so you can see insects;
  - Long pants and boots with pants tucked into boots;
  - Long sleeves when possible;
  - A hat; and
  - Gloves if you are cutting brush or need to handle or move vegetation.
- Check your body and clothing for insects, shower after work and wash/dry clothes at as high temperature as possible.
- Don't swat at insects and don't eat in areas where there are insects.
- Avoid sweet smelling personal hygiene products.
- Unless contraindicated by the work being performed (e.g., sampling, data collection), wear EPA approved repellants such as those containing DEET.

Spider bites generally cause only localized reactions such as swelling, pain, and redness. However, bites from a Black Widow or Brown Recluse or if you are allergic to spiders, can cause more serious symptoms. If nausea, vomiting, difficulty breathing or swallowing occurs, medical attention should be sought immediately. Otherwise, clean the bite area with soap and water or alcohol and place a cold pack over the bite area.

Ticks are common, especially in the warmer weather months and may carry diseases such as Rocky Mountain Spotted Fever and Lyme Disease. If a tick is found on the body:

- Use a fine tipped tweezers, grasp tick firmly as close to skin as possible and pull the body away from skin. Avoid crushing the body and don't twist.
- If tick mouth parts remain in skin, don't be alarmed as the mouth will dislodge as skin sloughs off.
- Wash the area with soap and water and apply antiseptic or antibiotic ointment to prevent infection.
- If unexplained symptoms develop such as severe headaches, fever, or rash within 10 days of the bite, seek medical attention.

Mosquitoes are common, especially in areas with standing water and in damp, humid environments in the warmer months, and generally appear between dusk and dawn.

Snakes

Leave snakes alone – many people are bitten because they try to kill a snake or get a closer look at it. If you see a snake, even if you know it's not poisonous, walk away quietly giving it a wide berth (at least 6 feet).

- Be especially cautious when opening monitoring well casings and other enclosed field objects;
- The use of a heavy high-top work boot, denim work pants, etc., will help reduce the severity if bitten; and
- Whenever possible:
  - Stay out of tall grass;
  - Remain on paths as much as possible;
  - Keep hands and feet out of areas you can't see; and
  - Don't pick up rocks, timber or other vegetation.

If bitten by a poisonous snake, the following is recommended:

- Seek medical attention immediately.
- Wash area with soap and water.
- Stay calm and remain as motionless as possible.
- Keep the bite area below the heart, if possible.
- Do not use cold packs or ice on the bite area.
- Do not make incisions or try to suck the venom out.

Rodents and Diseases

Rodents can carry a variety of diseases that can be transmitted to humans via saliva, body fluids or droppings. Hantavirus is a disease which is transmitted from infected rodents via saliva or excretion. Symptoms include sudden onset of fever, aching, bleeding of internal organs, shock, and renal syndrome.

Field personnel can protect themselves from disease by donning appropriated PPE, avoiding contact with rodents and rodent/animal droppings. If contact is made, decontaminating or disposing of PPE and frequently washing hands and face thoroughly is recommended.

Bloodborne Pathogens

Bloodborne pathogens (BBP) include such disease as Hepatitis B and C or HIV, and they can be transmitted to another human through exposure to infected blood or other body fluid. Exposure can be a concern at a job site for employees who have been designated to render first aid must do so and body fluid is present.

If field personnel are designated to provide first aid, an Exposure Control Plan will be developed and implemented. In addition, these employees will be offered the Hepatitis B vaccination series and trained in accordance to 29 CFR 1910.1030, Occupational Exposure to Blood borne Pathogens; and

To avoid occupational exposure, all on-site personnel who are designated to provide first aid will consider any body fluid as contaminated when rendering first aid and will wear, at a minimum, gloves and eye protection. Gloves will also be worn when handling contaminated first aid supplies and the supplies will be discarded as directed in the Exposure Control Plan.

Permit Required Confined Spaces

Confined spaces include excavations, storage tanks, bins, sewers, in-ground vaults, vessels, tunnels, manholes, pits. etc. These enclosures, because of inadequate ventilation and/or the introduction of hazardous gases and vapors, may present conditions that could produce asphyxiation or injury.

- Excavations will be considered a confined space until tested and cleared by the SSO.
- All other confined spaces will be identified and marked appropriately including all tanks and vessels.
- Before entering, attending or supervising a confined space, the SSO and PHSM must be notified of intent to enter, attend or supervise.

In the event it is required for ARCADIS or subcontractor staff to enter, attend or supervise entry into confined spaces, the Project Manger, with assistance from the project H&S staff, will ensure that a program has been developed and implemented, that all applicable employees have received the appropriate training and that a Permit-Required Confined Space Entry form has been completed and is in place at the site. The SSO will review with site personnel safe entry requirements, which include:

- Removal of Contents: Before entering, confined spaces should be as clean and free of hazardous materials and chemicals as possible. Where appropriate, confined spaces may be purged by water or other suitable means. Purging with hazardous solvents should be avoided where possible.
- Isolation: All input lines, which discharged into the confined space, shall be disconnected and capped or isolated.
    - The use of a single in-line valve shut-off as the sole means of isolating the confined space from any input lines **is prohibited**. However, the use of a double in-line valving arrangement with a vent or drain in between the two valves is acceptable provided that dangerous air contaminants are not introduced by such venting.
    - Isolation valves shall be locked closed, vent or drain valves shall be locked open, and the person performing the job shall keep the key.
- Electrical Lockout: Where electrical devices located within the confined space (motors, switches, etc.) are to be repaired or worked on, the line-disconnect switches supplying the power must be tagged and locked in the "OFF" position. The lock key is to be kept by the person performing the job, and only this person is authorized to unlock the switch and remove the tag upon completion of the job. Where more than one person is working on the line, each must place a lock on the switch and retain his own key.

- Where there are multiple sources of power to an electrical device that supplies power to the device through an automatic or manual bus transfer switch, lockout devices must be placed on the breaker nearest to the electrical device that is to be isolated, and an electrician shall test the power supply lines to ensure that power has been secured.

- Line-disconnect switches supplying power to any mechanical apparatus in the confined space (mixers, conveyors, etc.) must also be tagged and locked in the "OFF" position. This must be done for any entry, even though work will not be performed on the apparatus itself.

- Securing of Covers: All manhole and cleanout covers shall be removed and the openings maintained clear of any obstructions. When hinged doors or lids are provided, they shall be secured so they cannot close. See Excavations and Trenches for guarding requirements.

- Testing Atmosphere: The SSO using only equipment approved and tagged for Class 1, Division 1 locations shall make appropriate tests of the atmosphere in the confined space and place a record of the test results at the entrance to the confined space. Testing shall ensure the following:

  - Toxic gas and vapor levels do not exceed more than 5 ppm as measured with a photoionization detector.

  - Combustible gas and vapor concentrations do not exceed 10 percent of the lower explosive limit.

  - Oxygen content is no less than 19.5 percent and no greater than 23.5 percent.

  - Appropriate respiratory protective equipment and other appropriate personal protective devices have been provided for all employees when concentrations of toxic materials exceed applicable occupational exposure levels.

- Continuous Monitoring: If the nature of the work to be performed introduces, or has the potential to introduce, harmful air contaminants, continuous monitoring of the atmosphere and/or the oxygen content drops below 19.5 percent, all personnel shall evacuate the confined space immediately.

- Ventilation: All confined spaces found to be unsafe must be ventilated by means of mechanical exhaust systems arranged so as to avoid recirculating contaminated air. Personnel shall be evacuated immediately in the event of failure of the mechanical ventilation system. The confined space shall be retested prior to reentry following ventilation system repair.

All entry of permit required confined spaces will be performed in accordance with Permit Required Confined Space Entry Program Permit, provided as Appendix [[__]] As a minimum, signs with the following wording must be posted around the entrance and exit of confined spaces:

HAZARD AREA KEEP OUT

DANAGER

CONFINED SPACE

AUTHORIZED PERSONNEL ONLY

PPE IS REQUIRED IN THIS AREA

Revised 5/26/04

Cold Stress

The four environmental conditions that cause cold-related stress are low temperatures, high/cool winds (wind chill), dampness or cold water. One, all or a combination of these factors can cause cold-related hazards. Cold stress, including frostbite and hypothermia, can result in severe health effects. Exposed skin is highly susceptible to wind chill and low temperatures.

