NEW YORK STATE SUPERFUND CONTRACT

On-Site Soil and Ground Water
Revere Smelting and Refining Site
Wallkill, New York

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY WORK PLAN

Report and Appendices A-G

Work Assignment No. D004090-1

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WORK PLAN

Remedial Investigation/Feasibility Study Work Plan

Revere Smelting & Refining Site
Wallkill, New York

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Vice President

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O'BRIEN & GERE
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1. Introduction

This purpose of this work plan is to describe the scope of work for the Remedial Investigation/Feasibility Study (RI/FS) which will be conducted at the Revere Smelting and Refining Corporation (Revere) facility in Wallkill, New York (the site). This work plan provides a discussion of the objectives of the RI/FS, details the types of activities to be completed and identifies the number and type of environmental samples to be collected and analyzed as part of the field program.

A site-specific Health & Safety Plan (HASP), Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP) and a Citizen Participation Plan (CPP) have been prepared in support of this work plan. These documents are appendices to this work.

The Revere Site (the site) is located at 65 Ballard Road in Middletown, Orange County, New York. The site is located in a suburban industrial area and occupies a 62-acre parcel of land. The location of the Revere Site is shown on Figure 1.

Approximately one third of the property is used for plant operations. The remainder of the property consists of undeveloped land containing overgrown field, mature woodlands, wetlands, and a pond. A mixture of residential and commercial/industrial properties are located in the vicinity of the site.

The Revere site has been divided into four separate operable units (OUs):

OU-1 On-site soil, surface water and sediment exclusive of the operating facility
OU-2 On-site ground water
OU-3 Off-site area (includes Revere parcel south of railroad tracks)
OU-4 Operating facility (Plant area)

This work plan covers the activities to be completed in conjunction with OU-1 and OU-2.

1.1. Background

The Revere facility was constructed in 1970 and was acquired by Revere in 1972. The site is located in a suburban industrial area and occupies a 62-acre parcel of land. Approximately one third of the property is used for plant operations. The remainder of the property consists of undeveloped land containing overgrown field, mature woodlands, wetlands, and a pond.

Revere operates a secondary lead smelter and manufactures lead, lead alloys, polypropylene, and sodium sulfate crystals. The process materials used at the plant include spent and industrial lead-acid batteries, factory scrap, coal fines, hard rubber battery cases, pebble lime and sodium carbonate. Calcium oxide, ferric sulfate, sodium hydroxide, phosphoric and hydrochloric acids, and flocculants are used for process water treatment.

The battery recycling process includes draining of the acid, shredding of the batteries, and subsequent separation of the lead-bearing material. The lead-bearing material is then placed into the smelter where smelting fluxes such as coal, fines, coke or rubber from battery cases, pebble lime and iron are added. Depending on the requirements, the material may be run through the smelter more than once to refine the mixes. Other additives such as red phosphorus, pyrite, sulfur, sodium nitrate, sodium hydroxide, tin, antimony, arsenic, and copper may also be added to refine the product or make alloys.

Revere recycles approximately 4,000,000 to 5,000,000 batteries per year using this process. During the late 1970's and early 1980's, large quantities of material containing lead slag, battery parts, and other wastes were disposed on the property.

In addition to physical waste disposal, fugitive emissions have contributed to the deposition of metal containing material around the site. Specifically, furnace-feed materials were historically stored in an uncovered area of the property which allowed for erosion and potential transport of materials. In addition, historic use of uncontrolled ventilation units within the production facility may have resulted in fugitive emissions of airborne materials from the facility.

1.2. Hydrogeology

Based on investigations conducted to date by Revere, on-site soils have been generally classified into three units: 1) fill, 2) reworked glacial till, and 3) silty glacial till. The fill material generally consists of reworked till mixed with anthropogenic material such as process residuals and slag associate with facility operations. The reworked till and silty till are

generally the same, consisting of clayey silt with varying amounts of sand, gravel, and rock fragments. The reworked till is generally dark brown to gray in color and has a greater percentage of gravel and rock fragments than the native till. The native till is yellowish brown to reddish brown in color.

Ground water investigations conducted at the site between 1992 and 1994 resulted in the installation of seventeen monitoring wells within the fill and natural materials at the site. The depths of these wells ranges from 8 to 33 ft below grade. In 1994, ground water levels from these wells ranged from approximately 1 to 18 ft below grade. Ground water elevation data indicated that ground water flow in the site area is generally to the south-southeast towards the pond under a hydraulic gradient of 0.10 near the process area to 0.04 ft/ft within the fill deposits on the eastern portion of the facility. A slurry wall was partially completed in 1999, which may have impacted the natural flow direction and water levels. A site map is provided as Figure 2.

1.3. RCRA corrective actions (CAs)

Two CAs were completed at the site that involved the excavation and/or off-site disposal of impacted soils. One CA involved the removal of surface soils in the grassy area between the facility and Ballard Road and will be referred to as the North and South Lawn CA. The second CA involved the excavation of soils from behind the containment building and will be referred to as the Back CA. The approximate locations of the CA activities are provided on Figure 2. As illustrated on this figure, the North Lawn CA was completed in the area north of the driveway leading to the facility and the South lawn CA was completed to the south.

The North and South Lawn CA was reportedly conducted between October 7, 1998 and November 17, 1998. The locations of these excavations provided on Figure 3 are approximate. Confirmation samples were collected from the sidewalls and base of the excavation and analyzed for total lead. The grid spacing was approximately 50 ft by 50 ft.

Review of field notes and sample location maps presenting the results of the confirmation analysis reveals that excavation was completed vertically in one foot layers until the lead concentration at the base of a given grid area was below 500 mg/Kg. The depth of the excavation at each of the grid areas varied from 1 to 3 feet. Laterally, the excavation was completed until the confirmation samples revealed lead levels less than 500 mg/Kg except along the driveway or Ballard Road. In these areas lead concentrations in excess of 500 mg/Kg remain.

The Back or eastern fill CA was initiated on April 11, 1999 but was not completed. The activity involved the excavation of approximately

46,508 tons of impacted soil followed by stabilization and off-site disposal of 34,260 tons of material (soil mixed with stabilizing agent. Approximately 12,125 tons of treated soil and 2,600 cy of unprocessed material currently remains on site in piles. 1,259 tons of clean fill was used to backfill the southernmost portion of the excavation. The exact location of the excavation has not been established. Figure 2 provides an approximate location of the excavation area. No confirmation samples were collected from the sidewalls or bottom of the excavation except where backfilling occurred.

1.4. Data gap analysis

A data gap analysis was completed to evaluate the applicability of data generated during previous investigations for use in evaluation of remedial options. In general, the scope of the data gap analysis consisted of compiling available site-related information into a central database and geographical information system (GIS). The database and GIS were then utilized to evaluate existing data and aid in identifying data gaps in on-site surface and subsurface soils data which needed to be filled prior to evaluation of remedial options. Specifically, the following tasks were completed as part of the Data Gap Analysis.

- Site Background Evaluation
- Cut and Fill Evaluation
- Historical Data Compilation/Database and GIS Development
- Data Usability Analysis
- Compounds of Potential Concern (COPC) Selection
- Horizontal and Vertical Extent Analysis for Surface and Subsurface Soils
- Development of Conclusions and Recommendations

Details pertaining to the efforts completed and the findings of the evaluation are provided in the document entitled Data Gap Analysis for Soils, March 2001 by O'Brien & Gere Engineers, Inc. A summary of the findings follows.

1.4.1. Cut and fill evaluation

Since it is known that large quantities of process-material containing lead slag, battery parts, and other wastes were deposited on site property during the late 1970's and early 1980's, a cut and fill evaluation was completed to evaluate the areas on the site where deposition of process-waste likely occurred. A pre-construction topographic map from 1971-1972 was compared with a more recent topographic site map to complete this evaluation.

A 1971-1972 base map was prepared by Quemetco, Inc. for Revere Smelting prior to acquisition of the property. At the time of acquisition

the property was apparently undeveloped. The Quemetco map shows a proposed location plan for the initial building and parking area for the facility. In addition, this map contains the topographic contours that existed prior to development.

To assess the type of cut-and-fill activities that historically took place on the property, a comparison was made between the Quemetco map and the most current map provided by Environmental Strategies Corp. which contained topography prepared by Wehran Corp. The exact date of the topography is unknown but it is presumed that it was completed in the 1990's and predates the excavations that were completed as CAs at the site as discussed in Section 1.3.

Figure 3 depicts the areas where differences in elevations indicate that process-waste deposition may have occurred. In general, the fill areas extend around the buildings and on the northern and eastern portions of the property.

1.4.2. Surface and subsurface soil evaluation

Surface Soil
There is limited surface soil data for the 0 to 2 inch interval and, of the surface soil sample (defined as those samples less than 0.5 feet) data available, there is limited coverage in the site area. Furthermore, surface soil data within the fill area in the vicinity of the Back Excavation area is not valid at this point in time due to the movement of materials during completion of the CA.

Based on review of the surface soil information, the far north area of the property appears to be clear of impacts. Confirmation samples in the 0-2 inch interval may be appropriate. Outside of the fill area in the eastern portion of the site, there are four areas within OU-1 that warrant further evaluation. These areas include the vicinity south and west of MW-1 (near the Containment Building), confirmation around the North and South lawn CA area, north and west of the Employee Parking Area, and north of the North Lawn Excavation area. In these areas, surface soil samples have been found which exceed action levels.

Surface soil sampling should also be completed within the area surrounding the fill area in the back of the facility to re-evaluate the distribution of contaminants as a result of the more recent soil moving activity. This activity should include collection of the 0 to 2 inch interval to assess exposure risks and assess whether the recent activity involved redeposition of thicker layers of soil.

Subsurface Soil
Similar to the surface soil distribution pattern, it appears that subsurface soils on the north side of the site have not been impacted by historic operations. This should be confirmed.

The horizontal and vertical extent of impacted subsurface soil has not been fully addressed in several areas. The primary area of impact is the fill area in back of the facility. However, there have been limited subsurface investigations completed within the fill area identified to be between the facility and the Lawn Excavation areas to assess whether clean fill or waste materials were placed in this area. Furthermore, of the three areas that have been investigated, two contained soils with total lead and TCLP lead levels in excess of the clean up goals. These areas are west of the Containment Building, near MW-1, and near the Crystalizer Building. Although these areas are in OU-4, the extent of impacted soils may extend to OU-1.

1.5. Conceptual site model

The objective of a conceptual site model is to provide a basis for the Remedial Investigation efforts. The conceptual model has been developed based on review of previously collected information regarding site operations, site development, investigations and corrective action measures.

Primary constituents of concern from the lead smelting industry include lead and other heavy metals used as the primary feedstock for the process. Additives to the process include sulfur, red phosphorus, coal, fluxes, and rubber battery cases. Compounds associated with these materials include metals, and semi-volatile polynuclear hydrocarbons (PAHs) and phenolics. Phosphoric and hydrochloric acids are used in the water processing. The recycling of lead batteries also generates sulfuric acid, which has a low pH.

The Revere facility was constructed on an undeveloped parcel. Review of pre-construction topography suggests that, in order to provide a flat area to construct the facility, a north-south trending area along the center of the production area was cut and the surrounding area in all directions was filled. Previously collected data suggests that the area to the east of the production buildings was filled with waste material from the smelting process. Although some areas to the west of the facility were found to contain impacts, there is no information to suggest that this material consists entirely of waste. Review of an older photograph of the plant indicates that fill on the eastern side of the site was placed up to the low-lying area which is now occupied by a pond and wetland.

Although the containment building now houses the production and waste materials, these materials were historically placed on the outside of the building prior to disposal. Furthermore, air discharges were not treated until the late-1990s when a containment building was constructed for the raw feed stock and air treatment systems were installed. These historical practices may have resulted in the redistribution of site materials, predominantly lead, via wind and vehicular traffic.

Ground water quality data has been collected from several monitoring wells since 1992. The analytical results suggest that ground water is impacted by low pH, lead and sulfate at levels which exceed the ground water standards. The area of impacts is limited to the eastern side of the site in the immediate vicinity of the fill area. Many of the impacted wells are those that have been installed within the fill material. One downgradient well contains elevated sulfate. The elevated levels were also observed the bedrock well at this location.

Low pH has been noted at several wells in the eastern fill area including the water filled excavation which is the result of one of the corrective actions. In contrast to sulfate, the low pH and dissolved metals do not appear to migrate from the immediate fill area. This may be due to the natural buffering capacity of the native soils which neutralizes the pH resulting in dissolution of metals.

Surface water samples have been collected from the discharge from the pond in 1981 by NYSDOT indicated that seepage to the drainage channel on the south side of the waste water treatment plant had pH levels on the order of 3.2. At the location were the drainage channel crossed under the railroad tracks the pH was noted to be between 4.7 and 5.6. Lead concentration at this time was reportedly 3 ppm. In 1982 NYDEC noted pH values on the order of 2.3 while the pH of the natural pond was 2.6 to 2.8. More current evaluation of the drainage channel on the southern side of the building reveal that the pH of the surface water from 1994 to 2000 ranged from 6.5 to 7.5. This suggests that the elevated pH discharges are not currently occurring.

Sediment data was collected from the natural pond in 1988 by Cannonie reportedly contained lead concentrations ranging from 7.7 to 289 mg/Kg. Results of samples collected from the drainageway leading from the pond under the railroad tracks between 1994 and 2000 reveal concentrations of lead from approximately 600 to more than 1600 mg/Kg. Of note, sulfate concentrations seem to have increased from between 200 and 300 mg/Kg in 1997 and 1999 to 16,000 mg/Kg in 2000.

1.6. Objective

The objectives of the RI will be to collect sufficient environmental data to address the data gaps for on-site soils in OU-1 defined by the data gap analysis and evaluate the current ground water quality so that appropriate remedial alternatives can be evaluated in the FS.

2. Remedial investigation

Previous investigations and remedial activities at the Revere site have generated a large volume of data pertaining to the concentration of constituents of concern at the Revere site. However, as stated in Section 1, additional data needs to be generated to allow for the evaluation of the remedy for the soil and ground water impacts at the site.

The following investigation activities have been identified to meet the RI objectives:

- surface soil sampling
- subsurface soil sampling including test pits and soil borings
- ground water quality and flow evaluation
- surface water and sediment sampling

Table 2-1 summarizes the activities to be completed.

Table 2-1. *Field Activities*

Field Task	Rationale	Analyses
Surface soil samples	•Evaluate potential direct exposure pathways	Lead TAL Metals TCL/TAL (10%)
Sediment	•Evaluate sediment quality	Lead TAL Metals TCL/TAL (10%)
Surface water	•Evaluate surface water quality	TAL Metals Hardness TCL/TAL (10%)
Test Pits	•Define edges of process-waste fill	Lead TAL Metals
Soil Borings	•Assess subsurface soil conditions •Estimate volume of affected soils, if any •Verify soils not affected, if warranted	Lead TAL Metals TCL/TAL (10%)
Ground water Evaluation	•Evaluate ground water quality exiting OU-1	TCL/TAL Sulfate Alkalinity pH

2.1. Surface soil

Surface soil samples are to be collected in accordance with the procedures outlined in the FSP. Based on the goals of the RI, general considerations for the collection of surface soil samples are as follow:

- Background samples will be collected to establish a background concentration for lead and arsenic (0-2 inch depth)
- In areas where waste was not disposed, and where existing samples were not collected from the 0 to 2-inch interval. Samples will be collected to verify that the area is not impacted
- In areas where the existing 0 to 0.5-ft samples did not meet the cleanup objectives, deeper samples will be collected as needed in

addition to the 0 to 2-inch interval to define the area of contamination

- Most of the samples will be analyzed for the constituent of concern, lead.
- 10 % of the samples will be analyzed for TCL/TAL minus volatile organics.

Specific locations and numbers of samples to be collected are provided below:

Table 2-2. *Surface Soil Sampling Plan*

Location	Rationale	Number of Samples
Background	to establish background concentrations of lead	6
Between employee parking lot and north lawn excavation	no data available	3
North of north lawn excavation	delineate area where historic samples exceed guidelines	5
North portion of property	no 0 to 2 inch samples to confirm surface soils are below action levels (2 traverses with samples spaced at 400 ft intervals along each traverse)	6
Vicinity of samples SS-5 and SS-2-3C (NE side of site)	exceedances of cleanup goals, no 0 to 2 inch samples	5 (0 to 2 inch) 5 (0 to 2 ft)
East of eastern fill area (between fill and pond)	No data	1
West, east, and south sides of South Lawn Excavation	no 0 to 2 inch data; some exceedances of deeper soils	6 (0 to 2 inch) 6 (0 to 2 ft)
Along Ballard Road – west of North and South Lawn excavations	no 0 to 2 inch data; exceedances of deeper soils	6 (0 to 2 inch) 6 (0 to 2 ft)
West and south of OU-4 (Plant Area) from MW-1 to MW-3	exceedances of cleanup goals, no 0 to 2 inch samples	6 (0 to 2 inch)
Northeast of pond	no 0 to 2 inch samples (if wet, then no samples will be collected	2

Locations of the samples are illustrated on Figure 3.

2.2. Test pits

As discussed in section 1.4.1, fill areas were identified using cut and fill analysis from topographic maps of the site. As illustrated on Figure 3, the fill areas extend around the buildings and on the northern and eastern portions of the property. Based on our current understanding of the site from previous analytical data and site operation summaries, the fill areas identified to the west and north of the facility are generally considered to be clean fill that was placed for the purposes of providing a level surface for the placement of the buildings and other infrastructure for the facility. The fill area on the east side of the operating facility is considered to be process waste material. The material on the south side of the facility is also thought to be process waste.

To assess the horizontal extent of the fill material, test pits will be completed around the northern and eastern sides of the eastern fill area as shown on Figure 4.

To minimize the potential for mixing the process waste with native materials, the test pits will be completed beginning from a point outside of the presumed backfill and proceed toward the fill area and backfilling of the test pit will occur as the test pit is advanced. The test pits will be completed to between 4 and 8 ft below grade and advanced toward the fill area until evidence of the fill material is observed. Once the edge of the fill is encountered, a flag will be placed at grade to demark the edge of the fill. Soil borings will subsequently be used to define whether concentrations of lead in soils outside of the identified fill material are below clean-up objectives.

Because it is not possible to visibly differentiate the fill from the native soils, x-ray fluorescence (XRF) will be used to screen selected soil samples in the field for the presence of lead. The lead values will be used to establish the extent of fill. Field screening will be implemented in accordance with the procedure outlined in the FSP. Up to 10 samples will subsequently be analyzed for total lead by the analytical laboratory for use in verification and correlation of the field screening data.

To further evaluate the distribution of lead concentrations within the various particle sizes of the fill material, up to four samples of the fill will be collected for grain-size and laboratory analysis. A sieve analysis will be conducted on each of the samples using, at a minimum, a No. 60 sieve to separate the fraction of soils less than 250 μm. Up to four additional coarser sieves will be used as appropriate to further divide the coarser fraction. Selected fractions will be analyzed for lead to assess the lead distribution with respect to grain size.

2.3. Soil borings

Subsurface soil samples are to be collected in accordance with the procedures outlined in the FSP. Based on the goals of the RI, general considerations for the collection of surface soil samples are as follow:

- Background samples will be collected to establish a background concentration for lead and arsenic
- TCLP analyses will be conducted where historic lead concentrations are significant
- The samples will be analyzed for the constituent of concern, lead.
- 10% of the samples will be analyzed for TCL/TAL parameters.

Specific locations and numbers of samples to be collected are provided below:

Table 2-3. Soil Boring Plan

Location	Rationale	Number of Borings	Boring Depth	No. of Samples Per Boring
Within the driveway	unclear as to the original location, Lawn excavation data suggests that process waste may have been placed in this area	2	8 ft	2
Vicinity of SS-9	verify sample that had 3500 ppm lead at 0.5 to 1 ft	2	2 ft	1
North and east of the Eastern Fill area	to define the "clean zone" once the fill is defined by test pits.	5	20 ft	2
North of Plant Area	to confirm that there are no exceedances of clean-up goals in soils within fill areas	3	8 ft	2
Fill Area south of Plant Area	to define horizontal and vertical extent of fill material exceeding clean-up goals within this area	4	20 ft	3
Within fill area East of Plant	to establish the maximum depth of impacted soils	2	20 ft	2
Along Ballard road	to identify if fill is present at depth in these areas	6	5 ft	2
Within excavation	to evaluate vertical extent of impacted soil at base of excavation	2	5 ft*	2
Shallow monitoring well borings	to evaluate impacts from soils to ground water	3	20	1

Note: * depth will be limited by method

Locations of the soil borings are provided on Figure 4.

Soil borings will be completed using hollow stem auger or direct push methods depending on the type of soils encountered. Samples will be collected continuously during completion of the borings. A portion of each 2 ft sampling interval will be placed in an appropriate analytical-grade container for submittal to the laboratory. The number of samples identified in Table 2-3 will be selected for analysis. The remainder of the samples will be held for potential future analysis pending the results of the analysis of the selected samples.

2.4. Monitoring well installations

Historical investigations have resulted in the installation of 21 overburden and 4 bedrock monitoring wells at the site. In addition, three new monitoring wells were installed in June 2001 to augment the monitoring well network within the main plant area. The locations of these wells are shown on Figure 6. Table 2-4 summarizes the well construction information. As indicated on the figure and table, 15 wells have been abandoned. The majority of these abandoned wells were located in and around the fill area on the eastern side of the facility.

While the current monitoring well network allows for the evaluation of ground water quality migrating from the operating area and from the Revere property to the south, the network does not allow for the evaluation of ground water impacts from the fill area and migration to the southern parcel. Therefore, four additional monitoring wells will be installed during the RI to better evaluate the potential for migration of site-related constituents from the fill area to the southern parcel.

Three of the new wells will be installed within overburden material and one will be installed within bedrock as shown on Figure 6. The

overburden wells will be installed at a depth to monitor the shallow ground water. Based on information from other wells installed in the area the shallow overburden wells will be completed to between 8 and 20 ft below grade. The bedrock well will be installed between 30 and 45 ft deep depending on the depth that bedrock is encountered. The bedrock well screen will be set a minimum of 5 ft below the bedrock. Surface. Well completion details are provided in the FSP.