Engineering controls should be utilized whenever possible to protect workers from cold related hazards. For example, on-site heat sources, heated shelter, work areas shielded from drafty or windy conditions, and the use of thermal insulating material on equipment handles.

Effects arising from cold exposure will be minimized by the following control measures:

- Personnel will be trained to recognize cold stress symptoms.
- Field activities will be curtailed or halted if the equivalent chill temperature is below 20° F.
    - As much as possible, work that exposes personnel to the cold will be done during the warmest hours of the day.
    - Inactivity in cold conditions will be kept to a minimum.
- Frequent short breaks in warm, dry shelters will be taken.
- Vehicles will be equipped with supplies in case the vehicle becomes inoperable (e.g., blanket, dry clothing, water, food, a shovel, etc.).

The following PPE will be provided during work in cold environments

- Workers will be provided with insulated dry clothing when the equivalent chill temperature is less than 30° F.
- Feet, hands, the face, and the head should be protected (40% of the body's heat can be lost when the head is exposed).
    - Foot and hand wear may also need to be waterproof.
- Clothing should be layered so that adjustments can be made to changing environmental temperatures and conditions. For example, an outer layer to break the wind, a middle layer that will absorb sweat and retain insulation when wet, and an inner layer that allows ventilation.

Cold-Related Illnesses

Hypothermia: Hypothermia occurs when the body temperature falls to a level where normal muscular and cerebral functions are impaired. Although it usually occurs in freezing air and water temperatures, it can occur in any climate if a person's temperature falls below normal. Symptoms should not be ignored and a supervisor, or whomever is available, should be notified as soon as hypothermia is suspected.

Initially, symptoms may include shivering, an inability to do complex motor functions, sluggishness and mild confusion as the body temperature drops to around 95° F. As the body temperature falls, speech may

become slurred and behavior may be irrational, simple motor functions may be difficult to do and a state of "dazed consciousness" may exist. In severe states (below 90° F), heart rate, blood flow and breathing will slow. Unconsciousness and full heart failure can occur.

First Aid:

On land:

- Call for emergency help and move the victim (unless other injuries prohibit their being moved) to a warm, dry area and replace wet clothing with warm, dry clothing or a blanket. Move the person carefully because movement can increase the irritability of the heart.
- If the person is conscious and lucid, warm liquids can be provided but **not** alcohol or caffeinated drinks. If possible, have them to move their arms and legs to create muscle heat.
- If the person is unconscious or unable to assist, place warm bottles/packs in the person's arm pits, groin, neck and head areas.
- **Do not** rub the person's body or place them in warm water.

In water (the body loses heat up to 25 times faster than on land):

- Call for emergency help and get the victim out of the water. Move the person carefully because movement can increase the irritability of the heart.
- **Do not** remove clothing- button, buckle, zip and tighten collars, cuffs, shoes and hoods as the water trapped next to the body provides a layer of insulation that may slow the loss of heat.
- If it is you in the water, **do not** swim unless a floating object or person can be reached quickly as swimming uses the body's heat and reduces survival time by about 50%.
    - If you are in the water and is not possible to get out, conserve body heat by folding arms across the chest, keeping thighs together, bending knees and crossing ankles. If another person is in the water with you, huddle together.

Frostbite: Frostbite occurs when the skin actually freezes, and deep frostbite can affect deeper tissues such as tendons and muscles. Frostbite usually occurs when temperatures drop below 30° F, but wind chill effects can cause frostbite at above-freezing temperatures. The ears, fingers, toes, cheeks and nose are the most commonly affected body parts.

Initially, symptoms include an uncomfortable sensation of coldness. Tingling, stinging or an aching feeling of the exposed area is followed by numbness. Frostbitten areas appear white and cold to the touch and with deeper frostbite, the area becomes numb, painless and hard and can turn black.

First Aid:

- Seek medical attention as soon as possible and treat any existing hypothermia first.
- Warm liquid can be provided, but **not** alcohol or caffeinated drinks such as tea and coffee.
- **Do not** rub the affected areas, but cover them with dry, sterile gauze or soft, clean bandages.

- **Do not try rewarming the affected area if you have not been specifically trained to do so** and/or if there is a chance the affected area will get cold again.

Trench Foot: Trench Foot is caused by a continuous exposure to a wet, cold environment. Symptoms include tingling and/or itching sensation, burning pain and swelling and, in more extreme cases, blisters.

First Aid:

- Seek medical attention as soon as possible and move the victim to a warm, dry area.
- Affected tissue can be treated with careful washing and drying, slight elevation. **Do not try rewarming the affected area if you have not been specifically trained to do so.**

Cold Stress Monitoring

Monitoring for cold stress is difficult and will be completed by the SSO by monitoring for symptoms and the weather conditions on a daily basis. The following table may be used as a guideline for establishing a work/rest regimen.

TABLE THRESHOLD LIMIT VALUES WORK/WARM-UP SCHEDULE FOR FOUR-HOUR SHIFT

Air Temperature-Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
° C (approx.)	° F (approx.)	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	Normal	1	Normal	1	75 min	2	55 min	3	40 min	4
-29° to -31°	-20° to -24°	Normal	1	75 min	2	55 min	3	40 min	4	30 min	5
-32° to -34°	-25° to –29°	75 min	2	55 min	3	40 min	4	30 min	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min	3	40 min	4	30 min	5	Non-emergency work should cease			
-38° to -39°	-35° to -39°	40 min	4	30 min	5	Non-emergency work should cease					
-40° to -42°	-40° to -44°	30 min	5	Non-emergency work should cease							
-43° & below	-45° & below	Non-emergency work should cease									

Decontamination

All personnel and equipment entering any controlled work area (see Section 10.0 for description of work zones) must be adequately decontaminated prior to exiting the area. The procedures should be adopted for site-specific decontamination procedures.

Personnel Decontamination

Decontamination procedures must be carried out on all personnel who have been in contact with contaminated materials. Under no circumstances (except emergency evacuations) will personnel be allowed to leave a controlled work area where contaminants are exposed without performing decontamination.

Decontamination of personnel should be performed at a Personal Decontamination Station on the PROJECT and should consist primarily of soap and water washing and water rinse of exterior protective gear to remove contaminants, followed by doffing of the gear. Coveralls should be removed by turning the clothing inside out. A procedure appropriate to the degree of contamination should be established. The extent of washing required, or modifications to the sequence, may be specified as appropriate.

The designated decontamination areas will be located between the lines, which mark the boundaries of the exclusion Zone (EZ) and the Contamination Reduction Zone (CRZ). This configuration will ensure that all personnel and equipment leaving the clean side of the decontamination area will be entering the Support Zone (SZ) which will be considered a contaminant free area.

Level D Personnel Decontamination

Personnel exiting the Exclusion Zone while site activities require the use of Level D PPE will perform decontamination in the designated decontamination area in accordance with the following guidelines:

- Place tools, instruments, samples and trash at an appropriate location. The equipment drop area should be clean and dry and at a minimum, plastic bags should be available for trash. Waste PPE will not be placed in the same containers as general trash.

- Inspect equipment, samples, and if applicable, tools for signs of residual amounts of contamination or excessive soil buildup. If present, soils and contamination must be completely cleaned off of equipment, samples, and tools prior to removal from the decontamination areas back into the support zone.

- Personnel will visually check themselves for signs of excessive soils and possible contamination. If observed, soils and contamination will be completely removed before further decontamination is performed.

- Prior to exiting the decontamination areas, personnel will wash their hands with soap and water in order to minimize the potential for contaminant exposure from the final handling of equipment and PPE.

Modified Level D Personnel Decontamination

Where activities are performed in Modified Level D PPE personnel will perform decontamination using the following guidelines:

- Place tools, instruments, samples and trash at an appropriate location. The equipment drop area should be clean and dry and at a minimum, plastic bags should be available for trash. Waste PPE will not be placed in the same containers as general trash.

- Inspect equipment, samples, and if applicable, tools for signs of residual amounts of contamination or excessive soil buildup. If present, soils and contamination must be completely cleaned off of equipment, samples, and tools prior to removal from the decontamination areas.

- Personnel will visually check themselves for signs of excessive soils and possible contamination. If observed, soils and contamination will be completely removed before further decontamination is performed.

- Untape wrists and ankles.

- Remove outer work gloves and place in an appropriate container specified for waste PPE.

- Remove outer Tyvek coveralls and place them in an appropriate container specified for waste PPE.

- Remove inner protective gloves and place them in an appropriate container specified for waste PPE.

- Wash hands using soap and water (separate from other decontamination cleaners/solutions).

Level C Personnel Decontamination

Personnel involved in activities that require the use of Level C PPE will observe the following decontamination guidelines:

- Place tools, instruments, samples and trash at an appropriate location. These areas should be clean and dry, and at a minimum contain plastic bags for trash. Waste PPE will not be placed in the same containers as general trash.

- Inspect equipment, samples and if applicable, tools for signs of residual amounts of contamination or excessive soil buildup. If present, soils and contamination must be completely cleaned off of equipment, samples and tools prior removal from the decontamination areas. Personnel will visually check themselves for signs of excessive soils and possible contamination. If observed, soils and contamination will be completely removed before further decontamination is performed.

- Untape wrists and ankles.

- Remove outer work gloves and place them in an appropriate container specified for waste PPE.
- Remove outer Tyvek coveralls and place them in an appropriate container specified for waste PPE.
- Wipe off and remove respirator mask (also goggles if worn).
- Remove inner protective gloves and place them in an appropriate container specified for waste PPE.
- Wash hands using soap and water (separate from other decontamination cleaners/solutions).

Equipment Decontamination

Heavy equipment used for this project is expected to contact hazardous substances as defined by HAZWOPER and therefore, will require decontamination procedures. Proper decommissioning procedures of heavy equipment will be instituted by the SSO.

Decontamination During Emergencies

Often during emergencies the need to quickly respond to an accident or injury must be weighed against the risk to the injured party from chemical exposure. It may be that the time lost or the additional handling of an injured person during the decontamination process may cause greater harm to the individual than the exposure that would be received by undressing that person without proper decontamination.
An additional consideration to include when bypassing decontamination of injured personnel is the acceptance of contaminated personnel at emergency medical facilities. Many facilities will not accept contaminated personnel. Site response personnel should accompany contaminated victims to the medical facility to advise on matters involving decontamination.

Disposal of Decontamination Wastes and PPE

Disposal of waste associated with the project will be handled in accordance with the specification for each identified contaminant. The SSO will determine the disposal requirements as the situation arises.

Heat Stress

Heat stress can be a significant hazard, especially for workers wearing protective clothing. Depending on the ambient conditions and the work being performed, heat stress can occur very rapidly, within as little as 15 minutes. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim and the prevention of heat stress incidents. Workers will be encouraged to immediately report any heat-related problems that they experience or observe in fellow workers.

During breaks, workers should be encouraged to drink plenty of water or other liquids to replace lost fluids and to help cool off.

Any worker exhibiting signs of heat stress and exhaustion should be made to rest in a cool location and drink plenty of water. Emergency help by a medical professional is required immediately for anyone exhibiting symptoms of heat stroke, such as red, dry skin, confusion, delirium or unconsciousness. Heat stroke is a life threatening condition that must be treated by competent medical authority.

Prevention

Whenever possible or within the control of ARCADIS, engineering controls should be utilized to protect workers from heat related hazards. For example, isolation from the heat source, ventilation such as open windows, fans or other methods of creating air flow, and heat shielding such as awnings or umbrellas.

Appropriate work practices can also lessen the chances of heat related hazards. Some of these include:

- Water intake should be about equal to the amount of sweat produced (i.e., drinking 5-7 ounces of water every 15-20 minutes).
    - Electrolyte fluids may also be necessary.
- Whenever possible, gradual exposure to heat is preferred.
- Whenever possible, adjust the work schedule. For example, postpone nonessential or heavier work to another day or a cooler part of the day.
- Whenever possible, rotate personnel.
- Increase the number and/or duration of rest breaks, but do not increase individual work periods when longer and/or more rest break periods are given.
    - Whenever possible, rest break areas should be in a cool area and as close to the work area as is feasible.

PPE is available, such as thermally conditioned clothing including self-contained air conditioning in a backpack and plastic jackets/vests with pockets that can be filled with dry ice or ice. However, the type of work being done, other required PPE, and where the work is being done may prohibit or make the use of this PPE impossible or impractical.

Heat-Related Illnesses

The following guidance can be used in the identification and treatment of heat related illness.

Heat Stress: This is the mildest heat-related illness, but prompt action may prevent a more severe heat-related illness. Symptoms include irritability, lethargy, significant sweating, headache or nausea.

First Aid:

- Take the victim to a protected (e.g., shaded) area, remove any excess protective clothing, and provide cool fluids.
- If an air-conditioned spot is available, this is an ideal break location.
- Once the victim shows improvement he/she may resume working, however the work pace and practices (e.g., does fluid intake need to be increased) should be moderated to prevent recurrence of the symptoms.

Heat Exhaustion: Usually begins with muscular weakness, dizziness, nausea, and a staggering gait. Symptoms include pale, clammy skin, and profuse sweating, vomiting, and the bowels may move involuntarily. The pulse is weak and fast, breathing is shallow. Fainting can occur.

First Aid:

- Immediately remove the victim from the work area to a shady or cool area with good air circulation (avoid drafts or sudden chilling – you do not want the victim to shiver).
- Call a physician or emergency service, or transport the victim to medical care.
- Remove all protective outerwear.
- If the victim is conscious, it may be helpful to give him/her sips of water.

Heat Stroke: Heat stoke is a severe medical condition requiring first aid and emergency treatment by a medical professional as death can occur without appropriate care. Heat Stroke represents the collapse of the body's cooling mechanisms. As a result, body temperatures often rise to between 105°-110°F. As the victim progresses toward heat stroke symptoms include hot and usually dry, red and spotted skin, headache, dizziness, nausea, mental confusion, delirium, possible convulsions and loss of consciousness.

First Aid:

- Immediately remove the victim from the work area to a shady or cool area with good air circulation (avoid drafts or sudden chilling - you do not want the victim to shiver).
- Summon emergency medical help to provide on-site treatment and transportation to a medical facility.
- Remove all protective outerwear and loosen personal clothing.

- Give no stimulants or hot drinks.
- Apply cool wet towels, ice bags, etc. to the head, armpits, and thighs. Sponge off the bare skin with cool water or rubbing alcohol, if available, or even place the victim in a tub of cool water.
    - The main objective is to cool without chilling the victim or causing him/her to shiver.

Skin Hazards

Sunburn and prickly heat are both symptoms of skin irritation/damage produced through exposure to sunlight and operating in hot work environments.

- Protect exposed skin with an appropriate sunscreen. A sunscreen with a sun protection factor (SPF) of 15 or greater is required for work in the sun with reapplication at breaks and lunch.
- Heat rash, also known as prickly heat, can be prevented by the application of a hydrophobic, water repellent barrier cream such as Kerodex 71.

Heat Stress Monitoring

The prevention of heat stress-related illnesses is best performed through continuous observation of employees and routine heat stress awareness training. Although heat stress monitoring can be accomplished using one of the techniques discussed below, any results obtained from monitoring techniques should be used as guidance only.

To properly mitigate the effects of heat stress, it is necessary to establish a work routine that incorporates adequate rest periods to allow workers to remove protective clothing, drink fluids (vital when extreme sweating is occurring), rest, and recover. The frequency and length of such work breaks must be determined by the Task Manager and SHSO based upon factors such as the ambient temperature and sunshine, the amount of physical labor being performed, the physical condition of the workers, and protective clothing being used. Breaks must be sufficient to prevent workers from manifesting symptoms of heat stress regardless of monitoring results.

Evaluation of heat stress using the methods below, to determine appropriate work/rest cycles, is performed, at the discretion of the SHSO and PHSM whenever fieldwork activities are occurring.

Basic Instrument Measurements Method: Used at the discretion of the SHSO and/or PHSM to monitor heat stress where workers **are not** using chemically protective clothing. The Wet Bulb Globe Temperature (WBGT) value will be determined using a WBGT meter (Reuter-Stokes 214 DL or equivalent), and compared with the values shown in Table 1 to determine appropriate work/rest cycles.