To assess potential influence of fill or soils on the ground water quality of each of the overburden monitoring wells, a soil sample will be collected from the screened interval for analysis. The samples will be analyzed for TAL metals.

2.5. On-site excavation sampling

The excavation on the eastern side of the plant building remains open and is currently filled with water, presumably from surface water runoff and ground water infiltration. The bottom of the excavation was never sampled during completion of the excavation program, Therefore, to evaluate the presence of lead at the base of the excavation three samples will be collected for analysis. The sampling crew will select the locations at the time of collection. Approximately 5 ft of water is in the excavation; sediment sampling techniques will be used to collect the samples as outlined in the FSP.

Sample locations within the excavation will be accessed using a flat-bottomed boat. Samples will be collected using push core techniques as described in Section 2.5. The push core will be advanced to approximately 3-ft or refusal, which ever occurs first. Each core will be segregated into three samples for analysis. The sample intervals for analysis will be selected to represent surface, mid and lower portions of the core.

2.6. Sediment sampling

As illustrated on Figure 6, a small stream runs from north to south along the west side of the plant area. The stream crosses under the railroad tracks bordering the south side of the plant and traverses southward across the southern parcel of the property. A second stream originates from the pond located to the north of the railroad tracks on the eastern side of the Revere property. This stream crosses under the railroad tracks to the southern parcel and joins the other stream. Samples of the sediment from this stream and pond have been collected during previous investigations and suggests that the stream and pond are impacted. Additional samples will be collected from these features to address current conditions for the purposes of evaluating remedial scenarios.

Sediment samples will be collected from five locations identified on Figure 5. Two of these locations are within the pond and three are

located within the stream/drainage channel. The samples will be collected from the stream/drainage channel, or in the case of the pond, where standing water is present. Samples will be collected from likely depositional areas located along the primary flow channels or preferred flow pathways using polycarbonate tubes. Sample collection methods are defined in the FSP.

It is anticipated that the majority of sediment samples will be collected using push core techniques. Push core sampling techniques employ manual penetration of sediment using a sampling device that contains a polycarbonate tube to collect the sediment core. The device also consists of a handle that contains a check valve to allow air to escape during sediment penetration and develops a vacuum to retain the core as it is recovered. It is anticipated that three-inch diameter polycarbonate tubes will be used.

Within the pond the push cores will be manually advanced to approximately 3-ft or refusal, which ever occurs first. Within the stream the push cores will be advanced to 2-ft or refusal, whichever occurs first. Generally, refusal represents the full sediment column consisting of the unconsolidated material. If bedding material contain a large fraction of cobbles, rocks, and boulders, push core sampling methods may not work. for these locations sediment will be collected from depths of up to 1 foot using a soil auger modified with polycarbonate tubing and two 6-inch samples will be collected for analysis (0 to 6 inches and 6 to 12 inches).

At the pond locations, up to three samples will be selected for analysis at the following intervals: 0 to 6 inches, 12 to 18 inches and the last 1 ft interval within the core barrel. In the stream bed, two samples will be selected for analysis from the following intervals: 0 to 6 inches, and 12 to 24 inches. The samples will be analyzed for lead. One sample from the pond and one from the stream/drainage channel will be analyzed for TCL/TAL parameters.

2.7. Surface water sampling

Surface water samples are collected quarterly from two locations: the point at which the stream exits the southern parcel and from the pond. These data will continue to be collected and will be used for the remedial alternative evaluations. No new sampling locations are proposed.

2.8. Ground water sampling

Ground water samples are currently being collected quarterly from selected monitoring wells. To further evaluate the ground water quality at the site, ground water samples will be collected from each of the four ground water monitoring wells installed as part of this study in addition

to MW-13. If possible, the timing for collection of the ground water samples will coincide with a quarterly monitoring event to allow for the data to be used for both, the RI and the monitoring program requirements.

Ground water samples will be collected using low-flow sampling techniques to minimize the potential for turbid samples. The sampling procedures are detailed in the FSP. Prior to initiating the sample activity, water levels will be measured at each of the wells and piezometers to allow for an evaluation of ground water flow characteristics.

The collected ground water samples will be analyzed for TCL/TAL parameters, alkalinity, and total sulfate. Conductivity, turbidity, and pH will also be measured using field instrumentation during sample collection.

2.9. Analytical program

Based on the site history and historic data collected from the Revere site, inorganics are the constituents of concern. As identified by the data gap analysis, areas where lead in soil exceeded clean-up goals encompassed those areas where arsenic or antimony also exceeded clean-up goals. Therefore, the sampling program developed for the RI focuses on the identification of those locations where lead exceeds clean-up objectives. In addition, to confirm that there are no other constituents that may govern the remedial goals of the program, a percentage of samples will be analyzed for TCL/TAL parameters.

In addition to lead analysis, approximately 10 % of the samples collected will be analyzed for TCL/TAL parameters to verify that there are no other constituents of concern present that require evaluation. In addition, selected samples collected from fill areas previously defined as containing high levels of lead will also be analyzed for TCLP lead to identify the presence of characteristic hazardous waste.

As stated in Section 2.7, ground water samples will be analyzed for TCL/TAL parameters, alkalinity, and sulfate. Conductivity, turbidity, and pH will also be measured using field instrumentation during sample collection.

The QAPP defines the specific requirements of the analytical program. In general, the samples will be analyzed using New York State Analytical Services Program (NYSASP) methods and procedures. Level IV data quality objectives will be used and Category B deliverable packages will be provided. The data will subsequently be evaluated for conformance with the QAPP and a Data Useability Summary Report (DUSR) will be prepared to document the integrity of the data for use in the evaluation of remedies.

Table 2-5 summarizes the sampling and analysis program identified for the site.

2.10. Decontamination

Drilling tools and non-disposable sampling equipment used during the implementation of the remedial investigation will be decontaminated in accordance with the decontamination procedures outlined in the FSP. At a minimum decontamination of drilling and excavating equipment will be completed between each boring. Sampling equipment will be decontaminated following sample collection of each location.

A decontamination pad shall be set up on-site for use during decontamination of the drilling and excavating equipment. Water generated during this procedure will be treated through the on-site waste water treatment system.

2.11. Investigation derived waste handling

Soils generated during the investigation such as drill cuttings will be placed under the cover of one of the piles of unprocessed soil from the previous corrective action. Soil from the test pits will be placed back into the test pit in the order from which it was removed. Backfilling of the test pits will be completed in lifts with limited compaction by the backhoe bucket.

Water generated during the decontamination and well purging activities will be contained in 55-gallon drums or a single plastic tank for later characterization and offsite disposal.

2.12. Survey

Surveying activities will be completed on two occasions during the RI. A preliminary survey will be completed prior to initiation of the field activities to locate proposed surface soil and soil boring locations that are identified to further delineate previously identified impacted areas or confirm that previously completed Correction Actions were complete. Up to two benchmarks will be established (location and elevation) at the time the preliminary survey is completed for use by the field crews as appropriate.

Following completion of the RI, the locations of the sampling activities will be surveyed. Horizontal and vertical data will be obtained for soil borings and monitoring wells. Horizontal information will be established for surface soil, test pits, surface water and sediment samples.

A New York-licensed surveyor will be used to complete the survey. Horizontal locations will be established to an accuracy of 0.1 ft using a

nearby USGS datum. Elevations will be established to an accuracy of 0.01 inch using the National Geodetic Vertical Datum 1929.

2.13. Ground water user survey

A ground water user survey will be completed to identify and locate residential, commercial, municipal and industrial users within a one mile radius of the site. This information will be used to further assess the potential exposure pathways.

The ground water user survey will include review of publicly available data from the United States Geological Survey (USGS), local health department and other appropriate agencies.

Information such as well size, depth, geologic units, well yields and water uses will be compiled, if available, and incorporated into the RI report.

3. Health and environmental risk assessment

This document outlines the procedures and methods that will be applied to assess the potential risks to human receptors posed by exposure to lead at the site. A human health risk assessment addressing lead concentrations in soil and groundwater at the site will be completed. The objective of the risk assessment will be to evaluate the potential adverse health effects in receptor population potentially exposed to lead at the site. The human health risk assessment will be organized into four basic sections: data evaluation, exposure assessment, toxicity assessment/body burden analysis, and risk characterization.

3.1.1. Data evaluation

The objective of the data evaluation will be to determine if the data generated by field sampling and analysis is suitable for risk assessment purposes. The steps that will be performed in the data evaluation process include:

- compilation of data available from the site investigations and classification of data according to medium sampled,
- compilation of data available from the site investigations according to sample location,
- evaluation of data quality with respect to laboratory qualifiers and detection limits, and
- comparison of the concentrations of potential site related compounds with background levels.

Based on the evaluation, a set of data suitable for use in the human health risk assessment will be developed. The dataset will be compiled into a relational database to facilitate data manipulation and incorporation into the assessment.

3.1.2. Exposure assessment

Exposure is defined as the contact of a receptor (humans in the case of a health risk assessment) with a chemical or physical agent. An exposure pathway describes a mechanism by which a receptor may be exposed to constituents at or originating from a site. The objective of the exposure assessment is to identify and characterize exposure pathways at the site, and determine or estimate the likely magnitude, frequency, duration, and route of exposure of human receptors that may be exposed. There are several factors which influence potential exposure to inorganic

constituents such as lead and these will be addressed to the extent practicable. The exposure assessment consists of the following steps.

a. Characterization of exposure setting. In this step, the exposure setting is characterized with respect to the general physical characteristics of the site and the characteristics of the populations on and near the site. Basic site characteristics such as climate, vegetation, ground water hydrology, and the presence and location of surface water are identified.

b. Characterization of exposure pathways. In this step, the potential exposure pathways for previously identified receptor populations are identified and characterized. Exposure pathways are identified and characterized based on consideration of the sources, releases, types, and location of constituents at the site. Exposure pathways may be classified as being complete or incomplete. A complete pathway is an exposure pathway in which exposure of receptors may occur, under the site specific conditions. An incomplete exposure pathway is an exposure pathway for which it is determined that receptors would not be exposed under the specified conditions. Incomplete exposure pathways are not considered further in the risk assessment. For complete exposure pathways, exposure points (locations where receptors may contact on-site chemical residues) are identified.

c. Quantification of exposure. In this step, the magnitude, frequency, and duration of exposure for the complete pathways are estimated. This involves the estimation of exposure point concentrations, which may involve the use of fate and transport models, or may be based on the statistical evaluation of chemical data from the site. Based on the exposure point concentrations, and the estimated frequency, duration, and route of exposure, the estimated intakes of the on-site chemicals by receptor populations are estimated.

Special considerations for lead

Unlike exposure to many organic compounds, heavy metals have a complex chemistry which can substantially impact (1) exposure to the constituents, and (2) the adverse effects resulting from exposure. A specific issue that will factor in to exposures to heavy metals such as lead is the constituent's *bioavailability*. Bioavailability is a measure of the extent to which the body can absorb the compound following exposure. The bioavailability of a heavy metal such as lead is influenced by three factors: particle size, the chemical form, and the geochemical matrix in which the compound is found.

For example, heavy metals such as lead that are often bound to other molecules when they are present in soil. If the lead particles are bound to large molecules and this complex is ingested, the lead can pass through the body without being absorbed into the bloodstream (USEPA 2001). These particles may be too large to be absorbed or dissolved, and therefore in these instances exposure to lead does not

equate to an adverse effect. Particle size also factors into the total amount of lead to which a person is exposed. Larger particles tend to be less mobile due to the increased bulk and weight of the particle. For instance, larger particles are not easily transported via wind, and are less likely to become components of indoor air dust particles. Because particle size influences both exposure and bioavailability, to the extent that this data is available it will be used to refine these aspects of the exposure assessment. The Technical Review Workgroup for Lead (TRW) recommends that the fine fraction (less than 250 μm) be used to predict exposure to lead in surface soil via incidental ingestion (USEPA 2000).

The chemical form is the second factor to consider, although it will not be directly measured for this assessment. Certain chemical forms and complexes of lead are more soluble and therefore bioavailable following exposure. Thirdly, the geochemical matrix is a consideration. These factors will be addressed qualitatively in the assessment.

3.1.3. Toxicity assessment

The purpose of the toxicity assessment is to weigh available evidence regarding the potential for site related chemical residues of potential concern to cause adverse effects in exposed individuals. In the case of lead, the toxicity assessment is different compared to a chemical risk assessment for other compounds. Traditionally, reference toxicological information which provides a dose-response estimate of the relationship between exposure and the increased likelihood and/or severity of toxic effects is identified for the chemicals of potential concern. However, since reference doses have not been established by the United States Environmental Protection Agency (USEPA) for lead exposure, the toxicity assessment will be comprised of the calculated fetal blood lead levels and a comprehensive toxicity profile for lead. The toxicity profile will collate toxicological information on the effects of lead exposure by credible references such as the USEPA; Agency for Toxic Substances and Disease Registry (ATSDR); and scientific, refereed journals.

3.1.4. Risk characterization

The purpose of the risk characterization step is to quantify the potential health risks to receptors that may result from exposures to on-site lead. The specific methodologies for the surface soil assessment and ground water and surface water assessments are presented in the sections below. Given the respective methodologies to be applied, the risk characterization for surface soil will be presented as predicted blood lead levels in fetuses in women of child-bearing age exposed to lead in site soils. The potential implications for other human receptors at the site will be qualitatively assessed based partially on the results for the predicted adult blood lead levels.

The risk characterization for exposure to ground water and surface water will be based on the USEPA's action level in water, as described below in Section 1.3.

3.1.5. Methodology - soil

The USEPA's procedures for assessing risks to adults exposed to lead in soil will be applied to this evaluation (USEPA 1996). This approach was chosen because the methodology was specifically developed for assessing risks from non-residential adult exposures to lead in soil. The approach is recommended by the TRW as a useful approach for assessing places of employment which have lead contaminated soils.

The USEPA (1996) model assesses lead intake from soil and relates this exposure to blood lead levels in adult women of child-bearing age. The USEPA has identified children as a subpopulation that is particularly sensitive to lead exposures, and therefore has sought to limit childhood exposures to lead. Therefore, although this model was designed to assess non-residential exposure scenarios, the ultimate goal is to predict blood lead levels in children borne to women exposed to lead in soil from workplace exposures. Women of child-bearing age are identified as potential receptors for the adult lead uptake model since they represent a means of exposure to the sensitive population (children). Potential implications for other receptors will be assessed qualitatively and described in the risk characterization.

The first component of the model predicts the mean estimate of blood lead concentrations in adults that are exposed to soil lead concentrations at the site. This equation is presented below.

$$PbB_{adult,\,central} = PbB_{adult,0} + \left(\frac{PbS \times BKSF \times IR_S \times AF_S \times EF_S}{AT} \right)$$

Where:

$PbB_{adult,central}$	Central estimate of blood lead concentrations (µg/dL) in adults (*i.e.*, women of child-bearing age) that have site exposures to soil lead at concentration, PbS.
$PbB_{adult,0}$	Typical blood lead concentration (µg/dL) in adults (*i.e.*, women of child-bearing age) in the absence of site exposures to the site that is being assessed.
PbS	Soil lead concentration in the fine fraction (less than 250 µm) (µg/g) (appropriate average concentration for individual).

BKSF Biokinetic slope factor relating (quasi-steady state) increase in typical adult blood lead concentration to average daily lead uptake (µg/dL blood lead increase per µg/day lead uptake).

IR_s Intake rate of soil, including both outdoor soil and indoor soil-derived dust (g/day).

AF_s Absolute gastrointestinal absorption fraction for ingested lead in soil and lead in dust derived from soil (dimensionless).

EF_s Exposure frequency for contact with assessed soils and/or dust derived in part from these soils (days of exposure during the averaging period); may be taken as days per year for continuing, long term exposure.

AT Averaging time; the total period during which soil contact may occur; 365 days/ year for continuing long term exposures.

The predicted adult blood lead levels from exposure to lead in site soils can then be translated to a resultant fetal blood lead level. The USEPA's Office of Solid Waste and Emergency Response guidance calls for the establishment of cleanup goals to limit childhood risk of exceeding 10 µg/dL to five percent (USEPA 1994). The resultant fetal blood lead levels will be predicted using the following equation.

$$PbB_{fetal,0.95} = PbB_{adult,central} \times GSD_{i,adult}^{1.645} \times R_{fetal/maternal}$$

Where:

$PbB_{fetal,0.95}$ Goal for the 95th percentile blood lead concentration amount fetuses born to women having exposures to the specified site soil concentration. This is interpreted to mean that there is a 95 percent likelihood that a fetus, in a woman who experiences such exposures, would have a blood lead concentration no greater than $PbB_{fetal,0.95,goal}$ (*i.e.*, the likelihood of a blood lead concentration greater than 10 µg/dL would be less than five percent, for the approach described in this report (USEPA 1996)).

$GSD_{i,\ adult}$ Estimated value of the individual geometric standard deviation (dimensionless); the GSD among adults (i.e., women of child-bearing age) that have exposure to similar on-site lead concentrations, but that have non-uniform response (intake, biokinetics) to site lead and non-uniform off-site lead exposures. The exponent, 1.645, is the value of the standard

normal deviate used to calculate the 95th percentile from a lognormal distribution of blood lead concentration.

$R_{fetal/maternal}$ — Constant of proportionality between fetal blood lead concentration at birth and maternal blood lead concentration (dimensionless).

The USEPA provides suggested default values for the parameters in the above equations (USEPA 1996). These default values for parameters such as $PbB_{adult,0}$, BKSF, AF_s, EF_s, IR_s, $GSD_{i,\ adult}$, $R_{fetal/maternal}$ will be applied to this assessment. If site-specific information for exposure frequency is available, it will be used and compared to the results for the USEPA default value.

3.1.6. Methodology – Ground water and surface water

To evaluate potential effects from exposure to lead in ground water, the detected concentrations will be compared with the USEPA action level for lead in water (15 µg/L). For assessment of potential adverse effects caused by exposure to drinking water (if applicable), this comparison will be the extent of the evaluation. However, for exposure via other complete exposure pathways that are identified, a comparative dose will be calculated from the USEPA water action level as follows:

$$\text{Risk based dose}\left(\text{mg/kg - day}\right) = \frac{15\ \mu g}{L} \times \text{Ing}\left(\frac{L}{\text{day}}\right) \times \frac{1}{\text{BW (kg)}} \times \text{CF}$$

Where:

Ing Daily water ingestion
BW Body weight
CF Conversion factor

A lead dose for site specific exposure will be calculated based on the identified complete exposure pathways and compared with the comparative dose for drinking water ingestion. The parameter values for body weight and daily water ingestion (at 15 µg/L) will chosen from USEPA studies and guidance when complete exposure pathways are identified.

3.2. Fish and wildlife impact analysis (FWIA)

Evaluations of potential impacts to ecological receptors at hazardous waste sites in New York State are performed in accordance with guidelines prepared by the New York State Department of Environmental Conservation (NYSDEC). The NYSDEC document, entitled "Fish and Wildlife Impact Analysis at Inactive Hazardous Waste Sites (FWIA)"

(1994), presents a stepwise approach to evaluating ecological impacts that allows decisions to be made regarding the need to proceed to subsequent steps based on the results of the previous steps. The 1994 document is a revision of the 1991 FWIA guidance cited in the Work Plan. There are five Steps of a FWIA as follows:

Step I - Site Description - presents a physical description of the site and evaluates potential ecological receptors based on covertype associations.

Step II - Contaminant Specific Impact Analysis - identifies complete exposure pathways for ecological receptors and evaluates the impact of the exposure on the receptors.

Step III - Ecological Effects of Remedial Alternatives - evaluates each of the identified potential remedial alternatives for their impacts on the habitats and receptors of the site.

Step IV - Implementation of Selected Alternative in Design - delineates the ecological resources affected by the remedy and identifies methods for protection, restoration, or replacement of affected resources.

Step V - Monitoring Program - monitors and evaluates the efficiency of the remedial design in operation at protecting ecological resources.

Step I A through D and Step II A, B and C will be completed to provide an understanding of the ecological receptors, exposure pathways, constituents of ecological concern and the ecotoxicity of the identified constituents. Per the NYSDEC (1994) guidance document, Step I - *Site Description* of the FWIA consists of the following:

A. Site Maps
   1. Topographic Map
   2. Covertype Map
   3. Drainage Map
B. Description of Fish and Wildlife Resources
   1. Fish and Wildlife Resources and Covertypes
   2. Fauna Expected Within Each Covertype and Aquatic Habitat
   3. Observation of Stress
C. Description of Fish and Wildlife Resource Values
   1. Value of Habitat to Associated Fauna
   2. Value of Resources to Humans
D. Identification of Applicable Fish and Wildlife Regulatory Criteria

Step II - Contaminant-Specific Impact Assessment consists, in part, of:

A. Pathway Analysis
B. Criteria-Specific Analysis
C. Toxic Effect Analysis

As part of the Step IIA Pathway Analysis, a conceptual site model and exposure pathway analysis for the site will be developed. The conceptual site model describes the site and its environs, and presents hypotheses regarding the contaminants present, their routes of migration, and the potential exposure of human and ecological receptors. The conceptual site model will describe potentially affected media at the site, potential routes of migration, and receptor populations. Based on the conceptual site model, the potential exposure pathways at the site are identified and qualitatively described. The Step IIB Criteria-Specific Analysis will compare site contaminant levels to applicable criteria. This comparison will provide an assessment of potential impact to site biological receptors.

Based on existing information obtained from previous site investigatory activities, it appears that constituent concentrations in site media warrant performance of the Step IIC *Toxic Effect Analysis*. A toxic effect analysis presumes that fish and wildlife resources have been identified and that the contamination of resources and complete exposure pathways exist. Performance of the toxic effects analysis requires specific toxicological and ecological information. An analysis of toxic effects may look at individual organisms, populations, communities or ecosystems. The appropriate level of analysis will be selected based on the results of the previous Steps of the FWIA.