Table 1 WBGT Values for Level D Work/Rest Cycles*

Continuous Work	86	80	77
75% Work – 25% Rest	87	82	78
50% Work – 50% Rest	89	85	82
25% Work – 75% Rest	90	88	86

*Re-printed from ACGIH's 1999 Threshold Limit Values for Chemical Substances and Physical Agents

Modified Instrument Measurements Method: This method will be used whenever personnel use chemically protective clothing. The WBGT value will be determined as above with the measured value then be compared with the values shown in Table 2 to determine the appropriate work/rest cycle.

Table 2 WBGT Values for CPC Work/Rest Cycles*

Continuous Work	75	69	66
75% Work – 25% Rest	76	71	67
50% Work – 50% Rest	78	74	71
25% Work – 75% Rest	79	77	75

Modified from ACGIH's 1999 Threshold Limit Values for Chemical Substances and Physical Agents

Direct Observation: This method can be used as a substitute for the Modified Instrument Measurements Method and can be used whenever personnel use chemically protective clothing. At the start of the workday, each worker's baseline pulse will be determined by counting the number of beats per minute (bpm) and then pulses taken at the beginning and end of each break period.

- Start of Break: As recommended by the ACGIH, each worker's maximum heart rate at the start of any break should be less than 180 minus workers age bpm (e.g., a worker is 40 so their pulse should be less than 120bpm). If this value is exceeded for any worker, the duration of the following work period will be decreased by at least 10 minutes.

- End of Break: At the end of each break, all workers heart rates must have returned to within +10% of the baseline pulse rate. If any worker's pulse rate exceeds this value, the break period will be extended for at least 5 minutes with the pulse rates will be re-measured and the end-of-break criteria again applied.

Heavy Machinery and Certification Requirements

Purpose

The purpose of this procedure is to present the minimum safety performance requirements for the operation of heavy equipment on ARCADIS project sites. Project Managers are responsible for ensuring all equipment used on an ARCADIS site is certified and that equipment owners have submitted the attached Machinery and Mechanized Equipment form.

General Requirements

All equipment shall comply with all applicable requirements for motor vehicles and material handling heavy equipment contained in 29 CFR 1926 Subpart O. Heavy equipment includes, but is not limited to, drill rigs, front-end loaders, backhoes, track hoes, bulldozers, forklifts, cranes, derricks and similar equipment used for the implementation of the project Statement of Work.

Equipment Safety Inspections

The following presents general guidelines for certifying equipment is in safe operating condition before activities commence at the site and during site operations. The following guidelines are not meant to be all-inclusive.

- All machinery and mechanized equipment will be certified to be in safe operating condition by a competent individual, (using the attached form), within seven days of initial onsite operation.
  - Certification is valid for one year.
- Equipment will be inspected on a daily basis by the owner/operator and daily logs will be maintained. All discrepancies shall be corrected prior to placing the equipment in service.
- Inspections shall include, but are not limited to: all hydraulic lines and fittings for wear and damage, all cable systems and pull ropes for damage and proper installation, exhaust systems, brake systems, and drill controls, etc.
- The driller in charge on a daily basis shall inspect drill rigs and related support equipment and vehicles. These inspections shall be recorded/documented.
- Preventive maintenance shall be conducted for all equipment according to manufacturer recommendations and/or established internal policies, schedules, and equipment SOPs.
- Only designated qualified persons shall operate machinery and mechanized equipment.
- Records of tests and inspections shall be maintained at the site by the operating contractor, and shall be made available upon request of the designated authority, and shall become part of the official project file.
- Equipment not found to be in safe operating condition, or when a deficiency affecting the safe operation of the equipment is identified, the equipment shall immediately be taken out of service and its use prohibited until safe conditions have been corrected.
- All equipment shall be kept in the exclusion zone until work or the shift has been completed. Equipment will be decontaminated within designated decontamination areas. Note: this is not typical for construction sites. It would be for remediation sites.
- All Equipment must have an audible alarm that sounds when equipment is moving in reverse.

HEAVY EQUIPMENT CERTIFICATION REQUIREMENTS

Initial Equipment Inspection Checklist

TO: DATE:

FROM:

Project Name:

Project Location:

1. This form provides certification of machinery and mechanized equipment to be used on the referenced project for the following work:

Description of equipment work:	
Project Site:	
Owner of equipment: Address:	
Dates (duration) of equipment work:	

2. Inspection and certification of machinery and mechanized equipment, as required by ARCADIS Project Team has been made prior to, but within seven calendar days advance of, use on the project site. Re-certification will be required for equipment that is used on the project site for more than one year.

	Identification of equipment (make, model, serial no.)	Date of Certification
1		
2		
3		

3. The above listed equipment has been inspected and tested as indicated above, and is CERTIFIED TO BE IN SAFE OPERATING CONDITION BY THE FOLLOWING COMPETENT INDIVIDUAL:

Name		Title	
Company			
Signature		Date	

4. If there are any questions regarding this certification, please contact the following ARCADIS Project Team representative: _____.

Daily Inspection Form

DAILY HEAVY EQUIPMENT INSPECTION CHECKLIST

EQUIPMENT I.D. NO:_____

EQUIPMENT NAME: _____

DATE: ____/____/_____ PROJECT #: _____ CONTRACT #: _____

ITEM INSPECTED	**Inspectors Initials**
Falling Object Protective Structure (FOP)	
Roll-Over Protective Structure (ROP)	
Seat Belts	
Operators Seat Bar(s)	
Side Shields, Screens or Cabs	
Lift Arm Restraining Device	
Grab Handles	
Back Up Alarm(s) – Working	
Lights	
Guards	
Horn	
Anti-Skid Tread Steps Clear of Mud	
Safety Signs (Counterbalance swing area)	
Fire Extinguisher (arrow in green, monthly inspection)	
General Condition	
Fuel Condition	
Oil (Full, No Leaks)	
Clear of Extra Materials	
Controls Function Properly	
Damaged Parts	
Hydraulic System (Full, No Leaks)	
Parking Brake	
Lift Arm and Bucket	
Tires/Tracks	
Steering	
Hours at Time of Inspection	
Time Inspected	
Site Name	
Inspectors Name (Printed)	

INSTRUCTIONS – Inspect all applicable items indicated each shift prior to use.
Note any unsatisfactory conditions on the back of this sheet and bring to the attention of the supervisor immediately. Operators are required to sign in on this sheet the first time that they operator the equipment each day.

Medical Screening and Health Surveillance

HAZWOPER MEDICAL SURVEILLANCE

All ARCADIS personnel and subcontractors will have completed appropriate medical examinations in accordance with the requirements of 29 CFR 1910.120 (f) prior to project site work inside any controlled work area, if respirator use is required, and/or if there is potential for exposure to hazardous substances or health hazards at or above recognized occupational health standards, Permissible Exposure Limit (PEL) or Threshold Limit Value (TLV)), without regard to the use of respirator.

The PM, in conjunction with the PHSM, will review with the ARCADIS office administrator and subcontractor personnel, the status of project personnel medical surveillance clearance and restrictions. A copy of each person's written medical clearance will be made available for review following a request from the PHSM.

- Employees who have not received a medical examination within 12 months (or 24 months if approved by the medical provider) of their previous medical exam will be required to immediately obtain an appropriate medical exam and provide a copy of the medical evaluation to the PHSM for review prior to starting work on the project.

- Restrictions of on-site activities may be required for personnel with certain medical conditions that could be aggravated by chemical exposure or physical demands at the PROJECT.

    - The PHSM will then ensure that project management observes and enforces the restrictions.

    - In addition, each employee is responsible for notifying the PHSM and the SSO of physical or medical restrictions.

Other Medical Screening

Medical screening may also include:

- Drug and/or alcohol testing if required by the client/contractor.

- Blood and/or urine screening for other hazardous substances as required by 29CFR 1910 Subpart Z.

Holes and Pits

The presence of holes and pits at a site expose site workers to several hazards depending on how these hazards will be addressed and controlled. If the pits and holes are inherent to the site and will not be specifically investigated or addressed during site activities, then the hazard comes from the possibility of site workers falling into them. All pits and holes on a site will be properly marked with barriers to ensure that site workers will not fall into them. In addition, all site workers will be notified of their presence and locations, and be provided with instructions to stay a safe distance from these structures.

If holes and pits will be investigated or addressed in any way during site activities, they will be addressed under the appropriate procedures for trenching and excavations, fall protection, and confined space entry.

Noise Exposure

OSHA generally considers any environmental condition where a person must shout to be heard from a distance of 3 feet, a hazardous noise environment. Under these conditions, personnel must be protected through the use of appropriate hearing protective devices.

Hearing protection shall be worn:

- In any situation where normal conversation cannot be heard at a distance of 3 feet regardless of the source of the noise or where noise levels as measured with approved noise monitoring equipment is above 85 dBA.
- When operating gasoline or electric powered machinery.
- When working within 25 feet of operating heavy equipment (earth working equipment, etc.) as working around this type of equipment can result in exposure to hazardous levels of noise (levels greater than 90 dBA).
    - Earplugs or earmuffs will be worn.

The PHSM may also choose to monitor employee exposure to potentially hazardous noise levels.

Personal Safety

If there are issues of personal safety at a project site, resources such as the client, local law enforcement officials, Park or Wildlife Service, and Animal Control will be utilized as necessary to ensure the safest possible work environment. Some general guidelines are provided here, but *each situation is different and actions must be taken based on the specifics of each.*

Personal Safety

If it is deemed that a work site is in an area where an employee's personal safety may be at risk from potential criminal acts, the PM or SSO will work with the client and local law enforcement officials to evaluate the risk and determine what steps can be taken to minimize the risk. For example, can local law enforcement be present or make frequent drive-bys while the work is being done, should outside security be hired, should work only occur during certain times of the day, or should work not proceed at all.

In areas of risk such as this and if work proceeds, employees will not work alone and will have the ability to communicate with local law enforcement and the PM through cell phones or 2-way radios. Employees will check-in with the PM (or other specific individual) at predetermined times throughout each work day, and if employees do not call in, the PM will attempt to contact the team. If unsuccessful, the PM will notify local law enforcement.

If while on the project site and despite the other precautions set forth, an employee feels that their personal safety is at risk from potential criminal acts, the employee should leave the site immediately if possible and report their concerns to the PM or SSO so that appropriate steps can be taken as described above

Project Site In Isolated Area and Employees Working Alone

Whenever possible, employees will not work alone in isolated areas.

If the isolated area involves hiking/walking into areas that are unmarked or if there is potential to become directionally disoriented (e.g., no trails, unmarked trails, forested or highly vegetated areas), employees will be trained on the use of a compass and trail/topography maps and, if necessary, will take wilderness safety training. The PM or SSO will work with the Park/Wildlife service on what emergency planning is necessary (e.g., unexpected weather, animal attack, and search/rescue).

Communication through cell phones or 2-Way Radios will be utilized whenever possible. In addition, if employees are unable to check in on a daily basis because of the project location and cell phones or 2-Way Radios do not work, consider the use of some type of transponder or GPS locator device that can be used to locate the team if necessary.

Employees will check-in with the PM (or other specific individual) at predetermined times throughout each work day and if employees do not call in, the PM will attempt to contact the team. If unsuccessful, the PM will notify the appropriate authorities. In addition, and especially

if communication is not possible during the day, the PM will know the planned start and estimated finish times and employees will check in with the PM at the end of the work day.

If employees will be moving from isolated area to isolated area, for each day that this will occur:

- There will be established beginning and ending locations;
- Planned start and estimated finish times; and
- Planned routes that will be followed throughout the day.

Employees will not deviate from this schedule without first contacting the PM. It may also be appropriate and necessary to notify the client, law enforcement or Park/Wildlife officials of these schedules.

The PM should also check with local authorities in regard to any hunting season that may be in session and if it is possible that hunters may be present in the area in which ARCADIS personnel will be working. If so, employees will wear brightly colored hardhats/hats and reflective vests, will not work before dawn and work will end 30 minutes before dusk, and employees will be advised to make lots of noise by talking loudly at regular intervals or carrying a radio to help ensure that they aren't mistaken for an animal/bird.

Employees Working Late/Early Hours

Whenever possible, employees will not work before dawn and work will be completed before dark. If this is not possible, employees will wear appropriate reflective apparel and have appropriate lighting, such as portable lighting, flashlights, or headlamps as appropriate for the activity being conducted. Personal security will be assessed and measures taken as discussed above if appropriate.

No or Limited Cell Phone Service

The PM will assess if any other type of communication such as 2-Way Radios is appropriate for the area. If not, the PM will know the planned start and estimated finish times and employees will check in with the PM at the end of the work day. In addition, if employees are unable to check in on a daily basis because of the project location and 2-Way Radios do not work, consider the use of some type of transponder or GPS locator device that can be used to locate the team if necessary.

If employees will be moving from area to area within a day or over several days, each time the crew moves, the team will:

- Establish beginning and ending locations;
- Plan start and estimated finish times; and
- Plan routes that will be followed throughout the period.

Employees will not deviate from the schedule or planned route without first contacting the PM. It may also be appropriate and necessary to notify the client, law enforcement or Park/Wildlife officials of these schedules and routes.

Guard or Stray Dogs

If the client utilizes guard dogs at the site, the PM or SSO will work with the client each day to ensure that the dogs are unable to gain access to any area in which ARCADIS personnel will or could be working. ARCADIS personnel will also carry Pepper Spray or similar product that can be used to protect themselves in case a guard dog does come into the work area.

If stray dogs are known to be in an area in which ARCADIS personnel will be working, the PM or SSO will work with local animal control to have the dogs removed from the area. ARCADIS personnel will carry Pepper Spray or similar product as recommended by Animal Control that can be used to protect themselves from a dog that may become aggressive.

Severe Weather

Work activities at this site may take place during any season of the year, and employees may be exposed to extreme heat or cold, lightening, hail and severe weather.

During threatening weather, the SSO will monitor radio weather forecasts and heed any warnings. In addition, in the event of lightning in the vicinity of the site, the SSO will stop all activities and have site personnel take cover. Other severe weather such as high winds, hail or heavy rain will be evaluated by the SSO, PHSM and the Task Manager to determine how site activities should proceed.

Trenching and Excavation Safety

All trenching and excavation operations will be accomplished in accordance with requirements of 29 CFR 1926.650. The following safe operating guidelines apply to open trenches or excavations exceeding four (4) feet in depth **or** of any depth if in unstable soil conditions, as required by 29 CFR 1926.650. An excavation is any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal; a trench is a narrow excavation (in relation to its length) made below the surface of the ground.

Excavation Construction Guidelines

The following requirements are minimum requirements and must be met before any personnel are permitted to enter any excavation.

- Excavated materials will be stored and retained at least 2 feet from the edge of the excavation (Note: This procedure must be observed even when excavation/trench entry will not occur).
- Trees, boulders, and other surface encumbrances that create a hazard will be removed or made safe before excavation is begun.
- Special precautions will be taken in sloping or shoring the sides of excavations adjacent to a previously backfilled excavation.
- Except in hard rock, excavations below the level of the base of the footing of any foundation or retaining wall will not be permitted unless the wall is underpinned and all other precautions have been taken to ensure the stability of the adjacent walls.
- All ladders used in excavation operations will be in accordance with the requirements of 29 CFR 1926 Subpart L.
- Excavations will be inspected at least daily, or more often as conditions warrant, by a competent person to ensure that changes in temperature, precipitation, shallow groundwater, overburden, nearby building weight, vibrations, or nearby equipment operation has not caused weakening of sides, faces, and flows. The SSO will accompany the competent person and document this inspection in the daily safety log.
- Diversion ditches, dikes, or other suitable means will be used to prevent water from entering an excavation and for drainage of the excavation.
- When mobile equipment is used or allowed adjacent to excavations, stop logs or barricades will be installed. The grade will always be away from the excavation.
- Dust conditions during excavation will be kept to a minimum. Wetting agents shall be used upon the direction of the SSO.
- Field personnel shall not enter any excavation, without specific direction, for any reason except to rescue injured individuals who have fallen into the excavated area.

- All excavations will be marked and protected at all times to ensure site personnel, visitors, or unauthorized personnel do not enter without permission or fall into the trench.

- Personnel will work in pairs when working around an excavation of 2' or more.

Trench Entry Requirements

The following requirements must be met before any personnel are permitted to enter any excavation.

- Expected hazardous ground movement areas and banks more than four (4) feet high (or less if soil is deemed unstable by the competent person) shall be shored, laid back to a stable slope, shielded, or equivalent.