Food chain modeling

For the purposes of this Work Plan, the toxic effects posed to ecological receptors at the site will be evaluated through the performance of a screening-level risk calculation using food chain modeling. Food chain models are a commonly used tool for assessing the transfer of detected constituents from the source to receptors in different trophic levels. In food chain modeling, the chemical body burden in selected receptors at various trophic levels is estimated based on site-specific data, receptor specific information (such as feeding habits, habitat utilization, life history information), and measured or modeled estimates of constituents in media to which the receptors are exposed (soil/sediment, water, food base). As part of the screening-level risk assessment, conservative literature-derived biota-sediment accumulation factors (BSAF), bio-accumulation factors (BAFs), or bio-concentration factors will be applied to estimate the levels in the food base. The Total Daily Intake (TDI) or body burden of chemicals to identified receptors via feeding and direct contact is then calculated and compared to No Observed Adverse Effects Levels (NOAEL) or tissue residue threshold values to derive a Hazard Quotient (HQ). The HQ is a unitless ratio of a receptor's TDI (mg/kg/day) to the NOAEL (mg/kg/day). HQ results less than or equal to 1 indicate adverse effects are not likely to modeled receptors. HQ results greater than 1 do not necessarily indicate ecological impact, but indicate that the exposure pathway may require further evaluation

The constituents to be evaluated and the parameters to be utilized in the calculation of the HQ (*i.e.* assessment endpoint receptors, life history parameters, bioconcentration factors, NOAELs or other toxicity

reference values) will be selected, in part, based on the results of the previous Steps of the FWIA.

If the screening-level risk assessment indicates that adverse ecological effects at the site are likely, additional activities associated with the performance of the ecological risk assessment, such as refinement of the food chain model to be reflective of actual site conditions or the collection of additional site media data, may be required. Additional ERA steps beyond the screening-level risk assessment are not within the scope of this Work Plan. Therefore, if it is determined that additional ERA steps are warranted, consultation between the involved parties will occur.

4. Focused remedial investigation report

The focused RI Report will integrate and present the results of the focused RI and applicable historical information. The report will incorporate the following components:

- Introduction including purpose and objectives of the assessment, site history, site location and description, and regional setting.
- Site base map with field investigation locations.
- Field investigation procedures including surface soil sampling, subsurface soil sampling, monitoring well installation, ground water sampling and analysis.
- Site conceptual model including site hydrogeology, and nature and extent of ground water contamination.
- Results of the risk assessment and FWIA
- Applicable chemical-specific standards, criteria, and guidelines (SCGs) evaluation.
- Conclusions and recommendations, including the necessity for remedial action.

Data generated during the RI/FS will be added to the existing database of historical data arranged and presented in a report in a clear and logical format using tables, graphs, and figures. Analytical data will be presented on computer-generated summary tables. Various data summaries will include analytical results sorted by sample location.

Graphical displays will present the Site layout and sample locations. Maps depicting the areal extent of contaminant concentrations will be prepared. Generally, graphical displays will be prepared using computer-aided design/drafting (CADD) techniques.

Supporting data including laboratory analytical data, soil boring logs, and ground water sampling logs will be included in the report. The DUSR will be included as an appendix.

Evaluation of data will include reports that have been developed summarizing previously completed investigations. A list of available investigations is provided in references.

5. Focused feasibility study

As outlined in the introduction section of this Work Plan, a number of investigations and remedial activities have taken place at the Revere site. As part of these activities, constituents of concern have been identified and remedial alternatives have been evaluated. Therefore, the Feasibility Study (FS) completed for the on-site soils and ground water will be focused to the extent that the corrective measures have previously been evaluated under RCRA, public input has been provided, and there are limited alternatives for remediating metals in these media. A range of alternatives from "no action" to complete removal will be evaluated. In addition, to the findings of the RI, the FS will incorporate applicable portions of the previously completed corrective measures studies to assist the evaluation of alternatives.

The FS will be conducted consistent with USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA (1988) and NYSDEC's Technical and Administrative Guidance Memorandum entitled Selection of Remedial Actions at Inactive Hazardous Waste Sites (1990). The results of the FS will be documented in the RI/FS Report; the outline of the FS Report will consist of the following:

- Review of work completed during corrective measures study, corrective measures implementation plans and reports
- Development and Screening of Remedial Alternatives
- Development of remedial action objectives for the site based on consideration of site contaminant and exposure migration pathways and potentially applicable standards, criteria, and guidelines (SCGs)
- Estimation of areas and volumes of media to be addressed
- Development of general response actions
- Identification and screening of remedial technologies and process options
- Development of remedial alternatives
- Screening of remedial alternatives (if necessary to reduce the range of alternatives for detailed analysis)

Detailed Analysis of Alternatives

- Individual analysis of alternatives based on the following criteria:
- Overall protection of human health and the environment
- Compliance with SCGs
- Long term effectiveness and permanence
- Reduction of toxicity, mobility, or volume through treatment
- Short term effectiveness
- Implementability
- Cost

- State acceptance
- Community acceptance
- Comparative analysis of alternative based on the above criteria, including identification of the preferred remedy

6. Schedule

A schedule for implementation of the RI/FS Work Plan is provided as Figure 7.

References

United States Environmental Protection Agency (USEPA). 1994. *Revised Interim Soil Lead Guidance for CERCA Sites and RCRA Corrective Action Facilities. OSWER Directive No. 9355.4-12.* Office of Emergency and Remedial Response, Washington, D.C. EPA/540/F-94/043, PB94-963282.

USEPA. 1996. *Recommendations of the Technical Review Workgroup for Lead for an Interim Approach to Assessing Risks Associated with Adult Exposure to Lead in Soil.* Technical Review Workgroup for Lead. December.

USEPA 2000. *TRW Recommendations for Sampling and Analysis of Soil at Lead (Pb) Sites.* Office of Emergency and Remedial Response, Washington, D.C. EPA-540-F-00-010. OSWER 9285.7-38. April

USEPA. 2001. Providing Solutions for a Better Tomorrow: Reducing the Risks Associated with Lead in Soil. Office of Research and Development. Document No. EPA/600/F-01/014. March

Table 2-4
Ground Water Monitoring Well Information

Revere Smelting And Refining Site
Wallkill, New York

Well	Top of PVC Casing (msl)	Ground Elevation (msl)	Well Bottom Elevation (ft)	Well Depth (ft)	Status
Overburden Wells					
MW-1	*520.24*	*518.90*	*505.64*	*13.26*	*ABANDONED*
MW-IA	*520.29*	*518.80*	*495.24*	*23.56*	*ABANDONED*
MW-2	*513.42*	*510.90*	*484.21*	*26.69*	*ABANDONED*
MW-3	*509.47*	*507.10*	*485.14*	*21.96*	*ABANDONED*
MW-4	*512.80*	*511.40*	*493.31*	*18.09*	*ABANDONED*
MW-4A	*513.02*	*511.70*	*478.89*	*32.81*	*ABANDONED*
MW-5	514.72	513.00	493.32	19.68	ABANDONED
MW-6A	509.14	506.80	490.81	15.99	ABANDONED
MW-7	526.63	524.80	510.49	14.31	QTR. MON.
MW-8	*525.49*	*523.80*	*515.96*	*7.84*	*ABANDONED*
MW-8R	526.21	524.06	514.23	9.83	QTR. MON.
MW-9	519.35	518.70	508.61	10.09	QTR. MON.
MW-10	*499.98*	*497.60*	*489.76*	*7.84*	*ABANDONED*
MW-11	*533.48*	*531.40*	*522.12*	*9.28*	*ABANDONED*
MW-12	*502.09*	*500.20*	*491.08*	*9.12*	*ABANDONED*
MW-13	483.32	480.99	463.33	17.66	QTR. MON.
MW-14	483.38	481.20	454.20	27.00	QTR. MON.
MW-15	486.47	484.17	472.89	11.28	QTR. MON.
MW-16	495.22	493.12	476.61	16.51	QTR. MON.
MW-17	491.46	488.87	475.26	13.61	QTR. MON.
MW-18	533.28	530.92	521.29	9.63	QTR. MON.
RSR Well	*519.65*	*516.00*	*495.95*	*20.05*	*ABANDONED*
Bedrock Wells					
MW-13B	483.82	482.21	445.21	37.00	QTR. MON.
MW-14B	484.92	482.8	436.39	46.41	QTR. MON.
MW-15B	486.32	484.01	451.56	32.45	QTR. MON.
MW-188	533.39	531.42	499.84	31.58	QTR. MON.

Notes: msl - mean sea level
ft - feet
QTR. MON. - Well monitored quarterly

Table 2-5
Analytical Summary

Revere Smelting and Refining Site
Wallkill, New York

Samples	Matrix	Laboratory Analysis	Method	No. of Samples	Trip Blank	Field Duplicate	Equipment/ Field Blank	MS	MSD	Total
Surface Soils	Soil	Lead TCL/TAL	CLP-M CLP	56 6		3 1		3 1	3 1	65 9
Subsurface Soil (includes excavation bottom)	Soil	Lead TCL/TAL TCLP Lead	CLP-M CLP	56 6 5	1	3 1		3 1	3 1	65 10 5
Sediment	Soil	Lead TCL/TAL	CLP-M CLP	10 2	1	1 1	1 1	1 1	1 1	14 7
Test Pits (Incl. Sieved samples)	Soil	Lead TCLP Lead	CLP-M	34 10		2		2	2	40 10
Ground Water	Water	TCL/TAL Sulfate Alkalinity	CLP 375.4 310.1	5 5 5	1	1 1 1	1 1 1	1 1 1	1 1 1	10 9 9

FIGURE 1

ADAPTED FROM: GOSHEN, NEW YORK U.S.G.S. 7.5 MIN. QUAD

NEW YORK STATE D.E.C.
REVERE SMELTING AND REFINING
WALLKILL, NEW YORK

SITE LOCATION MAP

QUADRANGLE LOCATION

1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

FILE NO. 10653.26408.018
MARCH 2001

SCALE: 1:24000

O'BRIEN & GERE ENGINEERS INC.

DWG PATH: I:\DIV71\PROJECTS\10653\26408\DWGS\018.DWG-1

PLOT DATE: 03/01/01 SYR PWW

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PLOT DATE: 07/27/01

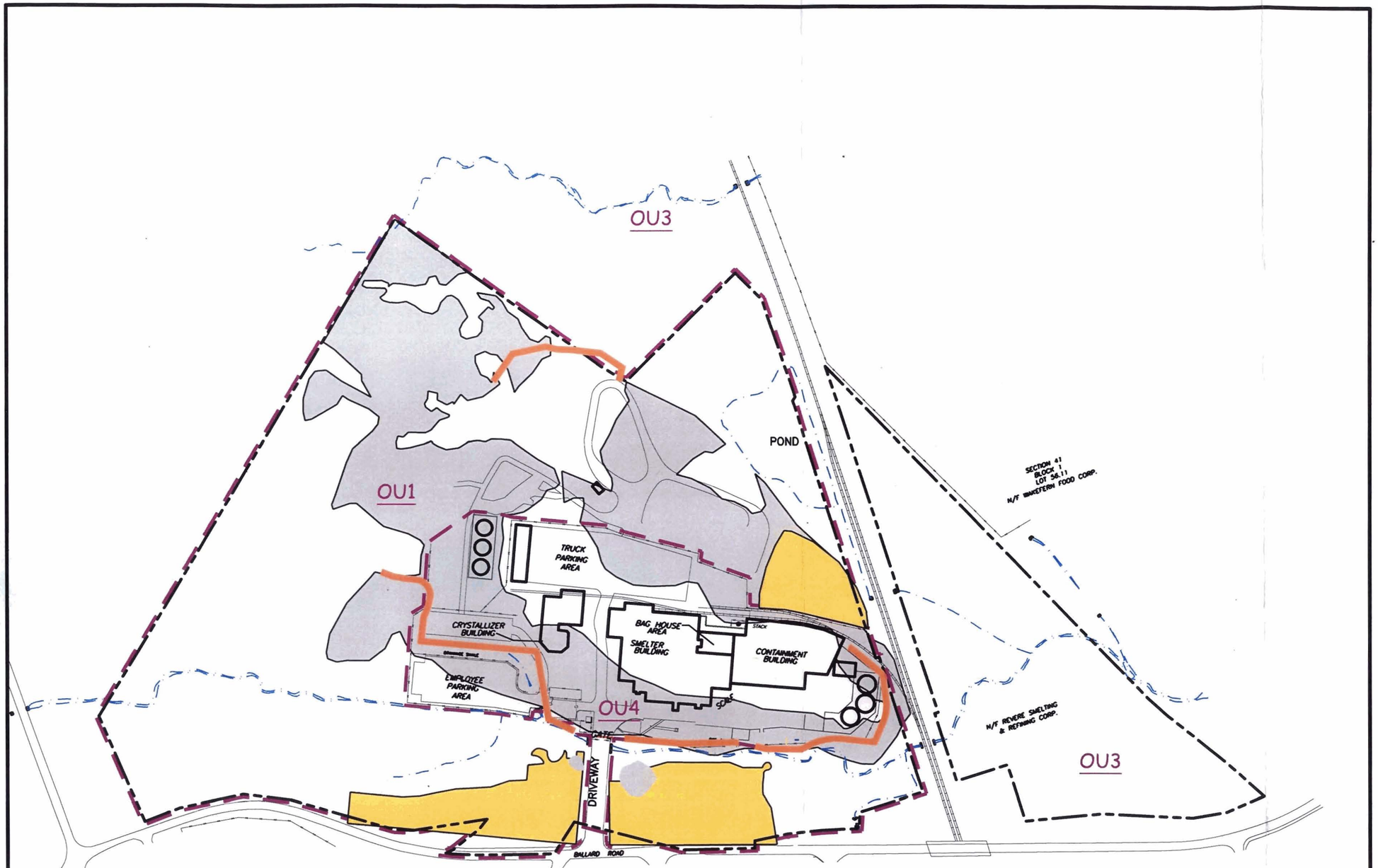


FIGURE 2

LEGEND

- FENCE
- PROPERTY LINE
- RAILROAD TRACKS
- OU BOUNDARY
- BARRIER WALL
- WATER BODY
- FILL AREA (FROM CUT & FILL EVALUATION)
- APPROXIMATE AREA OF IRM EXCAVATED SOIL

OPERABLE UNITS

OU1	ON-SITE SOILS
OU2	GROUND WATER
OU3	OFF-SITE SOILS
OU4	PLANT AREA SOILS

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

REVERE SMELTING AND REFINING WALLKILL, NEW YORK

SITE PLAN

300 0 300

SCALE IN FEET

FILE NO. 10653.26408.002

JULY 2001

O'BRIEN & GERE ENGINEERS INC.

FIGURE 3

LEGEND

- FENCE
- PROPERTY LINE
- RAILROAD TRACKS
- OU BOUNDARY
- WATER BODY
- FILL AREA (FROM CUT & FILL EVALUATION)
- APPROXIMATE AREA OF (CA) EXCAVATED SOIL
- PROPOSED SURFACE SOIL SAMPLE LOCATIONS
- SURFACE SOIL SAMPLE LOCATIONS

NEW YORK STATE
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

REVERE SMELTING
AND REFINING
WALLKILL, NEW YORK

PROPOSED SURFACE SOIL SAMPLE LOCATIONS

300 0 300

SCALE IN FEET

FILE NO. 10653.26408.014

JULY 2001

O'BRIEN & GERE
ENGINEERS INC.

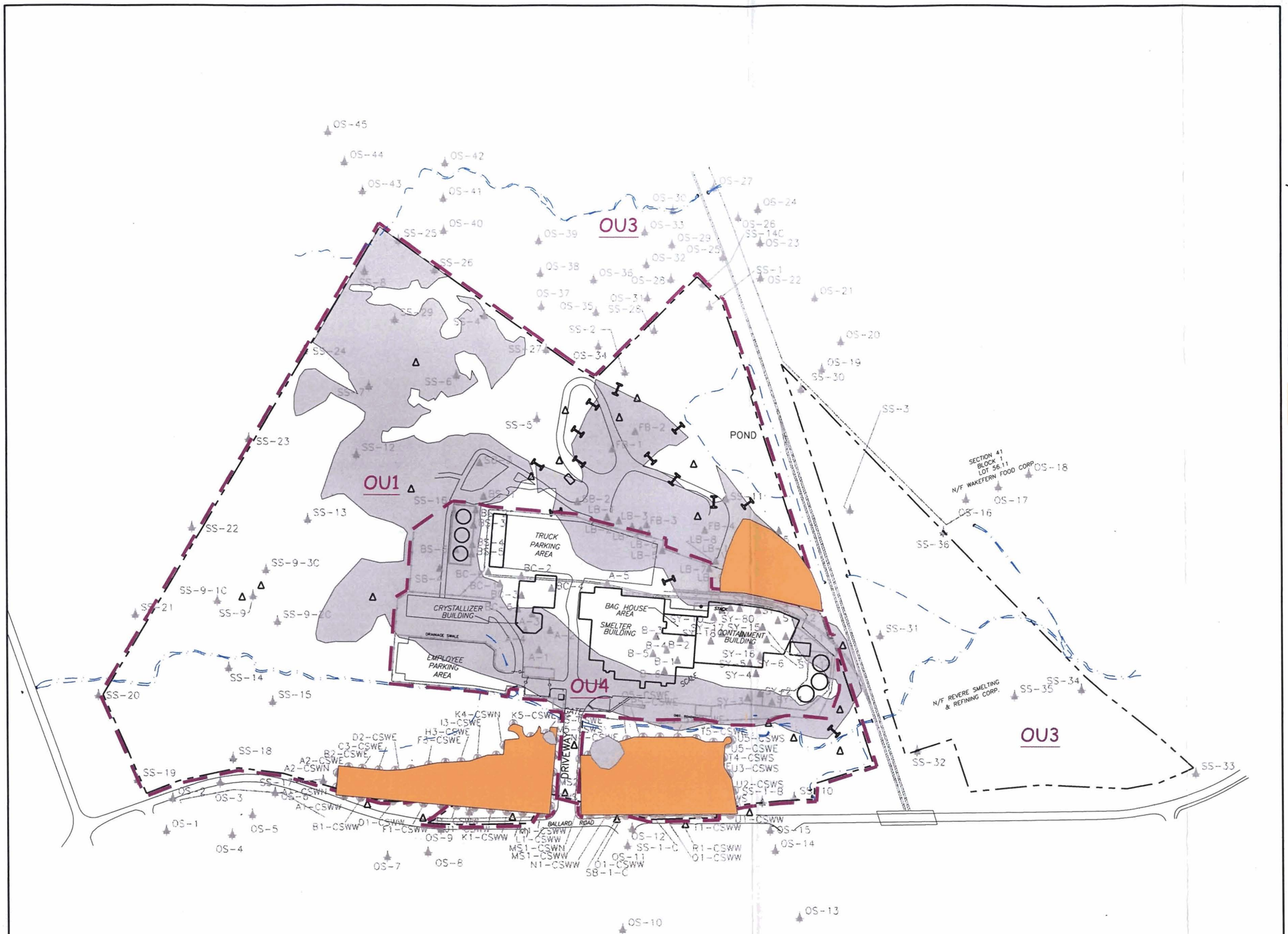
BASE MAP SOURCE: ADAPTED FROM ENVIRONMENTAL SCIENCE CORPORATION, RFI TASK IV, PHASE II, FIGURE 1 SHT# 213416-C13

PWW I:\DIV71\PROJECTS\10653\26408\DWG\71\005.DWG SF:1

PLOT DATE: 06/13/01

PWW I:\DIV71\PROJECTS\10653\26408\DWG\71\005.DWG SF:1

FIGURE 4



LEGEND

- FENCE
- PROPERTY LINE
- RAILROAD TRACKS
- OU BOUNDARY
- WATER BODY
- FILL AREA (FROM CUT & FILL EVALUATION)
- APPROXIMATE AREA OF (CA) EXCAVATED SOIL
- △ PROPOSED SOIL BORING LOCATION
- PROPOSED TEST PIT LOCATION
- △ SOIL BORING LOCATION

NEW YORK STATE
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

REVERE SMELTING
AND REFINING
WALLKILL, NEW YORK

PROPOSED TEST PIT AND SOIL BORING LOCATIONS

300 0 300

SCALE IN FEET

FILE NO. 10653.26408.015
JULY 2001

O'BRIEN & GERE
ENGINEERS INC.

BASE MAP SOURCE: ADAPTED FROM ENVIRONMENTAL SCIENCE CORPORATION, RFI TASK IV, PHASE II, FIGURE 1 SHT# 213416-C13

PLOT DATE: 06/13/01

FIGURE 5

LEGEND

- FENCE
- PROPERTY LINE
- RAILROAD TRACKS
- OU BOUNDARY
- WATER BODY
- FILL AREA (FROM CUT & FILL EVALUATION)
- APPROXIMATE AREA OF (CA) EXCAVATED SOIL
- PROPOSED SEDIMENT LOCATION
- PROPOSED SURFACE WATER LOCATION

NEW YORK STATE
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

REVERE SMELTING
AND REFINING
WALLKILL, NEW YORK

PROPOSED SURFACE WATER AND SEDIMENT SAMPLE LOCATIONS

300 0 300

SCALE IN FEET

FILE NO. 10653.26408.016

JULY 2001

O'BRIEN & GERE
ENGINEERS INC.

BASE MAP SOURCE: ADAPTED FROM ENVIRONMENTAL SCIENCE CORPORATION, RFI TASK IV, PHASE II, FIGURE 1 SHT# 213416-C13

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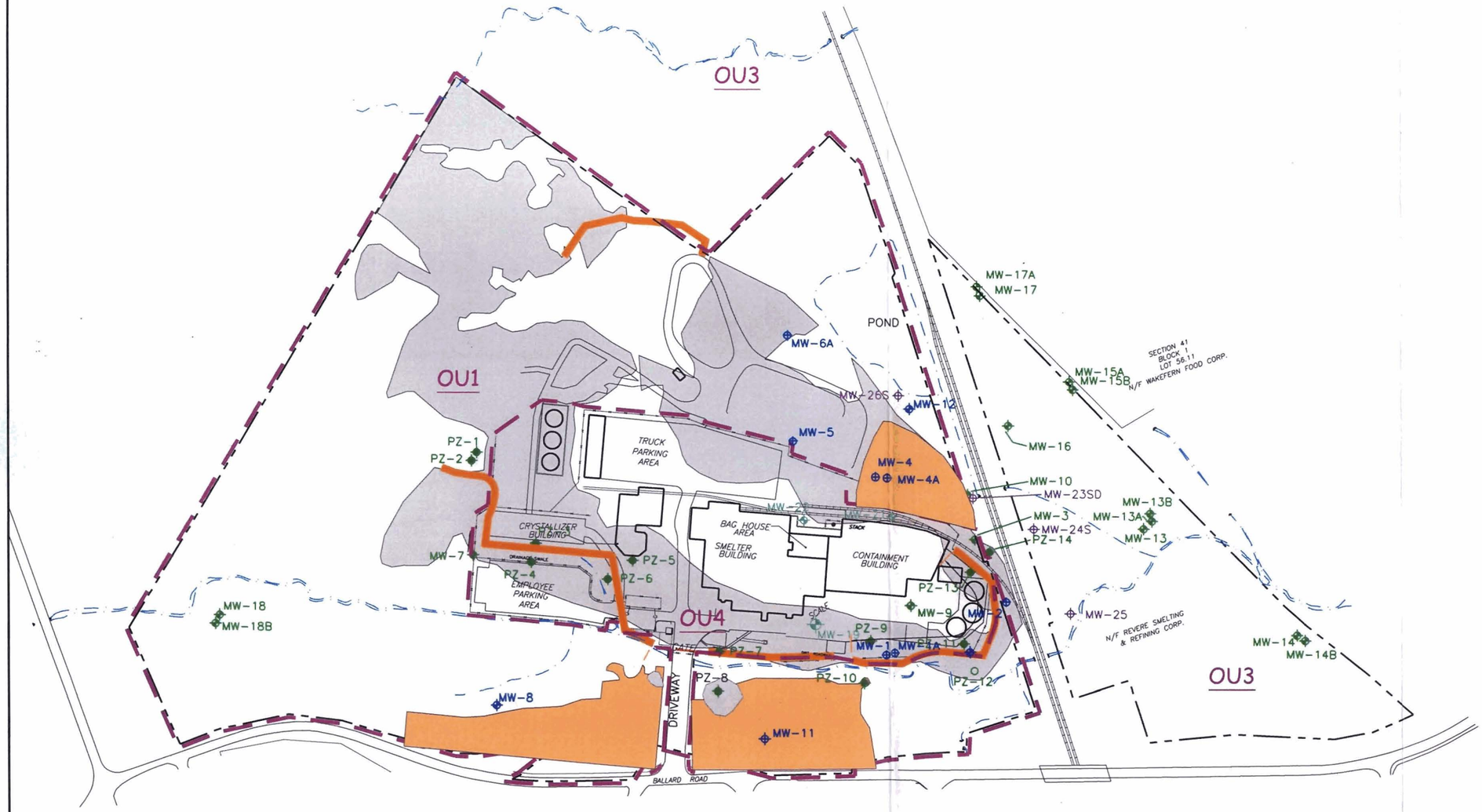
PLOT DATE: 06/13/01

PWW I:\DIV71\PROJECTS\10653\26408\DWG\71\005.DWG SF:1

FIGURE 6



LEGEND

- FENCE
- PROPERTY LINE
- RAILROAD TRACKS
- OU BOUNDARY
- WATER BODY
- SLURRY WALL
- FILL AREA (FROM CUT & FILL EVALUATION)
- APPROXIMATE AREA OF (CA) EXCAVATED SOIL
- MW-14 EXISTING MONITORING WELL
- MW-22 RECENTLY INSTALLED WELL (BY REVERE)
- PZ-1 EXISTING PIEZOMETER
- MW-25 PROPOSED MONITORING WELL
- MW-11 ABANDONED MONITORING WELL

NEW YORK STATE
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION

REVERE SMELTING
AND REFINING
WALLKILL, NEW YORK

GROUND WATER MONITORING WELL LOCATIONS

300 0 300

SCALE IN FEET

FILE NO. 10653.26408.017
JULY 2001

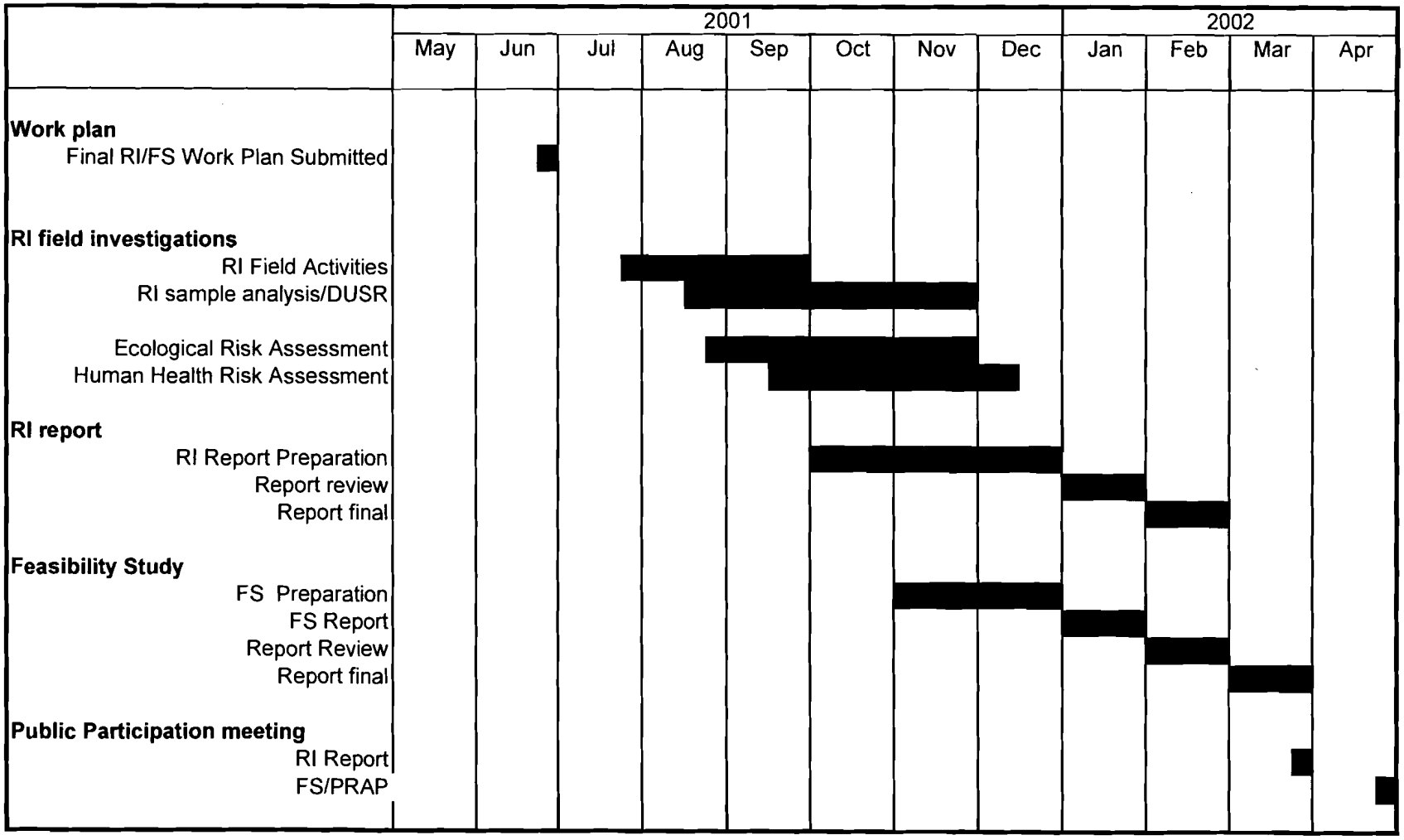
O'BRIEN & GERE
ENGINEERS INC.

BASE MAP SOURCE: ADAPTED FROM ENVIRONMENTAL SCIENCE CORPORATION, RFI TASK IV, PHASE II, FIGURE 1 SHT# 213416-C13

PLOT DATE: 06/08/01

Figure 7
RI/FS Project Schedule

Revere Smelting and Refining
Wallkill, New York



Work Plan

Field Sampling Plan

Revere Smelting & Refining Site
Wallkill, New York

July 2001

O'BRIEN & GERE
ENGINEERS, INC.

10653/26408

WORK PLAN

Field Sampling Plan

Revere Smelting & Refining Site
Wallkill, New York

James R. Heckathorne, P.E.
Vice President

March 2001

O'BRIEN & GERE
ENGINEERS, INC.

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1. Introduction

1.1. General plan

This field sampling plan (FSP) for the Revere Smelting & Refinishing Corporation Site contains the procedures for implementing Remedial Investigation/Feasibility Study (RI/FS) field investigations described in the RI/FS work plan (O'Brien & Gere, 2001). This FSP provides detailed procedures for collecting environmental samples including equipment and personnel requirements, drilling and well installation techniques, sampling techniques, and equipment decontamination procedures. Deviations from this FSP will require notification and prior approval of the NYSDEC.

A general checklist is provided summarizing sampling equipment required for the RI/FS investigations (Table 1).

2. Sampling program

2.1. Soil boring and surface soil sampling program

2.1.1. General

Supervision of the soil boring activities will be provided by a qualified geologist and/or hydrogeologist who will be in attendance during the test boring activities to:

- Perform air monitoring;
- Inspect soil;
- Prepare geologic field logs based on soil observations;
- Obtain soil samples for laboratory analysis; and
- Complete daily drilling records.

2.1.2. Subsurface soil sample collection

Drilling will be performed using direct push or hollow stem auger drilling techniques. Soil samples will be collected continuously to the base of the boring unless otherwise specified in the Work Plan using direct-push sampling methods or conventional split-barrel sampling (American Society for Testing and Materials (ASTM) Method D-1586-84).

Soil samples will be logged and a portion will be retained on-site for record or later review, if necessary. Boring logs describing subsurface materials encountered in each of the borings will be prepared by the on-site geologist or hydrogeologist. Descriptions of soil sample texture, composition, color, consistency, moisture content and recovery will also be recorded. An example boring log is attached as Appendix A.

A sufficient amount of soil from the selected sampling interval will be homogenized by mixing the sample in a decontaminated stainless steel mixing bowl with a decontaminated stainless steel trowel or disposable scoop. All samples selected for laboratory analysis will be placed in the appropriate containers provided by the laboratory.

2.1.3. Surface soil sample collection

Surface soil samples will be collected using decontaminated stainless steel or plastic equipment. If the selected sampling location is in a vegetated area, the vegetation will be removed prior to sample collection. Samples will be collected from the 0 to 2-inch interval by digging into the soil with a pre-cleaned plastic or stainless steel trowel or stainless steel hand auger. The soil will be homogenized by mixing the sample in a decontaminated stainless steel mixing bowl with a decontaminated trowel or disposable scoop. Samples selected for laboratory analysis will be placed in the appropriate containers provided by the laboratory.

2.2. Drilling and well installation program

2.2.1. Shallow unconsolidated unit drilling procedures

Soil borings will be advanced through the unconsolidated deposits utilizing hollow-stem auger drilling techniques. A minimum 4 ¼-inch diameter augers will be used for borings completed for well installation purposes. Split-barrel samples will be obtained continuously to the base of the boring according to ASTM Method D-1586. Soil samples will be logged and retained on-site for later review or geotechnical analysis, if needed.

Boring logs describing subsurface materials encountered in each of these borings will be prepared by the on-site geologist or hydrogeologist. Descriptions of soil sample texture, composition, color, consistency, moisture content and recovery will also be recorded. An example boring log is attached as Appendix A.

2.2.2. Shallow bedrock unit drilling procedures

For shallow bedrock well installation, soil borings will be advanced to the unconsolidated unit-bedrock interface utilizing 6¼-inch ID hollow-stem augers. The borehole will be further advanced a minimum of one foot into the top of the bedrock unit by advancing the augers into the top of the weathered zone or by utilizing rotary drilling techniques. The top of bedrock will be established by split-barrel sampler refusal and/or prolonged grinding of the augers.

Split-barrel samples will be obtained continuously down to the top of bedrock in one boring at each location according to ASTM Method D-1586 in advance of the hollow-stem augers. Boring logs describing subsurface materials encountered in each of these borings will be prepared by the on-site geologist or hydrogeologist. Descriptions of soil sample texture, composition, color, consistency, moisture content and recovery will also be recorded. An example boring log is attached as Appendix A.

Shallow bedrock wells will be constructed using a minimum 5-inch diameter steel or polyvinyl chloride (PVC) casing grouted into a rock socket prior to rock drilling and coring. The casing will be lowered into the borehole and tapped into place by driving it with a 140-pound hammer, or equivalent, to seat the casing. A cement-bentonite grout will be tremied into the annulus between the casing and the borehole. As the grout is pumped into the annulus, the tremie pipe will be kept within the grout as it is placed so that a continuous seal is achieved. The cement grout will be allowed to set overnight before further bedrock drilling is initiated. Any remaining grout inside the casing will be drilled out using a 4⅞-inch roller bit. The shallow bedrock wells will be drilled to final depth using a 4-inch OD (HX) diamond core bit.

2.2.3. Well installation

Monitoring wells will be constructed of 2-inch ID, flush joint, schedule 40 PVC riser pipe connected to 0.010inch or 0.020-inch slot PVC well screen. The base of each well will be equipped with threaded bottom plugs and the top of each well will be equipped with a vented, non-threaded cap. In addition, a designated measuring point will be notched in to the top of the PVC riser pipe to provide a permanent reference point for subsequent total depth and depth to water measurements.

After setting the well, sand will be introduced gradually inside the augers or borehole to fill the annular space between the screen and the borehole adjacent to the screen. The sand pack will extend from the bottom of the boring to approximately one foot above the top of the screen. The sand pack will consist of a clean, graded, silica sand with grain size distribution matched to the slot size of the screen.

A bentonite pellet seal will be placed above the sand pack to form a seal at least 2 feet thick. A thick cement-bentonite grout will extend from the top of the bentonite pellet seal to the ground surface. The grout material will consist of Type I Portland cement mixed with either a powdered or granular bentonite. The grout mixture will be prepared in accordance with ASTM D 5092-90, such that approximately 3 to 5 pounds of bentonite is mixed with 6½ to 7 gallons of water per 94-pound sack of cement. The grout will be introduced via a tremie pipe lowered to just above the top of the bentonite pellet seal. As the grout is pumped into the borehole, the tremie pipe will be removed in sections so that the grout is pumped into the borehole at a level below the top of the grout seal as it is emplaced.

Protective casings will be constructed of one of the following:

- Steel casing equipped with a locking cap placed over the monitoring well. The protective casing will extend at least two feet below ground surface and be cemented in place.
- Flush mounted casings.

- For bedrock wells with permanent steel casings, a lockable cap will be secured to the top of the casing.

If identified in the Work Plan, bedrock wells may be completed as open-hole wells or as 2 inch diameter PVC wells as outlined above.

2.2.4. Well development

Following the completion of the monitoring well installation program, each monitoring well will be developed prior to ground water sampling.

Each newly-constructed monitoring well will be developed to:

- Remove fine-grained materials from the sand pack and formation;
- Reduce the turbidity of ground water samples; and
- Increase the yield of the well to reduce the potential of the well yielding an insufficient volume of water during ground water sampling.

The monitoring wells will be developed as soon as possible, but not less than 24 hours after installation. The wells will be developed using one of the following procedures:

- Bailing;
- Inertial pumping (i.e., WaTerra pump); and/or
- Centrifugal pumping in conjunction with manual inertial pumping.

The well development equipment (i.e., bailers, tubing, etc.) will be new, pre-cleaned and/or dedicated to each monitoring well. Care will be taken not to introduce contaminants on the equipment during installation.

Well development will proceed by repeated removal of ground water from the well. The goals for development will be to obtain ground water in which the pH, temperature and specific conductivity have stabilized and exhibits a turbidity of less than or equal to 50 Nephelometric Turbidity Units (NTUs). However, a minimum of five well volumes will be removed regardless of whether these goals have been achieved earlier during development. Also, if the goals discussed above can not be obtained, well development will continue until an amount of ground water equivalent to ten well volumes has been removed.

Well development water will be handled in accordance with the procedures outlined in Section 4.

2.2.5. Water level measurements

Water level measurements will be obtained with an electronic water level indicator. The electronic water level measurement method involves lowering a probe into a well which, upon contact with the water, completes an electric circuit. At the instant the circuit is closed, the water level indicator provides an audible and/or visual alarm which indicates that the water has been contacted. The cable of the probe(s) utilized will be graduated in 0.01 feet increments.

All water level measurements will be obtained in accordance with the procedures below. Nitrile gloves will be worn during all water level measurement activities.

1. Unlock the well cover and carefully remove to avoid having any foreign material enter the well. The riser pipe will be monitored with a PID for the presence of VOCs, if required by the HASP.

2. Clean the water level probe and lower portion of cable, and test water level meter to ensure that the batteries are charged.

3. Lower the probe slowly into the monitoring well until the audible and/or visual alarm indicates the top of the water column.

4. Read the depth, to the nearest 0.01 feet, from the graduated cable using the notched measuring point on the monitoring wells riser pipe. Record the depth to water in the field notebook. If the well is dry or frozen, record that condition in the field notebook.

5. Remove the probe from the monitoring well slowly. Clean the probe and lower portion of cable using clean paper towels saturated with distilled or deionized water.

6. Replace the monitoring well's cap and lock the protective casing's cap in place.

2.2.6. Hydraulic conductivity testing

In-situ hydraulic conductivity tests will be performed to estimate the hydraulic conductivity of the screened interval. These tests involve observing the recovery of water levels toward an equilibrium level after an initial perturbation. The perturbation may be either a sudden rise or fall in water level. During a slug test, either a 5-foot inert rod or a volume of deionized water will be quickly introduced into the well to cause a water level rise. During a bail test, a 5-foot inert rod or a clean sampling bailer will be rapidly removed from the well to cause a water level drop. Procedures and equipment requirements may vary depending on the rate of the water level recovery. Each well will be tested in accordance with the following procedures:

- Determine the type of test to be performed based on the following:
  - If the screened interval of the well straddles the water table, only use a rising head test;
  - If the screened interval of the well is submerged within water, either method may be used, preferably both;
- Record appropriate initial data in field notebook, including date of test, well identification, well construction details (i.e., screen length, screen diameter, riser diameter, depth to top of screen, sand pack length, sand pack diameter, and depth to top of sand pack), type of test and names of field personnel;
- Clean the downhole equipment (e.g., pressure transducer, associated cable and, if used, the bailer or slug and associated line) following standard decontamination procedures before initiating test(s) at each well;
- Measure and record the static water level in the well (only wells which have fully recovered to static level conditions after drilling and development should be tested);
- Connect the pressure transducer to the data logger and lower the transducer into the well 5 to 10 feet below the water surface. Secure the position of the transducer by clamping the transducer cable to the well casing using a rubber-covered clamp. If the edges of the well casing are sharp, cover them with cloth or duct tape to protect the transducer cable;
- Quickly create the water level perturbation by slugging or bailing the well. While there is no fixed requirement for the magnitude of the change in water level, it is suggested that a minimum of 20% instantaneous hydraulic head differential be created to allow collection of a suitable data base; and
- If another test is to be performed, replace the bailer or solid object and allow the well to re-equilibrate prior to performing the next test. Repeat the procedures, changing settings as appropriate.

Interpretation of water level versus time data from the hydraulic conductivity tests will be performed using the Bower & Rice method. Other appropriate methods may be utilized, and if deemed necessary.

2.3. Ground water sampling

Ground water samples will be collected by either conventional (i.e., dedicated bailers or centrifugal pump with dedicated HDPE tubing)

and/or low flow sampling techniques. Low flow sampling techniques are typically used when sampling for natural attenuation parameters, PCBs or metals but may be used at any time to minimize the generation of water. Persons involved with the sampling program will be technically competent and familiar with the sampling procedures described herein.

Prior to any sampling event, the following steps must be taken by personnel responsible for sampling:

1. Review the sampling procedures and the HASP.

2. Assemble all equipment and materials necessary for sample collection.

A complete set of ground water elevations will be obtained from each Site well prior to commencing ground water sampling activities. Care will be taken to disturb only the upper portion of the well water column to avoid re-suspending settled solids in the wells. Water level measurements will be performed as described in Section 2.2.5.

2.3.1. Conventional sampling techniques

Field Equipment

Sampling Equipment
- Personal safety equipment (e.g., steel-toed work boots, nitrile gloves, safety glasses).
- Insulated sample coolers containing prepared sampling containers, preservatives, and wet ice.
- Water level indicators.
- Plastic sheeting.
- Plastic wrap for decontaminated bailers, if required.
- Tool box.
- Duct tape and clear tape.
- Distilled water.
- Paper towels.
- Suction-lift pump and ½-inch polyethylene tubing for well purging, if required.
- Dedicated Teflon® or PVC bailers with Teflon®-coated stainless-steel wire or disposable nylon line, if required.
- Dedicated one-way foot valves, if required.
- Peristaltic pump and Tygon® tubing
- Phosphate-free detergent.
- 5-gallon pails.

Documentation Equipment
- Prepared sample labels.
- Waterproof pens not containing organic solvents.
- Chain-of-custody forms.
- Custody seals.
- Field notebook.

Miscellaneous Equipment
- Sampling and Analysis Plan.
- Health & Safety Plan.
- Well keys.
- Calculator.

Inspect the equipment to ensure that it is in working order and decontaminate sampling equipment, as appropriate.

Note and replace any equipment or materials that are in short supply or are showing indication of wear.

Upon receipt of the sampling containers from the laboratory, inventory the containers to make sure appropriate containers were delivered, check if preservatives have been added, if necessary, and assess the general condition of containers.

Monitoring Well Purging

To collect representative ground water samples using conventional sampling techniques, ground water monitoring wells must be adequately purged prior to conventional sampling. Purging refers to the process of removing standing water from within the casing of a monitoring well. In rapidly recharging wells, a thorough purging will be accomplished by removal of a minimum of three well volumes of water to ensure that representative ground water is brought into the well for sampling. In slowly recharging wells, the well should be purged to dryness for a minimum of one well volume. Samples should be collected within three hours of completing well purging activities.