- Sides of trenches or excavations in unstable or soft material four (4) feet or more in depth (or less if soil is deemed unstable by the competent person) shall be shored, sheeted, braced, sloped, or equivalent.

- Sides of excavations in hard compact soil, including embankments, are shored or otherwise supported when the trench is four (4) feet or more in depth (less if soil is deemed unstable by the qualified person).

- Materials used for sheeting, sheet piling, bracing, shoring, and underpinning shall be in good, serviceable condition.

- A means of egress (ladder, ramps, stairways, etc.) shall be accessible at any location inside the excavation without requiring more than 25 feet of lateral travel distance.

- Additional precautions by way of shoring and bracing shall be taken to prevent slides or cave-ins when the competent person subjects excavations to vibrations as deemed necessary.

Atmosphere & Testing

Also, before an employee enters an excavation greater than four (4) feet in depth (or less if soil is deemed unstable by the competent person), the atmosphere must be tested to ensure that an oxygen deficient or hazardous atmosphere does not exist. If the concentration of any airborne contaminant exceeds one-half its permissible exposure limit (PEL) or other applicable occupational exposure limit (OEL), the airborne oxygen concentration is less than 19.5 percent, or explosivity exceeds ten percent of the lower explosive limit (LEL), then no personnel shall be permitted to enter the excavation until such engineering controls or other hazard controls are instituted to eliminate or control hazard.

Walking/Working Surfaces (Floor/Wall Openings; Slips, Trips, Falls and Protruding Objects)

Hazards from careless movements, protruding objects, debris, spills, placement of materials on paths or foot traffic areas, present a problem with regard to slips, trips, falls, and puncture wounds. If any such hazards are identified, correct them immediately and if that is not possible, report the hazard to your Site Health and Safety Officer or Project Manager as soon as possible.

Other Slip, Trip and Fall Hazards

Personnel should stay alert at all times and if tired or distracted, take this into account when working at the site. To minimize the possibility of injury:

- 8" sturdy steel toed boots with good tread are required on all field activities for this project.
- Don't run.
- Slide feet when walking on slick/wet surfaces.
- Don't walk up or down steep embankments/hills if possible.
  - If not possible, walk at an angle when going up/down embankments/hills.
- Don't carry items that block your vision.
- Use handrails/grips when available and maintain 3-point contact whenever possible.
- Don't jump down from equipment and look down before you step down.
- Use appropriate fall protection when working at elevation.
- Don't use ladders/scaffolds during high winds or when ice or snow is on the rungs/work surface.
- Don't use ladder substitutes like a box or truck fender, and don't use ladders/scaffolding that is not in good condition.
- Keep paths and work areas clear of tools, equipment, boxes, cords, etc.
  - Tape or secure cords, wires, etc. to minimize trip/fall hazard.
- If a protruding object cannot be moved, make sure the object can be easily seen or guard/pad the object if possible.
- Use ancillary lighting such as flashlights & headband lights when necessary.

ARCADIS

Attachment D-3

HASP Addendum Pages

Addendum Page

This form should be used to document any changes required to this HASP. These changes may be a result of changes to the scope of services, changes in field conditions, new hazards identified on the Site, higher or lower hazards than anticipated, etc. Please complete this form prior to the next work day once the changes have been identified. Review the modifications with all Site staff, including subcontractors, during the daily tailgate briefing, and complete the tailgate briefing form as required. Attach a copy of the addendum to all copies of the HASP including the Site copy.

Date of Changed Conditions: _____ Date of Addendum: _____

Description of Change that Results in Modifications to HASP:

_____

_____

_____

_____

_____

_____

Describe in Detail the Changes Required to the HASP:

_____

_____

_____

_____

_____

_____

_____

Signed: _____ Signed: _____

Project Manager Site Safety Officer

Signed: _____ Signed: _____

Project H&S Manager HASP Reviewer

ARCADIS

Attachment D-4

Visitor Sign-In Log

ARCADIS

Attachment D-4

HASP Acceptance and Site Visitor Log

By signing below, I waive, release and discharge the Owner of the Site and ARCADIS G&M, Inc. and their employees from any future claims for bodily and personal injuries which may result from my presence at, entering, or leaving the Site and in any way arising from or related to any and all known and unknown conditions on the Site.

Name	Company	Reason for Visit	Date/Time On Site	Date/Time Off Site

ARCADIS

Attachment D-5

Site Activities Tailgate Safety Briefing
Sign-In Log

ARCADIS

Attachment D-5

ARCADIS			
Site Activities Tailgate Safety Briefing Sign-in Log			
Project Number:	CI001286.000	**Project Name:**	Lake Calumet Cluster
Date:		**Time:**	
Briefing Conducted by:	**Signature:**	**Company: ARCADIS**	

This sign-in log documents the tailgate briefing conducted in accordance with the HASP. Personnel who perform work operations on Site are required to attend each briefing and to acknowledge receipt of each briefing, daily.

TOPICS COVERED (check all those covered):

☐ General PPE Usage	☐ Confined Space	☐ Excavation Safety
☐ Hearing Conservation	☐ Slips, Trips, Falls	☐ Confined Space
☐ Respiratory Protection	☐ Heat Stress	☐ Traffic Safety
☐ Personal Hygiene	☐ Thermal Stresses	☐ Changes to the HASP
☐ Exposure Guidelines	☐ Site Control	☐ Initial Review of Hazard Evaluation
☐ Decon Procedures	☐ Work Zones	☐ Other (specify):
☐ Emergency Procedures (include route to hospital)	☐ Lockout/Tagout	☐ Other (specify):

Printed Name	Signature	Company Name

ARCADIS

Attachment D-6

Additional Hazard Information

Safety (MSDS) data for benzene

Click here for data on benzene in student-friendly format, from the HSci project

General

Synonyms: benzol, phenyl hydride, coal naphtha
Molecular formula: C_6H_6
CAS No: 71-43-2
EC No: 200-753-7

Physical data

Appearance: colourless liquid
Melting point: 5.5 C
Boiling point: 80 C
Specific gravity: 0.87
Vapour pressure: 74.6 mm Hg at 20 C
Flash point: -11 C
Explosion limits: 1.3 % - 8 %
Autoignition temperature: 561 C

Stability

Stable. Substances to be avoided include strong oxidising agents, sulphuric acid, nitric acid. **Highly flammable.**

Toxicology

This material is a known carcinogen. The risks of using it in the laboratory must be fully assessed before work begins. TLV 10 ppm. Short-term exposure may cause a variety of effects, including nausea, vomiting, dizziness, narcosis, reduction in blood pressure, CNS depression. Skin contact may lead to dermatitis. Long-term exposure

may lead to irreversible effects. Severe eye irritant. Skin and respiratory irritant.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
ORL-MAN LDLO 50 mg kg^{-1}
ORL-RAT LD50 930 mg kg^{-1}
IHL-MUS LC50 9980 ppm
ORL-MUS LD50 4700 mg kg^{-1}

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R11 R23 R24 R25 R45 R48.

Personal protection

Safety glasses, gloves, good ventilation. Thought should be given to using an alternative, safer product.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S45 S53.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

This information was last updated on November 17, 2004. Although we have tried to make it as accurate and useful as possible, we can take no responsibility for its use or misuse. We welcome corrections, updates and suggestions for improvements.

Safety (MSDS) data for toluene

Click here for data on toluene in student-friendly format, from the HSci project

General

Synonyms: methylbenzene, phenylmethane, toluol, antisal 1A, CP 25, methacide, methylbenzol, NCI-C07272, RCRA waste number U220, tolu-sol
Uses: Solvent
Molecular formula: C_7H_8
CAS No: 108-88-3
EC No: 203-625-9
Annex I Index No: 601-021-00-3

Physical data

Appearance: Colourless liquid with a benzene-like odour (odour threshold 0.17 ppm)
Melting point: -93 C
Boiling point: 110.6 C
Specific gravity: 0.865
Vapour pressure: 22 mm Hg at 20 C (vapour density 3.2)
Flash point: 4 C
Explosion limits: 1% - 7%
Autoignition temperature: 536 C

Stability

Stable. Substances to be avoided: oxidising agents, oxygen, moisture. **Highly flammable.** Hygroscopic.