The procedure to be followed in purging the monitoring wells is as follows:

1. Prior to opening the well, water level and known total depth of each well will be reviewed to calculate the volume of water to be purged from the well. Using the water level and known total depth, the length of the water column in the well is calculated. This is accomplished by subtracting the depth to water from the measured total depth, both measured from the top of the casing, followed by multiplication by a conversion factor of 0.163 for 2-inch diameter wells to determine the number of gallons of water equaling one well volume. That value is multiplied by three to determine the volume of water required to purge the well of three well volumes.

2. The well cover will be unlocked and carefully removed to avoid having any foreign material enter the well.

3. If a dedicated Teflon®, polyethylene, or PVC bailer with either Teflon®-coated stainless-steel wire or new nylon line is used for evacuation, a sampling team member will remove the bailer from the protective bag and lower it down the well until it comes in contact with the water. The sampling team member will continue to lower the bailer allowing it to submerge. When the bailer has filled, it will be removed from the monitoring well and the water discharged into a 5-gallon pail. Care will be taken to prevent the bailer from touching the 5-gallon pail, which could lead to cross-contamination of the bailer. These steps will be repeated until three well volumes have

been removed or until the ground water has stabilized. Sufficient time will be allowed for slowly recovering wells to recharge prior to sampling.

4. Some of the monitoring wells in the network may be purged using a suction pump and dedicated ½-inch diameter HDPE tubing with a dedicated "Delrin" acetal thermoplastic foot valve. After securely attaching the foot valve to the HDPE tubing, the HDPE tubing will be carefully lowered just below the water level and lowered as the water level lowers while pumping the monitoring well. The HDPE tubing will be connected to the suction pump and a discharge hose will be attached to the pump and run into a 5-gallon pail. After the purging has been completed, the suction pump will be disconnected from the HDPE tubing.

5. All purge water will be initially collected in 5-gallon pails and will be monitored for pH. The purge water from on-site wells will subsequently be containerized in 55 gallon drums. Care will be taken such that the purge water does not spill onto the ground surface.

Ground Water Sample Collection

Ground water samples will, if at all possible, be collected within three hours of purging of the well to be sampled by conventional techniques. If recharge is sufficient, then samples will be collected immediately following well purging. For slowly recharging wells, every effort will be made to collect samples as soon as possible and within three hours of well purging. Samples will be collected using (a) dedicated ⅛-inch polyethylene tubing placed inside the dedicated ½-inch HDPE tubing or (b) dedicated, pre-cleaned, bottom-filling Teflon®, polyethylene, or PVC bailers and either dedicated Teflon®-coated, stainless-steel bailing line or disposable nylon rope. Sample containers will be filled directly from the bailer or tubing according to a prioritized order and using the specific sampling procedures listed below.

1. Well sampling should be performed on the same date as purging, at a time immediately after the well has recovered sufficiently to sample, or within three hours after purging, if the well recharges slowly. After well purging is completed and the well has sufficiently recharged, prepare the appropriate sample containers for sample collection.

2. Don new nitrile gloves.

3. If a bailer is utilized, lower the bailer slowly down the well taking care to minimize agitation of the water column which could result in the loss of VOCs. After the bailer is submersed to within the screened section of the well, slowly remove the bailer from the well and fill individual sample containers directly from the bailer. During sampling, take care to prevent the bailer and wire from coming in

contact with any objects other than the riser of the well, ground plastic and nitrile gloves worn by the sampler(s). Special attention should be taken when filling vials for volatile organic analysis. The vials will be filled in a controlled manner focused at reducing ground water contact with the air and ensuring that no headspace remains after capping.

4. For wells purged using the suction pump and dedicated HDPE tubing, sampling will be performed using small diameter (i.e., ⅛-inch) dedicated polyethylene tubing inserted inside the ½-inch HDPE tubing used for purging. The ½-inch HDPE tubing will then be hand pumped, creating a uniform, laminar flow through the small diameter tubing. Samples will then be collected through the small diameter tubing.

   Afterwards, the small diameter tubing will be removed, rinsed thoroughly with distilled water and placed in a clean plastic bag labeled with the well designation. The rinsate will be collected along with the purge water and subsequently treated in the on-site air stripper. The dedicated ½-inch HDPE tubing and foot valve will remain in the well between sampling events.

5. Fill the individual sample containers directly from the bailer or tubing in the prioritized order set forth below:

Priority	Parameter
1	Volatile Organics
2	Semi-Volatile Organics
3	Pesticides/PCBs
4	Metals
5	Dissolved Organic Carbon
6	Cyanide
7	Nitrate and pH
8	Sulfate, Sulfide, Chloride, Alkalinity, Specific Conductivity and Turbidity

6. After collecting the sample, record the date and time of sampling onto the sampling containers and in the field notebook.

7. Place sample containers in a cooler containing wet ice for transportation to the laboratory.

8. Close and lock the monitoring well. The dedicated bailer should be rinsed thoroughly with deionized water and placed in a labeled clean, plastic storage bag to be ready for the next sampling event. The rinsate will be collected along with the purge water and subsequently treated in the portable purge water treatment system. If non-dedicated equipment is used, then procedures for decontaminating non-dedicated equipment in Section 3.2 should be followed. Remove all waste materials from the area before moving to the next sampling location.

Specific information regarding sample bottle and preservation requirements are provided in the QAPP. Ground water sampling logs are provided in Appendix B.

2.3.2. Low-flow sampling techniques

The low-flow sampling method relies on direct in-line water quality indicator readings to establish equilibration or time criteria for collecting a representative ground water sample.

The following equipment should be available and ready for use prior to initiating the field sampling efforts.

- An adjustable rate, electric submersible pump, and a peristaltic pump.
- Tubing - Polyethylene, polypropylene, PVC, or Tygon® tubing may be used for sample collection.
- Water level measuring device, 0.01 foot accuracy (electronic preferred for tracking water level drawdown during all pumping operations).
- Flow measurement supplies (for example, graduated cylinder and stop watch).
- Power source (generator or battery).
- In-line indicator parameter monitoring instrument consisting of a clear flow-through cell housing the pH, specific conductance, temperature, dissolved oxygen, and oxidation-reduction potential probes. The volume of the flow-through cell will be minimized to expedite change over of ground water in the cell. Turbidity samples will be collected from an in-line tap prior to the flow-through cell.
- Decontamination supplies.
- Logbook(s).
- Interface probe, if needed.
- Sample bottles.
- Sample preservation supplies (as required by the analytical methods).
- Sample tags or labels.
- Well construction data, location map, field data from last sampling event.

- FSP.

Low Flow Ground Water Sample Collection

Prior to commencing daily sampling activities, the ground water quality monitoring probes/meters including pH, conductivity, ORP, dissolved oxygen, and turbidity will be calibrated. Dissolved oxygen calibration will be corrected for local barometric pressure and elevation. Calibration results will be recorded in the field log notebook.

The depth of wells and well screen intervals will be acquired from site-specific drilling logs or existing monitoring well specification tables. This data (and source of data) will be pre-recorded on the Ground Water Field Sampling Log.

1. Prepare the pumping system for operation. Connect the tubing to the in-line water quality indicator parameter meter.

2. When using the submersible pump, slowly and carefully lower the sampling pump and associated equipment into the well. When using the peristaltic pump, slowly lower the tubing into the well. The objectives are to minimize mixing of the stagnant water above the screened interval with the water within the interval, and to avoid re-suspending fines within the well. Position the pump intake near the center of the screened interval.

3. Commence well purging by low flow pumping from the well. The flow rate shall not exceed 0.5 liters/min. Efforts should be made to minimize the generation of air bubbles in the sample tubing by either increasing the flow rate as appropriate, or restricting the flow by clamping the tubing. Record purge rate on the Low Flow Ground Water Sampling Log.

4. During purging, monitor and record pH, specific conductivity, temperature, oxidation-reduction potential (redox), dissolved oxygen, and turbidity at time intervals sufficient to evacuate the volume of the flow-through cell.

5. Well sampling can commence after equilibration of water quality parameters. Well drawdown of 0.3 ft is desirable, but not mandatory. Equilibrated trends are generally obvious and usually follow either an exponential decay or asymptotic trend during purging. The equilibration guidelines are as follows:

temperature	±10%
pH	± 0.5 pH units
specific conductance	± 10%
redox	± 10 mV
DO	±10%
turbidity	± 10%

If the indicator field parameters have not equilibrated within the above specified limits after 2 hours of purging, then one of the following options may be taken: 1) continue purging until stabilization is achieved; 2) discontinue purging and do not collect samples (document attempts to achieve stabilization); or 3) discontinue purging and collect samples (document attempts to achieve stabilization). Record total volume of water purged and purging time on the Low Flow Ground Water Sampling Log for future reference.

6. Pumping rates should, if needed, be reduced to the minimum capabilities of the pump to avoid pumping the well dry and/or allow stabilization of indicator parameters. If the recharge rate of the well is very low and the well is purged dry, then sampling should commence as soon as the well has recharged to a sufficient level to collect the appropriate volume of samples. Sample collection using bailing techniques may be used in this situation. However, turbidity levels shall be maintained as low as possible.

7. Remove the sampling bottles from their transport containers, and prepare the bottles for receiving samples. Inspect all labels to insure proper sample identification. Sample bottles should be kept cool with their caps on until they are ready to receive samples. Arrange the sampling containers to allow for convenient filling.

8. Sample bottles for VOC analyses, containing hydrochloric acid for preservation, will be filled completely so that there is no headspace or bubbles. The VOC sample vials will be examined for proper filling by inverting the vials immediately after filling.

9. After the last sample has been collected, record the date and time.

10. Begin preparing the Chain-of-Custody documentation.

2.3.3. Field notes

Field notes will be entered into the designated field notebook. Sufficient information will be contained in the notebook to allow reconstruction of

sample collection and handling procedures at a later date. The field notebook should include the following: site map; monitoring well construction spreadsheet, daily field report forms; and individual monitoring well purging and sampling forms which include the information listed in the table below. Ground water sampling logs are provided in Appendix B.

Ground water sampling field notes

General

- Name and location of site.
- Date.
- Purpose of visit (i.e., water level measurements, sampling, etc.).
- Weather conditions.
- Other persons present on site.
- Names of field personnel.
- Any other field conditions/observations (e.g., damage to the well).

Water Level and Total Depth Measurements

- Well identification.
- Physical condition of well.
- Date and time.
- Depth to water.
- Total depth of the well (installed and measured).
- Measuring point identification.
- Measuring point elevation.

Conventional Sampling

- Date and time of sampling.
- Well identification number.
- Sample identification.
- Method of sample collection.
- Appearance of sample, odors present, etc.
- Amount purged.
- Type of container(s).
- Type of preservative, if any.
- Analytical method(s) requested.

Low Flow Sampling

- Date and time of sampling.
- Well identification number.
- Sample identification.
- Evacuation method
- Method of sample collection.
- Appearance of sample, odors present, etc.
- Temperature, pH, specific conductance
- Redox, DO, turbidity
- Elapsed time
- Flow rate
- Amount purged.
- Type of container(s).
- Type of preservative, if any.
- Analytical method(s) requested.

2.4. Surface water sampling

Surface water sampling will be conducted to evaluate potential areas of constituent loading in the surface water. Sampling will be conducted during two sampling events consisting of one spring high flow and one summer low flow event. The surface water sampling events are designed to represent critical time periods when elevated constituent concentrations or loading may occur. To evaluate the sediment as a potential source of constituent loading, results of water column sampling may be used to locate sediment samples in areas where loading increases are observed.

2.4.1. Procedures

For the high flow event, the surface water sample locations will be sampled from upstream to downstream to approximate sampling of a single parcel of water as it travels downstream, to the extent practical. During the water column sampling event, the flow of the stream will be obtained from the USGS website.

For the low flow event, surface water sample locations will be sampled from downstream to upstream to minimize the potential for interference during sampling. During the water column sampling event, the flow of the stream will be obtained from the USGS website.

For both events, water depths will be obtained at each water sample location. The water column samples will be collected from the center of the channel, facing upstream, using one of four approaches depending on water depth:

- For water depths less than 1.5 ft, a surface water sample will be collected by submerging a sample bottle below the water surface.
- For water depths between 1.5 and 3 ft, a water column sample will be collected using a Kemmerer sampler submerged below the water surface to a depth of 60% of the total depth.
- For water depths between 3 and 5 ft, two water column aliquots will be collected using a Kemmerer sampler to represent 20% and 80% of the total depth. The depth aliquots will be combined equally into a sample bottle.
- For water depths greater than 5 ft, three water column aliquots will be collected using a Kemmerer sampler to represent 20%, mid, and 80% of total depth.

Samples collected for analysis of dissolved organic carbon (DOC) will require filtration in the field. Samples intended for filtration will be

collected in a glass or plastic container and filtered using a 0.45 micron glass fiber filter into a sample container.

The field log documentation requirements are presented in Section 2.7. A copy of the field log is presented in Appendix C. Quality control samples will be collected as presented in the QAPP.

2.5. Sediment sampling

Sediment sampling in the stagnant waters will precede sediment sampling in the stream. Sediment samples will be collected as cores sectioned at 6" intervals. Sediment samples will not be collected from areas with coarse sediments, rock, or cobble.

2.5.1. Collection procedures

It is anticipated that the majority of sediment samples will be collected using push core techniques. Push core sampling techniques employ manual penetration of sediment using a sampling device that contains a polycarbonate tube to collect the sediment core. The device also consists of a handle that contains a check valve to allow air to escape during sediment penetration and develops a vacuum to retain the core as it is recovered. It is anticipated that 3-inch diameter polycarbonate tubes will be used. The push cores will be manually advanced to approximately 3 ft or refusal, which ever comes first. Generally, refusal represents the full sediment column consisting of the unconsolidated material.

In areas that are not amenable to push core sampling techniques, other sampling techniques may be employed. A ponar dredge may be used to collect sediment samples from areas that contain coarse sediment or a soil auger modified for sediment collection may be used in areas that the creek bed consists primarily of rock and cobble.

Sediment sampling will be conducted by boat to access locations. Field personnel are prohibited from wading in the stagnant waters due to the unknown nature of potential contaminants.

Field documentation requirements are presented in Section 2.7. For each core collected, observations of sediment type will be recorded in field logs (Appendix D). Quality control samples will be collected in accordance with the QAPP.

2.5.2. Core segmentation

Upon retrieval, sediment cores will be processed in the field. Samples will be obtained from the inner portion of the core, avoiding sediment that has contacted the tube. This prevents the inclusion of sediment that has smeared along the tube during collection, potentially biasing the distribution of constituents in this portion of the core.

The 6" surface interval will be extruded from the core, removing the outer portion of the core from the sample. The sample will be homogenized in a stainless steel mixing bowl and distributed to the appropriate sample jars. Subsequent depth intervals will be processed in the same manner for each interval collected.

During processing, samples collected from depth intervals will be screened to identify those that will be submitted to the laboratory for analysis. If odors are observed, PID screening may be used to evaluate the relative concentrations of vapors. It should be noted that the presence of odors may require upgrading of PPE during sample processing according to the HASP. The bottom interval of the core and a mid-depth interval will be submitted for analysis.

2.6. Test pit investigation

2.6.1. General

Test pits will be excavated using a rubber-tired backhoe. During excavation activities, personnel will stand upwind of the excavation area to the extent possible. Air monitoring will be conducted in accordance with the HASP. Test pit materials will be visually described, as well as photographed for future reference. Material removed from the test pit will be placed on polyethylene sheeting. Upon completion, the materials from the test pit will be placed back in the excavation.

Visually clean soils, such as surface soils, will be segregated from soils that may be impacted. The visually clean soils will be used to cover the impacted soils/source materials when placed back in the excavation. Test pits will be backfilled as soon as possible after completion. For gravel roadways and parking areas, the backfill will be tamped down in lifts as they are replaced. A 6-inch layer of clean run-of-crush gravel will be tamped in-placed as the final lift. For test pits located in asphalt-covered areas, the surface will be replaced with cold or hot asphalt mix, compacted by rolling, and trimmed flush with the adjoining surface. Following backfilling of the excavation, the test pit will be staked to facilitate subsequent location by surveying.

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

2.6.2. Collection procedures

If it is determined that soil samples are to be collected from the test pits, grab soil samples will be collected from the side walls, base, and/or bucket of excavator. Soil samples will be collected using decontaminated stainless steel or plastic equipment. Samples will be collected by digging into the soil with a pre-cleaned plastic or stainless steel trowel or stainless steel hand auger. The soil will be homogenized by mixing the sample in a decontaminated stainless steel mixing bowl with a decontaminated trowel or disposable scoop. Samples selected for laboratory analysis will be placed in the appropriate containers provided by the laboratory. All sample collection activities will be performed in accordance with the HASP.

2.7. X-ray fluorescence soil screening

2.7.1. General

X-ray fluorescence (XRF) soil screening will be conducted as an initial screening tool to identify areas of potentially elevated lead concentrations. Data quality objectives of the XRF soil screening will be to help identify areas of fill and to select potential soil boring locations. For purposes of this screening, areas with XRF screening results of 500 ppm or greater will be considered fill areas. The XRF screening will provide sample results with a detection limit of at least 250 ppm.

Soil samples may be screened with the XRF analyzer *in situ* or may be collected and screened with the XRF analyzer at different locations. It is not the intent of the XRF soil screening to have soil samples submitted to a laboratory for analysis.

2.7.2. Soil sample screening collection

The sampling areas that are screened *in situ* will be flat areas so that the analyzer will fully contact the soil. If the selected sampling area is in a vegetated area, the vegetation will be removed prior to the sample being screened. The XRF analyzer will be placed on the soil in accordance with the manufacturer's recommended procedures for *in situ* testing. Sampling information, including sample number, depth, location, date, and time, will be recorded in a field log.

Bulk soil samples collected from each sampling location will be representative of that sampling area. Soil samples will be collected using decontaminated stainless steel or plastic equipment. If the selected sampling area is in a vegetated area, the vegetation will be removed prior to sample collection. Samples will be collected from the 0 to 2-inch interval by digging into the soil with a pre-cleaned plastic or stainless steel trowel or stainless steel hand auger. The sample will then be homogenized in a stainless steel mixing bowl. Sticks, stones, and other

matter that is not representative of the sample will be removed and clumps of soil will be broken up with a stainless steel spoon. Also, because sample moisture content may affect the accuracy of the sample results, sample moisture content of less than 10% is recommended.

Approximately 8 ounces of the homogenized soil will be placed into a large clear plastic zipper-locking bag. Excess air will be withdrawn from the sample bag. The sample bag will be labeled with an indelible marker so that the sample identification is clearly visible. Information on the label will include sample number, depth, location, date, time, and name of sampler. The sampling tools and mixing bowls will be decontaminated with a wash/rinse prior to their first use and between sampling locations.

2.7.3. Soil sample screening analysis

For *in situ* screening, the XRF analyzer will be placed on the soil in accordance with the manufacturer's reccommended procedures for approximately 30 to 60 seconds. The results of the analysis will be recorded and logged with the sampling information in the field log.

For bulk sample analysis, the sample bag will be brought to the XRF sample analysis station. The soil sample bag will be shaped to form a continuous layer of at least ½-inch thickness. The sample bag will be placed on the analyzing surface and will be screened with the XRF analyzer in accordance with the manufacturer's recommended procedures. Each sample will be screened for at least 60 seconds. The results of the analysis will be recorded and logged with information from the sample label. Based on the results of the XRF screening results, the soil samples may be packaged for laboratory analysis or will be placed near its original location.

The XRF analyzer will be calibrated at the beginning and end of each day's use. Calibration of the XRF analyzer will be performed in accordance with manufacturer's recommended procedures. Standards used to calibrate the analyzer will be obtained from sources other than the project site. These standards may be standards prepared in-house, NIST certified standard reference materials, or equivalent. The XRF analyzer will also be re-calibrated after no more than 10 samples. If the calibration check performed at the end of the analytical sequence does not meet the manufacturer's criteria, then the instrument will be re-calibrated and all samples since the last compliant calibration check will be re-analyzed.

An instrument blank will be used to verify that no contamination exists in the spectrometer or on the probe window. The instrument blank will be silicon dioxide, a Teflon block, a quartz block, "clean" sand, lithium carbonate, or equivalent. The instrument blank will be analyzed on each working day before and after analyses are conducted and at a frequency of 1 per 20 samples. In addition, an instrument blank will be analyzed whenever the analyst suspects contamination. The analysis time will

match that of the other project samples. The instrument blank will not contain element concentrations greater than their respective MDLs. If concentrations exceed these limits, then the probe window and the instrument blank will be checked for contamination. The instrument blank analyses will meet criteria in order for the analysis to continue. All samples analyzed since the last compliant instrument blank will be re-analyzed in an analysis sequence that meets blank criteria.

A method blank will be used to monitor for sample preparation-induced contaminants or interferences. The method blank will be "clean" silica sand, lithium carbonate, or equivalent that undergoes the same preparation procedure as the samples. Method blanks will be prepared at a frequency of 1 per 20 samples. The method blank will not contain element concentrations greater than their respective MDLs. If concentrations exceed these limits, then the cause of the problem will be determined and corrected, and all samples associated with that method blank will be re-prepared and re-analyzed.

Sample analysis will be performed by qualified personnel either experienced in the operation of the XRF analyzer and knowledgeable in X-ray fluorescence, or under the direct supervision of an experienced and knowledgeable individual. The analyst will be thoroughly familiar with the XRF Reference Manual supplied by the instrument manufacturer, USEPA Method 6200 - Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment, and the Region I EPA-New England "Standard Operating Procedure for Elemental Analysis Using the X-MET 920 Field X-Ray Fluorescence Analyzer" dated October 30, 1996.

2.7.4. Health and safety issues

The XRF analyzer contains nuclear radiation sources. During all measurements, the sample lid on the probe will be closed over the sample to shield the user from exposure to nuclear radiation. The probe will not be opened except by authorized personnel. Proper training for the safe operation of the instrument and radiation training will be completed by the analyst prior to field operations. Additional radiation safety information for the XRF analyzer can be found in the operator's manual. Protective shielding will never be removed by the analyst or any personnel other than the manufacturer. The analyst will be aware of the local, state and national regulations that pertain to the use of radiation-producing equipment and radioactive materials with which compliance is required. The analyst will possess required licenses for radioactive materials, including those provided by the manufacturer for receiving, acquiring, owning, possessing, using, and transferring radioactive material incorporated in a device or equipment, and those issued to named persons for the operation of radioactive instruments as required by local state agencies. A copy of the radioactive material license and leak tests will be present with the instrument at all times.

Radiation monitoring equipment will be used with the handling of the XRF analyzer. The operator will be monitored continually for analyst exposure to radiation. Thermal luminescent detectors (TLD) in the form of badges or rings will be used to monitor operator radiation exposure. The maximum permissible whole-body dose from occupational exposure is 5 Roentgen Equivalent Man (REM) per year. Possible exposure pathways for radiation to enter the body are ingestion, inhaling, and absorption. The best precaution to prevent radiation exposure is distance and shielding.

2.8. Sample and field equipment handling

Sampling and field equipment will be inspected to ensure that it is in working order and sampling equipment will be decontaminated, as appropriate. Any equipment or materials that are in short supply or are showing indication of wear will be noted and replaced.

Upon receipt of the sampling containers from the laboratory, the containers will be inventoried to make sure appropriate containers were delivered, containers will be checked to make sure preservatives have been added, if necessary, and the general condition of containers will be assessed.

Samples will be handled and standard chain of custody procedures will be applied according to procedures presented in the QAPP. Upon collection, samples will be placed in appropriate containers. Samples will be assigned a sample designation identifying sample location, date, and time. Each sample collected will be identified with a unique sample identification (sample ID) according to the sample location designations. The sample ID prefix will identify the sample matrix. Labeled sample containers will be chilled to approximately 4□C, and transported to the analytical laboratory for analysis within 48 hours of sample collection except coolers containing hexavalent chromium analyses. Hexavalent chromium samples require analysis within 24 hours.

For each sample collected, field notes will be completed by field personnel to document details of the sampling event. Photographs of the site taken during investigation activities will include date and time. In addition, photographs of the surface waters will include tidal conditions.

A sample may be further labeled matrix spike (MS) or matrix spike duplicate (MSD) if the sample is to be used by the laboratory as a MS or MSD. Blind field duplicate samples will be labeled X-1, X-2, etc. Trip blank samples obtained from the laboratory will be dated and identified as a trip blank. The trip blank sample will accompany those samples collected on that particular date and submitted to the laboratory for VOC analysis. The field notes will identify the blind field duplicate samples as well as where they were obtained.

In addition to the sample identification, each sample container will be labeled with the following information:

- site name;
- date and time of sample collection;
- analysis requested;
- preservative(s); and
- client name.

All information should also be entered in the field notes in waterproof ink. Sample container labels should be completed with ink containing no organic solvents. Specific details on chain-of-custody protocols and shipping requirements are provided in the QAPP.

2.9. Sample location coordinates

The accuracy and precision of sample location coordinates will be assessed by occupying a benchmark with known coordinates and comparing these coordinates with instrument readings. Significant difference between actual and known coordinates will prompt corrective actions.

Each of the newly-installed monitoring wells, soil borings, surface water sample locations, surface soil/sediment sample locations and staff gauges will be surveyed for horizontal and vertical control and will be incorporated into the existing Site base map. Monitoring wells will be surveyed to the nearest 0.01 feet at the top of the wells riser pipe (measuring point) and top of protective steel casing. Ground surface at each location will be surveyed to the nearest 0.1 feet.

2.10. Quality assurance/quality control

Quality assurance/quality control (QA/QC) issues associated with this project are addressed in the QAPP developed for this program.

2.10.1. Sample and analytical data quality

QA/QC samples will be collected according to the QAPP. The QAPP specifies the collection and analysis of the following samples:

Matrix spike/matrix spike duplicate pairs are duplicate samples that are collected in the field, and submitted to the laboratory. The laboratory spikes the samples with a known amount of analyte to be tested. The percent recovery of the analyte is used to assist the evaluation of analytical accuracy. The relative percent difference (RPD) of the samples is used to assist the evaluation of analytical precision.

Blind duplicates consist of duplicate samples submitted to the laboratory without identification of the sample location. The RPD of the samples is used to assist the evaluation of environmental variability, sampling uncertainty, and analytical precision.

Equipment blanks are samples collected in the field by pouring water over clean sampling equipment. The results are used to evaluate potential interferences of field sampling equipment.

Trip blanks are laboratory reagent grade water samples prepared by the laboratory and placed in sample coolers containing field samples submitted for analysis of volatile organic compounds. Trip blank results are used to evaluate potential interferences of volatile organic compounds due to sample handling.

QA/QC samples will be collected and analyzed at a frequency of 5% of total sample numbers for a given matrix. The locations of QA/QC samples will be selected randomly in the field.

2.10.2. Data quality review

Data collected for this program will undergo quality control review. A portion of the data (TCL and TAL parameters) will be subjected to data usability and screening report (DUSR) validation review in accordance with NYSDEC and USEPA Region II protocols (e.g. Level 3 review). Geotechnical parameters and physical parameters (e.g. temperature, pH, conductivity) will be Level 1 review.

2.11. Health and safety

Health and safety issues associated with this project are addressed in the Health and Safety Plan (HASP) developed for this program. The HASP includes guidance on the use of a respirator for field sampling activities.

3. Decontamination procedures

Procedures for decontamination of non-dedicated sampling equipment and dedicated equipment for ground water sampling are presented in Sections 3.2 and 3.3, respectively. The drilling and test pit program will include decontamination procedures to minimize the potential for introducing contaminants into the borehole or transferring contaminants across the Site.

3.1 Drilling equipment and tools

The soil boring program will include decontamination procedures to prevent potential contaminants from being introduced into the borehole or transferred across the Site.

A temporary decontamination pad will be constructed at the facility at a location approved by the field manager. Prior to drilling the first boring, the equipment used in drilling will be cleaned to remove possible contaminants that may have been encountered during mobilization of drilling equipment to the facility. Equipment which will come into contact with the soil, as well as drill tools, augers, drill rod, hoses and the back of the drill rig, will undergo the initial cleaning process. While working at the facility, the drilling equipment that comes into contact with the soil will be decontaminated between soil boring locations to prevent cross-contamination. Drilling equipment will again undergo the cleaning process prior to leaving the facility at the conclusion of drilling activities.

The cleaning process of drilling equipment will involve the use of a high-pressure steam cleaner. Potable water will be used for decontamination and drilling procedures. Decontamination water will be collected and stored for subsequent characterization and off-site disposal in accordance with Section 4.0.

3.2. Non-dedicated sampling equipment

Prior to sampling, non-dedicated equipment will be washed with potable water and a detergent (such as Alconox). The sampling equipment will then be rinsed with potable water followed by a reagent-grade methanol or isopropanol rinse and finally a deionized water rinse. Additionally, equipment used to collect samples for metals analysis will receive a nitric acid rinse following the deionized water

Reusable, non-dedicated, field equipment (i.e., bowls, spoons, augers, bailers, and filtering equipment) will be cleaned before sampling at each station. Equipment cleaning will consist of a 6-step sequential rinse process:

1. Soapy water rinse and scrubbing with non-phosphate detergent (such as Alconox)
2. Rinse with tap water
3. Rinse with 10% nitric acid
4. Rinse with laboratory reagent water
5. Rinse with methanol or isopropanol
6. Final rinse with deionized water

If samples are not to be analyzed for metals, steps 3 and 4 are not required. Equipment cleaning may take place at the sampling location as long as liquids are contained in pails, buckets, etc. Between rinses, equipment may be placed on polyethylene sheeting. At no time will washed equipment be placed directly on the ground. Equipment will be wrapped in polyethylene plastic or aluminum foil when not in use.

3.3. Dedicated sampling equipment

Following the sampling round, the dedicated bailers and small diameter polyethylene tubing will be cleaned with distilled or deionized water. After rinsing, each bailer and small diameter polyethylene tubing will be placed in a labeled plastic bag and sealed to ensure that no outside contaminants are introduced prior to use during subsequent sampling activities. This procedure will also be utilized to clean any new dedicated equipment to be used at the facility and to clean any dedicated equipment that may become contaminated in the field.

Prior to initial assembly of the low flow sampling apparatus decontaminate the non-dedicated miscellaneous parts, which come in contact with the sample, with an Alconox and tap water wash, tap water rinse, isopropyl alcohol rinse, and a distilled water rinse. After rinsing, dry the various parts with clean paper towels and place in a plastic bag, sealing to ensure that no outside contaminants are introduced prior to use during subsequent sampling activities. Dedicated HDPE tubing will remain in the monitoring well; therefore, decontamination is not required.

4. Handling of investigation-derived materials (waste management plan)

4.1. General

The RI activities will produce investigation-derived materials (IDM) which will require appropriate management. IDM includes the following:

- Drill cuttings
- Ground water resulting from development of new monitoring wells
- Ground water resulting from the sampling of the monitoring wells
- Decontamination fluids and surface soil/sediments which may settle out of such fluids
- Surface soil/sediments which settle out of ground water produced during the above
- Personnel protective equipment (PPE) and associated debris resulting from the execution of field activities.

The management of these materials is discussed below.

4.2. Drill cuttings

Drill cuttings derived from each soil boring or monitoring well boring will be placed under the plastic cover of one of the untreated soil piles currently staged on site.

4.3. Ground water

Ground water produced during development and sampling of monitoring wells will be containerized in 55-gallon drums and transported to a central location at the facility. The drums will be labeled with the monitoring well identification and the date that the ground water was initially containerized. The final disposition of the ground water will be determined after the various analytical results from the investigation are available. Depending on the results of the investigation, and any other characterization deemed appropriate, it is assumed that the ground water can be disposed on-site. Alternatively, if the results of the investigation or any additional characterization, indicate that the ground water is contaminated, then the ground water may be treated on-site and/or may

be transported off-site for treatment and/or disposal at a permitted facility following receipt of necessary approvals.

4.4. Decontamination fluids

Decontamination fluids containing non-indigenous materials associated with drilling, and on-site (ground water and soil) sampling activities will be containerized in plastic 55-gallon drums and temporarily stored in or next to the hazardous waste storage building. At the conclusion of field activities, these materials will be appropriately characterized and, after receiving the necessary approvals, will be transported off-site for treatment and/or disposal at a permitted facility.

For surface water and sediment decontamination fluids, rinse water will be discharged to the surface water. Solvent and acid rinse fluids will be containerized and disposed of according to the procedures above.

4.5. Surface soil/sediment, PPE and associated debris

Used PPE and other associated debris (e.g., ground plastic, tubing, etc.) will be containerized in 55-gallon drums or plastic bags and temporarily stored in an area to be designated. At the conclusion of field activities, these materials will be appropriately characterized and, after receiving the necessary approvals, will be transported off-site for treatment and/or disposal at a permitted facility. Solids that settle out of the decontamination fluids will be containerized separately, but managed similarly.

Table 1. Equipment checklist

Check	*Equipment*
	General
	Cell phone
	Camera
	Film
	Watch
	Calculator
	Measuring tape
	Sample supplies
	Sample coolers
	Sample containers
	Sample labels
	Sample label tape (clear)
	Nitrile sampling gloves
	Equipment rinse sampling water
	pH paper
	Decontamination supplies
	Methanol
	10% nitric acid
	Distilled/deionized water
	Solvent bottles
	Water spray bottles
	Decon pan
	Decon waste container
	Cleaning buckets (5)
	Nonphosphate soap
	Plastic sheeting
	Long handled scrub brush
	Bottle brush
	Documentation
	Work Plan (FSP, QAPP, HASP)
	Emergency phone numbers
	Field logs (sediment probing, sediment, water column, monitoring well, soil boring, health & safety, site access)
	Chain of custody
	General supplies
	Trash bags
	Aluminum foil
	Paper towels
	Towel wipes
	Plastic sheeting
	Markers (not containing organic solvents)
	Plastic bags
	Duct tape
	Tools

Table 1. Equipment checklist

Check	*Equipment*
	Drinking fluids
	Personal Protection
	Work gear
	Hard hat
	Rain gear
	Steel toe boots
	Over boots
	Protective eye wear
	Mobilization/site reconnaissance
	Weed wacker
	Saw
	55-gallon drum to contain used PPE
	Metal detector
	PID
	Sledge hammer
	Marker stakes
	Marking tape
	Flashlight
	Sanborn maps
	Sediment sampling gear
	Water column sampling
	Kemmerer sampler
	Depth gage or measuring stick
	Waders
	Water quality meter (pH, conductivity, DO, salinity)
	Boat
	Buoys, rope, and cinder block anchors, as needed
	0.45 micron glass fiber filters
	Sediment sampling
	Sediment probe
	Stainless steel mixing bowl
	Stainless steel spoons
	Waders
	Sediment core sampler
	Polycarbonate tubing
	Ponar dredge
	Tools- hack saw, screw driver, pliers
	Pontoon boat
	PID
	Calibrated rope
	Depth rod
	Buoys, rope, and cinder block anchors, as needed
	Depth gage (optional)

Table 1. Equipment checklist

Check	*Equipment*
	Surface soil sampling
	Stainless steel mixing bowl
	Stainless steel trowel
	Hand auger
	RAM
	Groundwater sampling
	PID
	Tank
	Same keyed locks
	Water level indicators
	Plastic sheeting
	Suction-lift pump and ½" polyethylene tubing for well purging, if required
	Dedicated Teflon or OPVC bailers with Teflon-coated stainless-steel wire or disposable nylon line, if required
	Dedicated one-way foot valves, if required
	Peristaltic pump and Tygon tubing
	5-gallon pails
	Water quality meter
	Well keys
	Drum sampling
	Bailer
	Pontoon Boat
	Extra battery
	Spuds
	Anchor
	Pipe wrenches
	Tools
	Reciprocating saw (if needed)
	Personal flotation devices (PFDs)
	PFD and 90ft rope
	Flares
	Horn

Table 1. Equipment checklist

Check	*Equipment*
	Health & Safety
	Eye wash station
	Respirator
	Air purifying cartridges
	Bug spray
	First aid kit
	Sunscreen
	Hearing protection
	Colorimetric indicator tubes for benzene vapor
	PID
	Combustible gas monitor (CGM)
	Real-time air monitor (RAM)
	Red flags
	Yellow flags
	Fire extinguisher

Soil boring/well log

O'BRIEN & GERE ENGINEERS, INC.	TEST BORING LOG	REPORT OF BORING
Client:	Sampler:	Page 1 of Location:
oj. Loc:	Hammer:	Start Date:
File No.:	Fall:	End Date:
Boring Company: Foreman: OBG Geologist:		Screen = \ Grout Riser ▒ Sand Pack ■ Bentonite

Depth Below Grade	No.	Depth (feet)	Blows /6"	Penetr/ Recovery	"N" Value	Sample Description	Stratum Change General Descript	Equip. Installed	Field Testing PID (ppm)	UV

Appendix B

Ground water sampling logs

O'Brien & Gere Engineers, Inc. — Standard Ground Water Sampling Log

Date _____
Site Name _____ Weather _____
Location _____ Well # _____
roject No. _____ Evacuation Method _____
Personnel _____ Sampling Method _____

Well Information:

Depth of Well * _____ ft.
Depth to Water * _____ ft.
Length of Water Column _____ ft.
Volume of Water in Well _____ gal.(s)
3X Volume of Water in Well _____ gal.(s)

Water Volume /ft. for:
_____ 2" Diameter Well = 0.163 X LWC
_____ 4" Diameter Well = 0.653 X LWC
_____ 6" Diameter Well = 1.469 X LWC

Volume removed before sampling _____ gal.(s)
Did well go dry? _____

* Measurements taken from [ ] Well Casing [ ] Protective Casing [ ] (Other, Specify) _____

Instrument Calibration:

pH Buffer Readings		Conductivity Standard Readings	
4.0 Standard		84 S Standard	
7.0 Standard		1413 S Standard	
10.0 Standard			

Water parameters:

Gallons Removed	Temperature Readings	pH Readings	Conductivity Readings uS/cm
initial	initial	initial	initial

Water Sample:
Time Collected _____

Physical Appearance at Start		Physical Appearance at Sampling	
Color		Color	
Odor		Odor	
Turbidity (> 100 NTU)		Turbidity (> 100 NTU)	
Sheen/Free Product		Sheen/Free Product	

Samples collected:

Container Size	Container Type	# Collected	Field Filtered	Preservative	Container pH

Notes:

Surface water sampling field log

New York State Department of Environmental Conservation
Revere Smelting & Refinishing Corporation Site
Wallkill, New York

Water Column Sampling Field Log

____________________ (Sampling Date)

Station	Time	Sample Depths	pH	Cond.	Water Temp.	DO	Salinity	QA/QC Sample	Inspect Sample	Comments

Additional Notes:

Weather Data
Description:
Temperature:
Wind:
Precipitation:

Sampled by:

I:\albany\projects\26408\4_n7/24/01\Water Column-Log.xls

Sediment sampling field log

New York State Department of Environmental Conservation
Revere Smelting & Refinishing Corporation Site
Wallkill, New York

Sediment Sampling Field Log

Sampling Program	Sample ID Number	Date/Time	Weather Conditions
Water Depth	**Core Type**	**Core to be Composited?**	
		☐ Yes ☐ No	
Penetration Depth	**Length Recovered**	**GPS Coordinates**	
		Nothing/Lat. = Easting/Long. =	
Core Section Interval	**Visual Description**	**Grain Size**	**Comments**

Sampler Initials:

Work Plan

Quality Assurance Project Plan

Revere Smelting & Refining Site
Wallkill, New York

July 2001

O'BRIEN & GERE
ENGINEERS, INC.

10653/26408

WORK PLAN

Quality Assurance Project Plan

Revere Smelting & Refining Site
Wallkill, New York

James R. Heckathorne, P.E.
Vice President

July 2001

O'BRIEN & GERE
ENGINEERS, INC.

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1. Introduction

1.1. Purpose

The QAPP provides quality assurance/quality control (QA/QC) criteria for work efforts associated with sampling of environmental media at the Site. The QAPP indicates project organization and responsibilities and outlines the data quality objectives (DQOs) and analytical protocols to document that the data collected during the Remedial Investigation (RI) are of sufficient quality to support remedial decisions. This document has been prepared with the guidance of United States Environmental Protection Agency's (USEPA's) Interim Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA, October 1988) and New York State Department of Environmental Conservation's (NYSDEC's) Resource Conservation and Recovery Act (RCRA) Quality Assurance Project Plan Guidance (NYSDEC, March 1991).

Revere Smelting and Refining Corporation (RSR) is a secondary smelter that manufactures lead and lead alloys. The primary constituents of concern are inorganics, primarily lead and arsenic. Matrices that may be sampled and analyzed during the RI include soil, ground water, surface water and sediment.

2. Quality Assurance Project Plan

The following quality assurance (QA) topics are addressed in this plan:

- Data Quality Objectives (DQOs);
- Sampling procedures;
- Documentation and chain-of-custody;
- Calibration procedures;
- Sample preparation and analytical procedures;
- Data reduction, validation, and reporting;
- Quality Control checks;
- Preventative maintenance;
- Data assessment procedures;
- Corrective actions; and
- QA reports to management.

The remainder of this document provides details of these topics. Additional sampling procedures details are provided elsewhere in the FSP.

2.1. Data quality objectives

DQOs are quantitative and qualitative statements specifying the quality of the environmental data required to support the decision-making process. DQOs define the total acceptable uncertainty in the data for each specific activity conducted during the investigation. The uncertainty includes both sampling error and analytical error. Ideally, zero uncertainty is the intent. However, the variables associated with the process (field and laboratory) inherently contribute to some uncertainty in the data. It is the overall objective to keep the total uncertainty within an acceptable range that will not hinder the intended use of the data. QA/QC requirements have been established such that there will be a high degree of confidence in the measurements.

The principal DQOs of this investigation are to generate data of sufficient quality to support both qualitative and quantitative conclusions concerning potential nature and extent of chemical constituents at the facility, to support engineering evaluations of potential remedial response activities, and to support the baseline risk assessment. In order to achieve these DQOs, the process of data generation was designed to develop a body of analytical data of sufficient quality to be used to support conclusions made as a result of this investigation. Specific data quality requirements such as criteria for precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) are specified in this document.

Laboratory analyses and analytical levels will adhere to the guidelines described in USEPA's Data Quality Objectives for Remedial Response Activities (USEPA, March 1987). Analytical levels are defined in the guidance document as follows:

Level I implies field screening or analysis using portable instruments. Results are often not compound specific and not quantitative but results are available on a real-time basis.

Level II implies field analyses using more sophisticated portable analytical instruments. In some cases, the instruments may be set up in a mobile laboratory on-site. There is a wide range of the quality of data that can be generated for Level II analyses. In general, data quality depends on the use of suitable calibration standards, reference materials, sample preparation equipment, and training of the instrument operator(s). Results are available on a real-time basis or within several hours.

Level III implies that all analyses be performed in an off-site laboratory. Level III analyses may or may not use USEPA Contract Laboratory Program (CLP) procedures. The laboratory may or may not be a CLP laboratory. Level III analyses will provide data of the same quality as Level IV, but USEPA's methods such as Test Methods for Evaluating Solid Waste (USEPA SW-846, July 1992 with all current revisions) are utilized instead of CLP methods.

Level IV implies CLP routine analytical services (RAS). Analyses are performed in an off-site CLP analytical laboratory following CLP protocols. Level IV is characterized by rigorous QA/QC protocols and documentation.

Level V implies analyses by non-standard methods. Analyses are performed in an off-site analytical laboratory which may or may not be a CLP laboratory. Method development or method modification may be required for specific constituents or detection limits. CLP special analytical services (SAS) are Level V.

Table 2-1 contains sampling efforts, objectives, analyses, data uses, and analytical levels. The remainder of this QAPP describes the specific approaches that will be taken to achieve the required DQOs.