Toxicology

Toxic by inhalation, ingestion or by absorption through skin. Serious irritant. Experimental teratogen.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
ORL-RAT LD50 636 mg kg^{-1}
IPR-RAT LD50 1332 mg kg^{-1}
ORL-HMN LDLO 50 mg kg^{-1}
IPR-MUS LD50 59 mg kg^{-1}
IHL-MAM LC50 30 g m^{-3}

Irritation data
(The meaning of any abbreviations which appear in this section is given here.)
EYE-HMN 300 ppm.
SKN-RBT 435 mg mild.

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R11 R20

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
UN Major hazard class 3.0 Packing group II. UN No 1294. IMDG class 3.

Personal protection

Safety glasses. Good ventilation.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S16 S25 S29 S33.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

This information was last updated on October 26, 2004. Although we have tried to make it as accurate and useful as possible, we can take no responsibility for its use or misuse.

Safety (MSDS) data for ethylbenzene

General

Synonyms: phenylethane, EB, ethylbenzol, ethyl benzene
Molecular formula: C_8H_{10}
CAS No: 100-41-4
EC No: 202-849-4

Physical data

Appearance: colourless liquid
Melting point: -95 C
Boiling point: 136 C
Vapour density: 3.7
Vapour pressure: 10 mm Hg at 20 C
Specific gravity: 0.867
Flash point: 15 C
Explosion limits: 1 % - 6.7 %
Autoignition temperature: 432 C

Stability

Stable. Incompatible with oxidizing agents. Flammable.

Toxicology

May be harmful by inhalation, ingestion or through skin contact. Causes severe eye irritation. Skin and respiratory system irritant. Experimental teratogen. Narcotic in high concentration.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
ORL-RAT LD50 3500 mg kg^{-1}
SKN-RBT LD50 17800 mg kg^{-1}
IHL-GPG LCLO 10000 ppm

Irritation data
(The meaning of any abbreviations which appear in this section is given here.)
SKN-RBT 15 mg/24h open mld.

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R10 R36 R37 R38.

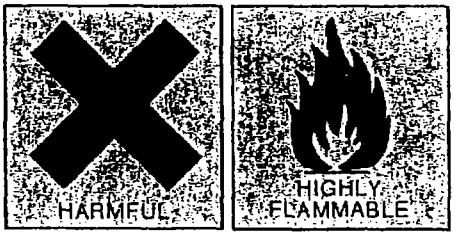
Personal protection

Safety glasses. Good ventilation.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

This information was last updated on April 14, 2005. We have tried to make it as accurate and useful as possible, but can take no responsibility for its use, misuse, or accuracy. We have not verified this information, and cannot guarantee that it is up-to-date.

Safety (MSDS) data for xylenes



General

Synonyms: dimethylbenzene, xylol
Molecular formula: $C_6H_4(CH_3)_2$ This is a mixture of the three xylenes, m-xylene (CAS 108-38-3), o-xylene (CAS 95-47-6) and p-xylene (CAS 106-42-3), and often also contains ethyl bezene (CAS 100-41-4).
CAS No: 1330-20-7
EINECS No:

Physical data

Appearance: colourless liquid
Melting point: -48 C
Boiling point: 137 C
Vapour density: 3.7 (air = 1)
Vapour pressure: 5.1 mm Hg at 20 C
Density (g cm^{-3}): 0.87
Flash point: 27 C (closed cup)
Explosion limits: 1.1 - 7%
Autoignition temperature:
Water solubility:

Stability

Stable. Highly flammable - incompatible with strong oxidizing agents.

Toxicology

Harmful if swallowed or inhaled. Eye, skin and respiratory irritant. May act as a narcotic. Typical TLV/TWA 100 ppm.

Toxicity data

(The meaning of any abbreviations which appear in this section is given here.)

ORL-RAT LD50 4300 mg kg^{-1}
SCU-RAT LD50 1700 mg kg^{-1}

Transport information

Personal protection

Safety glasses, good ventilation. Remove sources of ignition from the working area.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

This information was last updated on September 4, 2003. We have tried to make it as accurate and useful as possible, but can take no responsibility for its use, misuse, or accuracy. We have not verified this information, and cannot guarantee that it is up-to-date.

MSDS Number: **M4420** * * * * * *Effective Date: 05/14/03* * * * * *Supercedes: 07/22/02*

MSDS Material Safety Data Sheet

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

National Response In Canada
CANUTEC: 613-996-6666

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

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

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

J.T.Baker

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

METHYLENE CHLORIDE

1. Product Identification

Synonyms: MC; Dichloromethane (DCM); Methylene dichloride; Methylene bichloride; Methane dichloride
CAS No.: 75-09-2
Molecular Weight: 84.93
Chemical Formula: CH2Cl2
Product Codes: 9235, 9264, 9266, 9295, 9315, 9324, 9329, 9330, 9348, 9350, 9965, Q480

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Methylene Chloride	75-09-2	> 99%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED

THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, CARDIOVASCULAR SYSTEM, AND BLOOD. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.

SAF-T-DATA(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Cancer Causing)
Flammability Rating: 1 - Slight
Reactivity Rating: 2 - Moderate
Contact Rating: 3 - Severe
Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES
Storage Color Code: Blue (Health)

Potential Health Effects

Inhalation:
Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes formation of carbon monoxide in blood which affects cardiovascular system and central nervous system. Continued exposure may cause increased light-headedness, staggering, unconsciousness, and even death. Exposure may make the symptoms of angina (chest pains) worse.
Ingestion:
May cause irritation of the gastrointestinal tract with vomiting. If vomiting results in aspiration, chemical pneumonia could follow. Absorption through gastrointestinal tract may produce symptoms of central nervous system depression ranging from light headedness to unconsciousness.
Skin Contact:
Causes irritation, redness and pain. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.
Eye Contact:
Vapors can cause eye irritation. Contact can produce pain, inflammation and temporal eye damage.
Chronic Exposure:
Can cause headache, mental confusion, depression, liver effects, kidney effects, bronchitis, loss of appetite, nausea, lack of balance, and visual disturbances. Can cause dermatitis upon prolonged skin contact. Methylene chloride may cause cancer in humans.
Aggravation of Pre-existing Conditions:
Persons with pre-existing skin disorders, eye problems, impaired liver, kidney, respiratory or cardiovascular function may be more susceptible to the effects of this substance.

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4. First Aid Measures

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.
Ingestion:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. Get medical attention immediately.
Skin Contact:
Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Wash clothing before reuse. Thoroughly clean shoes before reuse.
Eye Contact:
Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

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5. Fire Fighting Measures

Fire:
Autoignition temperature: 556C (1033F)
Flammable limits in air % by volume:
lel: 12; uel: 23
Forms flammable vapor-air mixtures above 100C (212F).
Explosion:
Concentrated can be ignited by a high intensity ignition source. Vapor may form flammable mixture in atmosphere that contains a high percentage of oxygen. Sealed containers may rupture when heated.
Fire Extinguishing Media:
Dry chemical, foam or carbon dioxide. Water spray may be used to keep fire exposed containers cool.
Special Information:
In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Combustion by-products include phosgene and hydrogen chloride gases. Structural firefighters' clothing provides only limited protection to the combustion products of this material.

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6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Outside or detached storage is recommended. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product. To minimize decomposition, all storage containers should be galvanized or lined with a phenolic coating. This material may corrode plastic and rubber. Wear special protective equipment (Sec. 8) for maintenance break-in or where exposures may exceed established exposure levels. Wash hands, face, forearms and neck when exiting restricted areas. Shower, dispose of outer clothing, change to clean garments at the end of the day. Avoid cross-contamination of street clothes. Wash hands before eating and do not eat, drink, or smoke in workplace. Odor Threshold: 205 - 307 ppm. The odor threshold only serves as a warning of exposure; not smelling it does not mean you are not being exposed.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:
Methylene Chloride (Dichloromethane):
- OSHA Permissible Exposure Limit (PEL) -
25 ppm (TWA), 125 ppm (STEL), 12.5 ppm (8-hour TWA - Action Level)
- ACGIH Threshold Limit Value (TLV) -
50 ppm (TWA), A3 - suspected human carcinogen.

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

Personal Respirators (NIOSH Approved):
If the exposure limit is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or full-facepiece self-contained breathing apparatus. The cartridges recommended for this material have a predicted service of less than 30 minutes at concentrations of ten times (10x) the exposure limits. Actual service life will vary considerbly, depending on concentration levels, temperature, humidity, and work rate. This substance has poor warning properties.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Neoprene is a recommended material for personal protective equipment. Natural rubber and polyvinyl chloride ARE NOT recommended materials for personal protective equipment.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

Other Control Measures:
Do not use closed circuit rebreathing system employing soda lime or other carbon dioxide absorber because of formation of toxic compounds capable of producing cranial nerve paralysis. See OSHA Standard for medical surveillance, record keeping, and reporting requirements for methylene chloride (29 CFR 1910.1052).

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9. Physical and Chemical Properties

Appearance:
Clear, colorless liquid.
Odor:
Chloroform-like odor.
Solubility:
1.32 gm/100 gm water @ 20C.
Specific Gravity:
1.318 @ 25C
pH:
No information found.
% Volatiles by volume @ 21C (70F):
100
Boiling Point:
39.8C (104F)
Melting Point:
-97C (-143F)
Vapor Density (Air=1):
2.9
Vapor Pressure (mm Hg):
350 @ 20C (68F)
Evaporation Rate (BuAc=1):
27.5

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10. Stability and Reactivity

Stability:
Stable under ordinary conditions of use and storage.
Hazardous Decomposition Products:
Emits highly toxic fumes of phosgene when heated to decomposition. Decomposes in a flame or hot surface to form toxic gas phosgene and corrosive mists of hydrochloric acid. Carbon dioxide and carbon monoxide may form when heated to decomposition.
Hazardous Polymerization:
Will not occur.
Incompatibilities:
Strong oxidizers, strong caustics, plastics, rubber, nitric acid, water + heat, and chemically active metals, such as aluminum and magnesium powder, sodium, potassium, and lithium. Avoid contact with open flames and electrical arcs. Liquid methylene chloride will attack some forms of plastics, rubber, and coatings.

Conditions to Avoid:
Moisture, heat, flames, ignition sources and incompatibles.

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11. Toxicological Information

Toxicological Data:
Dichloromethane: Oral rat LD50: 1600 mg/kg; inhalation rat LC50: 52 gm/m3; investigated as a tumorigen, mutagen, reproductive effector.
Reproductive Toxicity:
Dichloromethane has been linked to spontaneous abortions in humans.

--------\Cancer Lists\----------

Ingredient	---NTP Carcinogen--- Known	Anticipated	IARC Category
Methylene Chloride (75-09-2)	No	Yes	2B

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12. Ecological Information

Environmental Fate:
When released into the soil, this material may leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released into water, this material may biodegrade to a moderate extent. When released to water, this material is expected to quickly evaporate. This material has a log octanol-water partition coefficient of less than 3.0. This material is not expected to significantly bioaccumulate. When released into the air, this material may be moderately degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of greater than 30 days. When released into the air, this material may be removed from the atmosphere to a moderate extent by wet deposition.
Environmental Toxicity:
The LC50/96-hour values for fish are over 100 mg/l. This material is not expected to be toxic to aquatic life.

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13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

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14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: DICHLOROMETHANE
Hazard Class: 6.1
UN/NA: UN1593
Packing Group: III
Information reported for product/size: 52L

International (Water, I.M.O.)

Proper Shipping Name: DICHLOROMETHANE
Hazard Class: 6.1
UN/NA: UN1593
Packing Group: III
Information reported for product/size: 52L

International (Air, I.C.A.O.)

Proper Shipping Name: DICHLOROMETHANE
Hazard Class: 6.1
UN/NA: UN1593
Packing Group: III
Information reported for product/size: 52L

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15. Regulatory Information

--------\Chemical Inventory Status - Part 1\--------

Ingredient	TSCA	EC	Japan	Australia
Methylene Chloride (75-09-2)	Yes	Yes	Yes	Yes

--------\Chemical Inventory Status - Part 2\--------

Ingredient	Korea	--Canada-- DSL	NDSL	Phil.
Methylene Chloride (75-09-2)	Yes	Yes	No	Yes

--------\Federal, State & International Regulations - Part 1\--------

Ingredient	-SARA 302- RQ	TPQ	------SARA 313------ List	Chemical Catg.
Methylene Chloride (75-09-2)	No	No	Yes	No

--------\Federal, State & International Regulations - Part 2\--------

Ingredient	CERCLA	-RCRA- 261.33	-TSCA- 8(d)
Methylene Chloride (75-09-2)	1000	U080	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
SARA 311/312: Acute: Yes Chronic: Yes Fire: No Pressure: No
Reactivity: No (Pure / Liquid)

WARNING:
THIS PRODUCT CONTAINS A CHEMICAL(S) KNOWN TO THE STATE OF CALIFORNIA TO CAUSE CANCER.

Australian Hazchem Code: 2Z
Poison Schedule: S5
WHMIS:
This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

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16. Other Information

NFPA Ratings: Health: 2 Flammability: 1 Reactivity: 0
Label Hazard Warning:
WARNING! HARMFUL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER, CARDIOVASCULAR SYSTEM, AND BLOOD. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. SUSPECT CANCER HAZARD. MAY CAUSE CANCER. Risk of cancer depends on level and duration of exposure.
Label Precautions:
Do not breathe vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep away from heat and flame.
Do not get in eyes, on skin, or on clothing.
Label First Aid:
If swallowed, DO NOT INDUCE VOMITING. Give large quantities of water. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. In all cases, get medical attention.
Product Use:
Laboratory Reagent.
Revision Information:
MSDS Section(s) changed since last revision of document include: 3.
Disclaimer:
****

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Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

ARCADIS

Attachment D-7

Air Monitoring Records

ARCADIS

Attachment D-7

Real Time Air Monitoring Data Collection Form

Document all air monitoring conducted on the Site below based on Section E of the HASP. Keep this form with the project files.

Site Name: Lake Calumet Cluster Date: _____

Instrument: _____ Model: _____ Serial #: _____

Calibration Method: (material used, settings, etc.)	
Calibration Results:	
Calibrated By:	

Activity Being Monitored	Compounds Monitored	Time	Reading	Action Required ? Y/N
During drilling of monitoring wells	Soil sample – total volatile organics			

Describe Any Actions Taken as a Result of this Air Monitoring and Why:

_____

_____

_____

Signed: _____

Site Safety Officer

ARCADIS

Attachment D-8

Confined Space Entry Permit

ARCADIS

Attachment D-8

CONFINED SPACE ENTRY PERMIT

Location:	
Date of Entry:	Date of Expiration:
Time of Entry:	Time of Expiration:
Purpose of Entry:	
Anticipated Hazards:	
I certify that all required precautions have been taken and necessary equipment is provided for safe entry and work in this confined space.	
Authorizing Supervisor:	Signature:

Entry Requirements:

☐ Lock out / de-energize	☐ Source of ignition removed	☐ Tripod escape unit
☐ Lines broken, capped or blanked	☐ Emergency scuba	☐ Lifelines
☐ Cleaned, drained, washed & purged	☐ Suitable footwear	☐ Fire extinguishers
☐ Ventilation	☐ Two way radios	☐ Lighting
☐ Secure area	☐ Telephone	☐ Hand protection
☐ Pedestrian guards	☐ Approved personal flotation devices	☐ First aid kit
☐ Vehicular barriers	☐ Hard hats	☐ Scuba
☐ Escape harness	☐ Eye protection	☐ Protective clothing
☐ Air purifying respirator	☐ MSDS's for confined space hazards	☐ Hot work permit

Monitoring Equipment: **Testing Technician:**

Monitoring Equipment / Serial #	***Tests Conducted***	***Permissible Entry Limit***	***Test Results***
	Oxygen	19.5 – 23.5%	
	Lower explosive limit	<10%	
	Carbon monoxide	25 ppm	
	Aromatic hydrocarbon	1 – 5 ppm	
	Hydrogen sulfide	10 ppm	

Emergency Response

Rescue Team Name	2-Way Radio Operational	Verification of Availability to Respond	***External Rescue Team***
			Ambulance - 911
			Fire - 911
			Police - 911

By My Signature, I Certify That I Have Read, Understand And Will Abide By This Permit And Any Attachments

ARCADIS

Authorized Entrant	Entry Time	Exit Time	Authorized Attendant

G:H&S/Manual/Ccorpuz/9-9-04