In order to assess adherence to DQOs, O'Brien & Gere has developed the QA/QC program described in this QAPP. The USEPA's CLP states that the purpose of a QA/QC program "is the definition of procedures for the evaluation and documentation of sampling and analytical methodologies and the reduction and reporting of data. The objective is to provide a uniform basis for sample collection and handling, instrument and methods maintenance, performance evaluation, and analytical data gathering and reporting." The NYSDEC, in its guidance document for QAPPs, states that "quality assurance is a management system for ensuring that all information, data, and decisions resulting from an investigation are technically sound, and properly documented." QC is defined as the "functional mechanism through which QA achieves its goals."

The following is a brief description of data quality parameters addressed in the QAPP. Goals for completeness, accuracy, and precision are also specified. It should be pointed out that these goals may not always be achievable due to matrix interferences and minor problems caused by analyte or instrument instability. In those cases where these goals are not met, the impact of not meeting the goals will be discussed in the data usability report contained in the data validation report.

Precision describes the reproducibility of measurements under a given set of conditions. Specifically, it is a quantitative measure of the variability of a group of measurements, that have been made in an identical manner, compared to their average value. Precision can be expressed in a variety of manners, including absolute methods such as deviation from the mean or median values, standard deviation and variance, or relative methods, such as relative deviation from the mean or median. The overall precision may be established through the analysis of field duplicate and laboratory duplicate samples. For this project, a DQO goal for precision has been established that 100% of the analytes in the precision measurement must meet the control limits specified in this QAPP. If this goal is met, the data will have acceptable precision and will be considered usable. If this goal is not met, appropriate corrective action will be taken.

Accuracy is defined as the degree of difference between measured or calculated values and the true value. The closer the numerical value of the measurement comes to the true value, or actual concentration, the more accurate the measurement is. Accuracy is expressed in terms of absolute or relative error. Accuracy will be determined through analysis of spiked samples and the analysis of standards with known concentrations. The percent recovery of surrogate spikes for organic analyses will also provide an evaluation of the accuracy of the measurements. An overall project DQO goal for accuracy has been established that 100% of the analytes within the accuracy measurements must meet the control limits specified in this QAPP. If this goal is met, the data will have acceptable accuracy and will be considered usable. If this goal is not met, appropriate corrective actions will be taken.

Representativeness refers to the degree to which a sample taken from a site accurately reflects the matrix at the site. It is a qualitative parameter which is most closely associated with the design of the sampling program. Factors that should be considered in the determination of representativeness include appropriateness of sampling and analytical methodologies, representativeness of the selected media, and representativeness of the selected analytical procedures. Representativeness will be achieved by the use of procedures for the collection and preservation of samples as described in USEPA's Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, July 1992 with all current revisions, the associated FSP, and this QAPP.

Comparability refers to the use of consistent procedures, second source reference standards, reporting units, and standardized data format with document control. Adherence to standard procedures and the analysis of external source standard materials maximizes the probability that data generated from a particular method at a given laboratory can be validly compared to the data of another. This QAPP has been written to provide data which will be comparable to other data collected, as standard methods will be utilized.

Completeness refers to the process of obtaining the required data as outlined in the associated FSP and RI/FS Work Plan. Completeness is also defined as the percentage of measurements judged to be usable. Samples for which the critical data points fail completeness objectives will require reanalysis of samples (within the specified holding times) until the DQOs are met. The completeness goal has been specified at 100% for this investigation.

Sensitivity refers to a measurable concentration of an analyte which has an acceptable level of confidence. Method detection limits (MDLs) are the lowest concentration of an analyte that can be measured with 99% confidence that the analyte concentration is greater than zero. For inorganics, the instrument detection limit (IDL) is determined by multiplying the Students t-Test value the standard deviation obtained for the analysis of a standard solution at a concentration of 3 to 5 times the estimated IDL on three days with a minimum of seven measurements. The practical quantitation limit (PQL) is the lowest concentration that can be reliably quantified within specified limits of precision and accuracy during routine laboratory operations. The contract required quantitation limit (CRQL) is the minimum level of quantitation acceptable for this project. CRQLs originated from the USEPA CLP scopes of work (SOWs) for the analysis of organic TCL and inorganic TAL. The analytical methods associated with this project can achieve the MDLs, PQLs, and CRQLs low enough to adequately meet the project's DQOs.

2.1.1. Field sampling

The objective of field sampling procedures is to obtain samples that represent the environmental matrix being investigated. This will be accomplished through the use of proper sampling techniques and equipment. Appropriate sampling protocols are presented in the associated FSP.

2.1.2. Laboratory analyses

To obtain data of a quality sufficient to meet the project DQOs, the following analytical laboratory techniques will be utilized:

- Total cyanide analysis using spectrophotometry;
- TAL total metals analysis using inductively coupled plasma (ICP) and cold vapor techniques;

pH analysis using an electrode;

Miscellaneous inorganic analyses using various wet chemistry techniques based on the selected laboratory.

The analytical QA/QC and data reporting will adhere to the specific analytical methods, or equivalents and/or updates, listed in Table 2-2 along with requirements of Exhibit E of the NYSDEC Analytical Service Protocol (ASP) October 1995 revision.

2.2. Sampling procedures

A detailed description of the sampling procedures that will be used during the RI/FS at the Site in are presented in the associated FSP.

2.2.1. Sampling locations

Sampling locations for each RI/FS task are presented in the associated work plan and FSP.

2.2.2. Field QA/QC samples

In order to evaluate data quality, QA/QC samples will be collected during the field investigation. The following field QA/QC samples will be collected for samples submitted for Level IV laboratory analyses.

2.2.2.1. Field duplicate samples

Collection of field duplicate samples provides for the evaluation of the laboratory's performance by comparing analytical results of two samples from the same location. Field duplicate samples are also collected to evaluate field sample collection procedures. Field duplicate samples are duplicate samples collected from one location and sent to the laboratory blind (with two different sample identifications). Field duplicate samples will be collected at a rate of one per 20 environmental samples per matrix per parameter.

2.2.2.2. Matrix spikes and matrix spike duplicates

Matrix spike/matrix spike duplicate (MS/MSD) samples are duplicate samples that have a known concentration of spiking solution added to evaluate potential matrix interferences. The percent recovery of the spiked amount indicates the accuracy of the analysis extraction or sample preparation, as well as interferences caused by the matrix, if any. Relative percent differences (RPDs) between spike sample recoveries will indicate the precision of the data. One set of MS/MSD samples will be collected at a rate of one per 20 environmental samples per matrix per parameter, if applicable (i.e., MS/MSD samples are not applicable for pH, alkalinity, specific conductivity, and turbidity analyses).

2.2.2.3. Field/equipment blanks

Field/equipment blanks will consist of analyte-free deionized water that has been passed through and/or over decontaminated sampling equipment. One field/equipment blank will be collected per type of sampling equipment per sampling event. Field/equipment blanks will not be required if dedicated sampling equipment is utilized. The field/equipment blanks will be subject to the same analyses as the environmental samples.

2.2.3. Sampling preparation and preservation

Immediately after collection, samples will be transferred to labeled sample containers and properly preserved. Table 2-3 lists the appropriate sample containers, volume requirements, and preservation techniques. Samples requiring refrigeration for preservation will be promptly transferred to coolers packed with ice. Samples will be shipped or transported within 24 hours of being collected and will arrive at the laboratory no later than 48 hours after sample collection. Proper chain-of-custody documentation will be maintained as discussed in Section 6 of this QAPP. Samples will be extracted and/or analyzed within the holding times specified in Table 2-3. Holding times begin from the laboratory verified time of sample receipt (VTSR).

2.2.4. Decontamination of sampling equipment

Protocols for the decontamination activities, if required, are described in the associated FSP.

2.3. Sample custody

Chain-of-custody procedures will be instituted and followed throughout the RI/FS at the Revere Smelting & Refinishing Site. These procedures include field custody, laboratory custody, and evidence files. Samples are physical evidence and will be handled according to strict chain-of-custody protocols. The QA Coordinator must be prepared to produce documentation that traces the samples from the field to the laboratory and through analyses. The USEPA has defined custody of evidence as follows:

- In actual possession;
- In view after being in physical possession;
- In a locked laboratory; or
- In a secure, restricted area.

Chain-of-custody records will be initiated in the field when sample collection has begun. The field sampler will indicate the sample identification number, date, time, sample matrix, sample type (i.e., grab or composite), number of containers and the analyses requested on the appropriate chain-of-custody form.

Chain-of-custody forms must be signed by both individuals upon transfer of sample coolers, unless shipped by an overnight courier. In this case, a copy of the overnight courier's signed shipping label will document the complete transfer. The chain-of-custody form will be signed and placed in a sealed bag and sealed in the shipping container. An example chain-of-custody form is attached as Figure 2-1. The shipping container will be closed, and two paper seals will be affixed to the latch and lid. The seal must be broken to open the cooler and will indicate possible tampering if the seal is broken before receipt at the laboratory.

The cooler will be shipped via an overnight delivery service or hand delivered to the laboratory. When the samples arrive at the laboratory, the sample custodian will sign the vendor's air bill or bill-of-lading (unless hand-delivered). The sample custodian's duties and responsibilities upon sample receipt will be to:

- Document receipt of samples by signing the chain-of-custody and internal laboratory log book;

- Inspect sample shipping containers for the presence or absence of custody seals and for container integrity;

- Sign the appropriate forms or documents, verify and record the agreement or disagreement of information on sample documents and, if there are discrepancies, record the problem and notify the Laboratory QA Officer and QA Coordinator;

- Label samples with laboratory sample numbers; and

- Place samples in secure, limited-access storage.

At the laboratory, the analysts will be required to log samples and extracts in and out of storage as the analysis proceeds. Samples and extracts will be returned to secure storage at the close of business. Written records will be kept of each time the sample or extract changes hands. Care must be exercised to properly complete, date, and sign items needed to generate data. Copies of the following will be stored for incorporation into the sample file:

- Documentation of the preparation and analysis of samples, including copies of the analyst's notebooks;

- Bench sheets, graphs, computer printouts, chromatograms, and mass spectra;

- Copies of QA/QC data;

- Instrument logs showing the date, time, and identity of the analyst; and

- Analytical tracking forms that record the date, time, and identity of the analyst for each step of the sample preparation, extraction, and analysis.

Upon completion of the analyses, the Laboratory QA Officer, or his/her designee, will begin assimilating the field and laboratory notes. In this way, the file for the samples will be generated. The final file for the sample will consist of:

- Laboratory data packages (including summary, instrument print outs, and raw data from the analysis of environmental and QC samples, chromatograms, mass spectra, calibration data, quantitation forms, work sheets, sample preparation logs); and

- Chain-of-custody records.

2.4. Calibration and frequency

2.4.1. Laboratory equipment calibration

Proper calibration of laboratory analytical instrumentation is essential for the generation of reliable data which meets the project's DQOs. Analytical instrument calibration is monitored through the use of control limits which are established for individual analytical methods. Calibration procedures to be followed are specified, in detail, in the analytical methods and in NYSDEC ASP October 1995 revisions, Exhibit E (hereafter "ASP Exhibit E"). These procedures specify the type of calibration, calibration materials to be used, range of calibration, frequency of calibration, and calibration QC criteria.

The laboratory will be responsible for proper calibration and maintenance of laboratory analytical equipment. The following subsections detail some of the calibration procedures outlined in the analytical methods and ASP Exhibit E.

2.4.1.1. Metals and inorganics

Instrument calibration for metal and inorganic analyses is performed daily. A two point calibration for ICP analyses is performed. Five point calibrations are performed for spectrophotometers and other applicable wet chemistry techniques. The calibration curves must have correlation coefficients greater than or equal to 0.995. Calibration verification is monitored by analyzing a calibration verification standard and a calibration blank following the initial calibration, every ten samples, and at the end of the analytical sequence. The calibration verification standard recovery must be within the criteria specified in this QAPP (i.e., Table 2-4) or the instrument must be resloped, if applicable, and if necessary, recalibrated. The calibration blank must not contain target compounds at concentrations greater than the PQL or CRQL, whichever is applicable, or corrective actions are implemented.

To verify interelement and background corrective factors for ICAP analysis, interference check samples (ICSA and ICSAB) must be analyzed at the beginning and end of the analysis sequence or a minimum of twice per eight hours. The percent recoveries for solutions must be within ASP Exhibit E criteria. In addition, for ICAP analyses, a serial dilution analysis must be performed per sample matrix. If the analyte concentration is greater than fifty times the MDL in the original sample, a serial dilution (five fold dilution) must agree within ten percent of the original determination. Detection limits, interelement corrective factors, and linear ranges must be established at the frequency specified in the method.

2.4.1. Standards and solutions

The use of standard materials of a known purity and quality is necessary for the generation of reproducible data. Standards and standard solutions are obtained from the USEPA or USEPA-certified commercial vendors. Standard reference materials and performance evaluation materials are obtained from the National Institute of Science and Technology (NIST) or USEPA-certified commercial vendors.

Standards and standard solutions are verified prior to use. This verification may be in the form of a certification from the supplier. Standards may also be verified by comparison to a standard curve or another standard from a separate source. Standards are routinely checked for signs of deterioration including unusual volume changes (solvent loss), discoloration, formation of precipitates, changes in analyte response, or age. Standards will not be used after expiration date.

Solvent materials are also verified prior to use. Each new lot of solvent is analyzed to verify the absence of interfering constituents. Reagent and method blanks are routinely analyzed to evaluate laboratory-based contamination of samples.

2.4.2. Standards records

A records book will be kept for standards and will include the following information:

- Material name;
- Control or lot number;
- Purity and/or concentration;
- Supplier/manufacturer;
- Receipt/preparation date;
- Recipient/preparer's name; and
- Expiration date.

These records will be checked periodically as part of the laboratory's internal controls review.

2.4.3. Calibration records

A bound notebook will be kept with each instrument that requires calibration. The notebook will contain a record of activities associated with QA monitoring and instrument repairs. These records will be checked during periodic equipment review and internal QA/QC audits.

2.5. Analytical procedures

2.5.1. Laboratory analytical procedures

The accuracy and precision of the analytical data generated by the laboratory will be determined through the analysis of duplicate samples, spiked samples, reference standard samples, laboratory control samples (LCS), and field and/or laboratory blank samples analyzed along with each set of environmental samples.

Interferences will be identified and documented. When matrix interferences are noted during sample analysis, actions will be taken by the laboratory to achieve the specified quantitation limits. Samples may be diluted only if analytes of concern generate responses in excess of the linear range of the instrument. The selection of analytical cleanup methodologies will follow SW-846 method requirements. In such cases, the Laboratory QA Officer will document that the laboratory demonstrates good analytical practices and that such practices are documented in order to achieve the specified quantitation limits.

The accuracy of the method will be determined by spiking the sample matrix with analytes and surrogates. Standards and reference materials will also be analyzed to determine analyte concentrations for comparison with expected concentrations to provide a measure of accuracy of the methods. Percent recoveries of the spikes will be calculated and compared with control limits. A measure of precision will be obtained through the RPD between MSs and MSDs. Sampling precision will be evaluated based on the RPD of duplicate field samples. RPDs will be compared to established control limits.

The generated data will be entered into the laboratory database management system. Complete descriptions of analytical procedures to be used in the laboratory are described by the NYSDEC ASP October 1995 Revision, USEPA Methods for Chemical Analysis of Water and Wastes, (March 1983), USEPA SW-846 methodologies and/or in the laboratory's QA Manual and standard operating procedures (SOPs).

2.5.2. Method detection limits and quantitation limits

The MDL is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. For inorganics, the instrument detection limit (IDL) is determined by multiplying the Students t-Test value the standard deviation obtained for the analysis of a standard solution at a concentration of 3 to 5 times the estimated IDL on three days with a minimum of seven measurements. The PQL is the lowest concentration that can be reliably quantified within specified limits of precision and accuracy during routine laboratory operations. The contract required quantitation limit (CRQL) is the minimum level of quantitation acceptable for each method. CRQLs originated from the USEPA CLP scopes of work (SOW) for the analysis of organic TCL and inorganic TAL. Table 2-4 lists CRQLs to be used for this project. The laboratory should report estimated concentrations (i.e., flagged with "J") for compounds detected between the IDL and the CRQL or PQL. The PQLs for the inorganic wet chemistry parameters (i.e., natural attenuation parameters) are laboratory dependent and will be evaluated and approved on a laboratory by laboratory basis.

2.6. Data reduction, validation, and reporting

The laboratory will be conducting analyses on samples in accordance with referenced USEPA method protocols, NYSDEC ASP (October 1995 revision) and the laboratory's QA Manual. Laboratory validation will be incorporated into their in-house effort for the appropriate parameters.

2.6.1. Data production, handling, and reporting

Specific laboratory procedures and instrumentation can be found in the QA Manual and/or SOPs from the laboratory. The data production and reporting procedures described below will be employed at the laboratory.

Analytical data packages, which are fully validatable and document sample preparation, extraction, and analysis, will be provided for the analyses. Data report forms will be securely bound and the pages will be sequentially numbered. The analytical reports for sample matrices will conform to the list of deliverable requirements included in Appendix A to this QAPP.

The analyst has the primary responsibility and accountability for the correctness and completeness of the analytical data. Each laboratory analyst has responsibility for QA/QC functions at their level and within their assigned tasks. Initial review by the analyst and supervisor is completed in relation to compliance with methodology and acceptability of precision and accuracy results. Review at the QA Officer level

includes these elements as well as a review of data acceptability based upon internal and project specific QC criteria. Tertiary review occurs with the laboratory management where pertinent information pertaining to each specific analysis is compiled. The data generated from the various laboratory sections is transferred to laboratory's QA Officer. Analytical data forms are then processed and data validation is accomplished.

2.6.2. Data validation

The laboratory data validation process begins with the appropriate laboratory personnel who will review the raw and reduced data for possible calculation and transcription errors. Additionally, these personnel will check unusually high or low parameter values. The Laboratory QA Officer will perform a final laboratory validation of the data which will include a review of QC sample analyses and data completeness. The laboratory report will then be reviewed and approved by the manager of analytical services prior to its release to O'Brien & Gere. O'Brien & Gere chemists will perform an independent data validation upon receipt of the analytical data packages.

Data validation is a systematic process of evaluating analytical data quality by comparing the data generation process (sample collection through sample analysis) to QC criteria established prior to the initiation of the field investigation. Data quality criteria are established based on the project DQOs which are, in turn, established based on the intended use of the data. A data validation report establishes data usability by determining the degree of adherence to QC criteria of the analytical data. As a result, sample data are determined to be usable as is, approximate, or unusable for the particular use established by the project DQOs. The analytical data will be validated in accordance with the criteria set forth in the following:

- Specific referenced USEPA method;
- NYSDEC ASP October 1995 Revision requirements;
- USEPA, Region II. January 1992. Evaluation of Metals Data for the CLP, SOP No. HW-2, Revision 11.

Data validation reports will be generated and incorporated into the RI Report.

The requirements to be checked for the validation of inorganics analyses include the following:

- Holding times;
- Sample preservation;

- Initial and continuing calibration;
- Blank analyses;
- Laboratory duplicate analyses;
- LCS evaluation;
- MS/MSD analysis;
- MSB analysis;
- Field duplicate analysis;
- Element quantitation and reported PQLs;
- Document completeness;
- Data usability; and/or
- Overall data assessment.

2.7. QC checks

2.7.1. Laboratory QA/QC checks

Table 2-5 contains information regarding audits, frequency, acceptance criteria, and corrective actions. Upon the completion of a sample analysis, the results of QA/QC data will be reviewed to verify compliance with the criteria listed. When results are reported to the Laboratory QA Officer, QA/QC data will be included in the package for review. MSs, reference standards, and LCSs will be used to monitor the accuracy of the methodologies by comparing recoveries to the established QA/QC criteria. MSDs and duplicate samples will be incorporated as an indicator of the precision of the sample results. The RPD calculations will also be compared to the established QA/QC criteria. Laboratory QA/QC procedures will be evaluated during data validation and will be discussed in the data validation report.

2.7.2. Field sampling QA/QC

Field sampling crews will be under direct supervision of a field sampling leader. Bound log books and appropriate data sheets will be used to document the collection of samples and data so that any individual sample or data set can be traced back to its point of origin, sampler, and

type of sampling equipment. Sampling will be performed according to the methods provided in the RI/FS Work Plan, FSP and in this QAPP. Blind field duplicate samples will be collected by the sampling team. These samples will be sent to the laboratory for analysis in conjunction with the environmental samples. Field sampling precision will be evaluated through the RPD of the duplicate sample analyses results. Control limits for field duplicate precision have been established at ±100% RPD for soil samples and ±50% RPD for water samples for this project. Decontamination of sampling equipment will be verified through the analysis of equipment blanks, if required. Proper chain-of-custody protocols, as presented in Section 6 of this QAPP, will be followed.

2.8. Preventive maintenance

Preventive maintenance procedures will be carried out on field equipment in accordance with the procedures outlined by the manufacturers' equipment manuals. Calibration activities involving field equipment will be recorded in a field log book.

The laboratory's maintenance activities are documented and maintained in permanent files and logbooks. The laboratory's internal preventive maintenance service should involve cleaning, adjusting, inspecting, and performing testing procedures designed to reduce product failure and extend useful product life.

2.9. Data assessment procedures

The procedures employed by the laboratory to assess the quality of data generated in the laboratory include, but are not limited to, the following:

- Determination of analytical precision per method;
- Determination of analytical accuracy per method;
- Determination of analytical completeness; and
- Determination of MDLs and PQLs.

Data quality reviews by analysts, supervisors, managers, laboratory directors, and QA personnel contribute to the total process. Analytical project managers interface with clients to evaluate whether the clients' needs are met and that the information provided fulfills their requirements.

Precision and accuracy will be assessed utilizing control charts. Control charts will consist of line graphs which provide a continuous graphic

representation of the state of each analytical procedure. The standard deviation of the mean of the QC measurements is calculated and the upper and lower warning limits are set at plus or minus two standard deviation units. The upper and lower control limits are set at plus or minus three standard deviation units. Acceptable data are realized when results fall between the lower and upper warning limits. If the QC value falls between the control limit and the warning limit, the analysis should be scrutinized as possibly out of control.

In general, the accuracy of the methods will be determined by spiking the sample matrix with the analyte and by analyzing reference materials with known concentrations. The spiking levels will be selected to reflect the concentration range of interest. Percent recoveries of the spikes and reference materials will be calculated and compared to the established limits. The precision of the methods will be determined by the analysis of MS and laboratory and field duplicate samples. The precision will be evaluated by calculating the RPD between the duplicates. RPD calculations will be compared to the established limits.

The definitions and equations used for the assessment of data quality are:

Accuracy - is a measure of the nearness of an analytical result, or a set of results, to the true value. It is usually expressed in terms of error, bias, or percent recovery (%R).

Normally, the term accuracy is used synonymously with percent recovery. It describes either the recovery of a synthetic standard of known value, or the recovery of known amount of analyte (spike) added to a sample of known value. The %R or accuracy can be calculated by using:

standards: %R = (observed value/true value) x 100

spikes: %R = (conc. spike + sample conc.) - sample conc. x 100)/conc. spike

Precision - refers to the agreement or reproducibility of a set of replicate results among themselves without assumption of any prior information as to the true result. It is usually expressed in terms of the percent difference (%D) or RPD. The %D is calculated by using:

%D = (larger SR - smaller SR x 100)/ smaller SR

where SR is the sample result. RPD is calculated by using:

RPD = (OSR - DSR x 100)/ ((OSR + DSR)/2)

where OSR is the original sample result and DSR is the duplicate sample result.

Average - The average or arithmetic mean (X) of a set of n values (Xi) is calculated by summing the individual values and dividing by n:

$$X = (\ Xi\ I=1\ to\ n)/n$$

Range - The range (Ri) is the difference between the highest and lowest value in a group. For n sets of duplicate values (X2, X1) the range (Ri) of the duplicates and the average range (R) of the n sets are calculated by the following:

$$Ri = X2 - X1$$

and

$$R = Rii=1\ to\ n/n$$

Standard Deviation and Variation - The standard deviation (S) of a sample of n results is the most widely used measure to describe the variability of a data set. It is calculated by using the following equation:

$$S = \frac{(Xi - X)2i\text{-}1\ to\ n}{n}$$

where X is the average of the n results and Xi is the value of result I. Normally, $X \pm S$ will include 68% and $X \pm 2S$ about 95% of the data for normally distributed data.

The variance is equal to S2. The percent%RSD or coefficient of variation (CV) is the standard deviation divided by the mean and multiplied by 100 as follows.

$$CV = 100S/X$$

The Laboratory QA Officer, with individual laboratory group leaders, will identify any data that should be rated as "unacceptable," based on the assessment of the QA/QC criteria. Data assessment will be evaluated during data validation and discussed in the data validation report.

2.10. Corrective Action

Corrective action procedures will be implemented based on unacceptable audit results or upon detection of data unacceptability during validation. Two types of audits may be performed during this investigation. The data generation process will be audited by assessing adherence to laboratory control limits. The field program will be audited by assessing adherence to the procedures outlined in the Work Plan and in this document by the analysis of field QC samples. If required, corrective action procedures will be developed on a case-by-case basis. The enacted corrective actions will be documented in the appropriate notebook, log, or case file.

The following corrective actions should be taken by the laboratory. When calibration, instrument performance, and blank criteria are not met, the cause of the problem will be located and corrected. The analytical system will then be recalibrated. Sample analysis will not begin until calibration, instrument performance, and blank criteria are met. When MS, reference standard, or duplicate analyses are out of control, samples analysis will cease. The problem will be investigated. Depending on the results of overall QC program for the sample set, the data may be accepted, accepted with qualification, or determined unusable. If the laboratory determines data to be unusable, those samples will be reprepared and reanalyzed. If matrix interferences are suspected, samples will be subjected to one or more of the clean-up techniques specified in the analytical methods. If QC criteria are met upon reanalysis, only the new results are reported. If QC criteria are still not met upon reanalysis, both sets of sample results will be reported.

The laboratory will make every reasonable effort to correct QC excursions and to document the presence of matrix interferences. In this way, unnecessary resampling of difficult matrices may be avoided. However, if matrix interferences are not documented resampling may be required.

Corrective actions for the field investigation program, if required, will generally involve altering the incorrect field procedure to match the guidelines set forth in the RI/FS Work Plan, FSP and in this QAPP. If problems arise with procedures or guidelines set forth therein, the client, the QA Coordinator, Project Officer/Manager, and the RI Manager will formulate an appropriate corrective action.

2.11. QA reports to management

The deliverables associated with the investigation will contain separate QA sections in which data quality information collected during the investigation is summarized. These data validation reports will be prepared under the direction of the Project Manager and will include the QA Coordinator's report on the accuracy, precision, and completeness of the data.

References

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Table 2-1
Sampling Efforts, Objectives, Analyses, Data Uses and Analytical Levels

Revere Smelting and Refining Site
Wallkill, New York

Sampling efforts	Objectives	Types of analyses	Data uses	Analytical levels
Ground water sampling	Quantify constituents, if any	total cyanide total metals Alkalinity Sulfate pH	Site Characterization, Baseline Risk Assessment, Evaluation of Remedial Alternatives, and Engineering Design	IV
Surface water sampling	Quantify constituents, if any	total cyanide total metals pH	Site Characterization, Baseline Risk Assessment, Evaluation of Remedial Alternatives, and Engineering Design	IV
Soil/sediment sampling	Quantify constituents, if any	pesticides total cyanide total metals pH	Site Characterization, Baseline Risk Assessment, Evaluation of Remedial Alternatives, and Engineering Design	IV

Table 2-2
Analytical Methods

Revere Smelting and Refining Site
Wallkill, New York

Sample type	*Parameter*	*Analytical Method*	*References*
Ground water, surface water	Metals	NYSDEC ASP Method 200.7 CLP-M	1
Ground water, surface water	Mercury	NYSDEC ASP Method 245 CLP-M	1
Ground water, surface water	Total Cyanide	NYSDEC ASP Method 335.2 CLP-M	1
Soil, sediment	Metals	NYSDEC ASP Method 200.7 CLP-M	1
Soil, sediment	Mercury	NYSDEC ASP Method 245 CLP-M	1
Soil., sediment	Total Cyanide	NYSDEC ASP Method 335.2 CLP-M	1
Ground water, surface water	Hardness	NYSDEC ASP Method 130.2	1
Ground water, surface water	Alkalinity	NYSDEC ASP Method 310.1	1
Ground water, surface water	TSS	NYSDEC ASP Method 160.1	1
Ground water, surface water	TOC	NYSDEC ASP Method 9060	1
Ground water, surface water	DOC	NYSDEC ASP Method 415.1	1
Sediment	TOC	Lloyd Kahn	2
Ground water	F-Specific Conductance	NYSDEC ASP Method 9050	1
Ground water	F-pH	NYSDEC ASP Method 9040B	1
Ground water	F-Turbidity	NYSDEC ASP Method 180.1	1

Notes:
Metals indicates the target analyte list (TAL) metals.
TSS indicates total suspended solids.
TOC indicates total organic carbon.
DOC indicates dissolved organic carbon; performed by field filtering samples and performing TOC by 415.1 on filtered sample.
F indicates field method
1 – NYSDEC, 1995. *Analytical Services Protocol (ASP)*, October 1995 Revisions. Albany, NY
2 – USEPA, Region II, Environmental Services Division, Monitoring Management Branch, *Determination of Total Organic Carbon in Sediment*, Edison, New Jersey, 1988b.

Table 2-3A
Field sampling QA/QC for water samples

Revere Smelting and Refining Site
Wallkill, New York

Parameter (method)	Matrix	Sample containers and volumes	Preservation	Holding times (from verified time of sample receipt)	QC sample frequency			
					Field duplicate	Trip Blank	MS/MSD Duplicate	Equipment Blank
VOCs (NYSDEC Method 95-1)[1]	Ground water and surface water	3 40-milliliter glass vials with Teflon® lined septum caps	4°C, ascorbic acid in the presence of residual chlorine, HCl to pH<2	7 days	one per 20 samples or one per matrix (for less than 30 samples)	1 ea. per cooler	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
SVOCs (NYSDEC Method 95-2)[1]	Ground water and surface water	2 one-liter amber glass container with Teflon® lined screw caps	4°C 0.008% $Na_2S_2O_3$ in the presence of residual chlorine	5 days to extraction; 40 days from extraction to analysis	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
Aniline (NYSDEC Method 8270C)[1]	Ground water and surface water	2 one-liter amber glass container with Teflon® lined screw caps	4°C 0.008% $Na_2S_2O_3$ in the presence of residual chlorine	5 days to extraction; 40 days from extraction to analysis	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
PCBs (NYSDEC Method 95-3)[1*]	Ground water and surface water	2 one-liter amber glass container with Teflon® lined lid	4°C	5 days to extraction; 40 days from extraction to analysis	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
Pesticides (NYSDEC Method 95-3)[1*]	Ground water and surface water	2 one-liter amber glass container with Teflon® lined screw caps	4°C	5 days to extraction; 40 days from extraction to analysis	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
Metals (NYSDEC Method 200.7 CLP-M)[1] Mercury (NYSDEC Method 245 CLP-M)[1] Total Cyanide (NYSDEC Method 335.2 CLP-M)[1]	Ground water and surface water	1 liter plastic bottle for metals, mercury, 1 500-milliliter plastic bottle for cyanide	Metals, mercury HNO_3 to pH<2, 4°C Cyanide 0.6 grams ascorbic acid in the presence of residual chlorine NaOH to pH>12	Metals 6 months Mercury 26 days Cyanide 12 days	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples) (MS/Duplicate)	one per sampling event as required.
Total and amenable Cyanide (NYSDEC Method 9010B/9014)[1]	Ground water and surface water	1 liter plastic bottle	Cyanide 0.6 grams ascorbic acid in the presence of residual chlorine NaOH to pH>12	Cyanide 12 days	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples) (MS/Duplicate)	one per sampling event as required.
Hexavalent chromium (NYSDEC Method 7196A)[1]	Ground water and surface water	1 500-milliliter plastic bottle	4°C	24 hours	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples) (MS/Duplicate)	one per sampling event as required.
Hardness (NYSDEC Method 130.2)[1]	Ground water and surface water	1 500-milliliter plastic bottles	HNO_3 to pH <2	6 months	one per 20 samples or one per matrix (for less than 20 samples)	NA	NA	one per sampling event as required.
Alkalinity (NYSDEC Method 310.1)[1]	Ground water and surface water	1 100-milliliter glass bottles	4°C	14 days from collection	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples) (MS/Duplicate)	one per sampling event as required.

Table 2-3A
Field sampling QA/QC for water samples

Revere Smelting and Refining Site
Wallkill, New York

Parameter (method)	Matrix	Sample containers and volumes	Preservation	Holding times (from verified time of sample receipt)	QC sample frequency			
					Field duplicate	Trip Blank	MS/MSD Duplicate	Equipment Blank
TSS (NYSDEC Method 160.1)[1]	Ground water and surface water	1 500-milliliter plastic bottles	4°C	5 days	one per 20 samples or one per matrix (for less than 20 samples)	NA	NA	one per sampling event as required.
TOC (NYSDEC Method 9060)[1]	Ground water and surface water	1 500-milliliter plastic bottles	4°C	26 days	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples) (MS/Duplicate)	one per sampling event as required.
DOC (NYSDEC Method 415.1)[1]	Ground water and surface water	1 100-milliliter plastic bottles	4°C	28 days from collection	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples) (MS/Duplicate)	one per sampling event as required.

Notes:

1 – New York State Department of Conservation 1995. *Analytical Services Protocol (ASP)*, October 1995 Revisions. Albany, NY.
MS/MSD indicates matrix spike/matrix spike duplicate sample.
VOCs indicates volatile organic compounds that are listed in Table 8-2A
SVOCs indicates semivolatile organic compounds that are listed in Table 8-3A
PCBs indicate polychlorinated biphenyls that are listed with pesticides in Table 8-4A
TOC indicates total organic carbon.
DOC indicates dissolved organic carbon; Method 415.1 will be performed on field filtered samples.
Inorganics and TOC are listed in Table 8-5A
NA indicates not applicable

* indicates that the same containers will be used to analyze both pesticides and PCBs

Table 2-3B
Field sampling QA/QC for soil and sediment samples

Revere Smelting and Refining Site
Wallkill, New York

Parameter (method)	Matrix	Sample containers and volumes	Preservation	Holding times (from verified time of sample receipt)	QC sample frequency			
					Field duplicate	Trip Blank	MS/MSD Duplicate	Equipment Blank
VOCs (NYSDEC Method 95-1)[1]	Soil and sediment	125-milliliter glass container with Teflon® lined caps	4°C	7 days	one per 20 samples or one per matrix (for less than 20 samples)	1 ea. per cooler	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required
SVOCs (NYSDEC Method 95-2)[1]	Soil and sediment	250-milliliter wide mouth glass container with Teflon® lined lid	4°C	10 days to extraction; 40 days from extraction to analysis	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
Aniline (NYSDEC Method 8270C)[1]	Soil and sediment	250-milliliter wide mouth glass container with Teflon® lined lid	4°C	10 days to extraction; 40 days from extraction to analysis	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
PCBs (NYSDEC Method 95-3)[1**]	Soil and sediment	250-milliliter wide mouth glass container with Teflon® lined lid.	4°C	10 days to extraction; 40 days from extraction to analysis	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
Pesticides (NYSDEC Method 95-3)[1**]	Soil and sediment	250-milliliter wide mouth glass container with Teflon® lined lid	4°C	10 days to extraction; 40 days from extraction to analysis	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples)	one per sampling event as required.
Metals (NYSDEC Method 200.7 CLP-M)[1] Mercury (NYSDEC Method 245 CLP-M)[1] Total Cyanide (NYSDEC Method 335.2 CLP-M)[1]	Soil	1 8-ounce wide mouth glass container with Teflon® lined lid	4°C	Metals 6 months Mercury 26 days Cyanide 12 days	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples) (MS/Duplicate)	one per sampling event as required.
Metals (NYSDEC Method 200.7 CLP-M)[1] Mercury NYSDEC Method 245 CLP-M)[1] Total Cyanide (NYSDEC Method 335.2 CLP-M)[1]	Sediment	1 8-ounce wide mouth glass container with Teflon® lined lid	4°C	Metals 6 months Mercury 26 days Cyanide 12 days	one 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples) (MS/Duplicate)	one per sampling event as required.
Total and amenable Cyanide (NYSDEC Method 9010B/9014)[1]	Soil and Sediment	1 8-ounce wide mouth glass container with Teflon® lined lid	4°C	12 days	one 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples) (MS/Duplicate)	one per sampling event as required.
Hexavalent chromium (NYSDEC Method 3060A/7196A)[1]	Soil and Sediment	1 8-ounce wide mouth glass container with Teflon® lined lid	4°C	30 days to digestion 7 days to analysis	one 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples) (MS/Duplicate)	one per sampling event as required.

Table 2-3B
Field sampling QA/QC for soil and sediment samples

Revere Smelting and Refining Site
Wallkill, New York

Parameter (method)	Matrix	Sample containers and volumes	Preservation	Holding times (from verified time of sample receipt)	QC sample frequency			
					Field duplicate	Trip Blank	MS/MSD Duplicate	Equipment Blank
TOC (Lloyd Kahn Method)[2]	Sediment	1 4-ounce wide mouth glass container with Teflon® lined lid.	4°C	14 days	one per 20 samples or one per matrix (for less than 20 samples)	NA	one per 20 samples or one per matrix (for less than 20 samples) (MS/Duplicate)	one per sampling event as required.

Notes:

1 – New York State Department of Conservation 1995. *Analytical Services Protocol (ASP)*, October 1995 Revisions. Albany, NY.
2- USEPA, Region II, Environmental Services Division, Monitoring Management Branch, *Determination of Total Organic Carbon in Sediment*, Edison, New Jersey, 1988b.
MS/MSD indicates matrix spike/matrix spike duplicate sample.
VOCs indicates volatile organic compounds that are listed in Table 8-2B
SVOCs indicates semivolatile organic compounds that are listed in Table 8-3B
PCBs indicate polychlorinated biphenyls that are listed with pesticides in Table 8-4B
TOC indicates total organic carbon.
Inorganics and TOC are listed in Table 8-5B
NA indicates not applicable

* indicates that the same containers will be used for both, pesticides and PCB analysis

Table 2-4A
Method CRQLs and O'Brien & Gere Lab IDLs and screening criteria for water samples

Revere Smelting and Refining Site
Wallkill, New York

Parameter	Water CRQL (µg/L)	Water IDL (µg/L)	NYSDEC Screening Criteria (µg/L)[1]		
			Ground Water	Surface Water	
			Drinking Water		Other
Aluminum	200	10.7	--	--	100 A(C) ionic
Antimony	60	1.9	3	3	
Arsenic	10	2.2	25	50	150 A(C), 340 A(A) dissolved
Barium	200	0.2	1000	1000	
Beryllium	5	0.1	3G	3G	
Cadmium	5	0.2	5	5	A(C), A(A)
Calcium	5000	4.4	--	--	
Chromium	10	1.0	50	50	A(C), A(A)
Cobalt	50	1.0	--	--	5 A(C) 110 GA(A)
Copper	25	0.5	200	200	A(C), A(A)
Iron	100	4.4	--	--	300 A(C) 300 A(A)
Lead	3	1.1	25	50	A(C), A(A)
Magnesium	5000	7.4	35000	35000	
Manganese	15	0.2	--	--	300 A(C), 300 A(A)
Mercury	0.2	0.17	0.7	0.7	7×10^{-4} H(FC), 0.77 A(C), 1.4 A(A) 0.0026 W dissolved
Nickel	40	3.1	100	100	A(C), A(A)
Potassium	5000	50.9	--	--	
Selenium	5	3.7	10	10	4.6 A(C) dissolved
Silver	10	0.8	50	50	0.1 ionic A(C), A(A)
Sodium	5000	2.8	--	20000	
Thallium	10	4.9	0.5G	0.5G	8 A(C), 20 A(A)
Vanadium	50	0.5	--	--	14 A(C), 190 A(A)

Table 2-4A
Method CRQLs and O'Brien & Gere Lab IDLs and screening criteria for water samples

Revere Smelting and Refining Site
Wallkill, New York

Parameter	Water CRQL (µg/L)	Water IDL (µg/L)	NYSDEC Screening Criteria (µg/L)[1]		
			Ground Water	Surface Water	
			Drinking Water		Other
Zinc	20	1.1	2000G	2000G	A(C), A(E), 5000E
Hexavalent chromium	10	1.7	50	--	11 A(C), 16A(A)
Total Cyanide	10	4.2	200	200	9000 H(FC), 5.2 A(C) and 22 A(A) as free CN
Amenable Cyanide	10	4.2	--	--	--
Hardness	20000	NA	--	--	--
Alkalinity	10,000	3629	--	--	--
TOC	1000	452	--	--	--
DOC	1000	452	--	--	--
TSS	10000	NA	--	--	
Chromium (hexavalent)	10	1.7	50	--	11 A(C) 16 A(A)

Table 2-4A

Method CRQLs and O'Brien & Gere Lab IDLs and screening criteria for water samples

Revere Smelting and Refining Site
Wallkill, New York

Parameter	Water CRQL (µg/L)	Water IDL (µg/L)	NYSDEC Screening Criteria (µg/L)[1]	
			Ground Water	Surface Water
			Drinking Water	Other

Notes:

Readily available NYSDEC screening criteria are presented in the table. Additional criteria that require derivation using site-specific data are not present. The screening criteria in this table are presented to assist in the evaluation of data quality objectives. Additional criteria may be applicable for assessment of site risks.

NYSDEC. Determination of Soil Cleanup Objectives and Cleanup Levels Proposed Values. Division Technical and Administrative Guidance Memorandum.

Soil Cleanup Objectives for protection of ground water; soil cleanup objectives assume an organic carbon content of 1% and should be adjusted for the actual soil organic content if it is known.

NYSDEC. 2000. Technical Guidance for Screening Contaminated Sediments. Division of Fish & Wildlife and Marine Resources.

Estimated Sediment Criteria Assumes a Total Organic Carbon (TOC) Composition of 3.5% (the mean concentration for sediment). Actual TOC concentration and therefore sediment screening values will vary.

Sediment screening values

H = human health bioaccumulation

A = benthic aquatic life acute toxicity

C = benthic aquatic life chromic toxicity

W = Wildlife bioaccumulation

A(A) = fish survival

A(C) = fish propagation

CRQL indicates contract required quantitation limit.

IDL indicates instrument detection limit.

µg/L indicates microgram per liter or parts per billion (ppb).

- indicates constituent-specific screening value is not available.

NA indicates O'Brien & Gere Labs detection limit not available.

Table 2-4B

Method CRQLs and O'Brien & Gere Labs IDLs and screening criteria for soil and sediment samples

Revere Smelting and Refining Site
Wallkill, New York

Parameter	Soil/Sediment CRQL (mg/kg) wet weight	Soil/Sediment IDL (mg/kg) wet weight	Screening Criteria (µg/g)[1]			
			Soil		Sediment	
			Soil Background	TAGM 4046	SEL	LEL
Aluminum	40	1.1	33000	SB	--	--
Antimony	12	0.2	N/A	SB	25.0 (L)	2.0 (L)
Arsenic	2	0.2	3 – 12 (NY)	7.5 or SB	33.0 (P)	6.0 (P)
Barium	40	0.02	15 – 600	300 or SB	--	--
Beryllium	1.0	0.01	0 – 1.75	0.16 or SB	--	--
Cadmium	1.0	0.02	0.1 – 1	1 or SB	9.0 (P)	0.6 (P)
Calcium	1000	0.4	130 – 35,000 (NY)	SB	--	--
Chromium	2	0.1	1.5 – 40 (NY)	10 or SB	110.0 (P)	26.0 (P)
Cobalt	10	0.1	2.5 – 60 (NY)	30 or SB	--	--
Copper	5	0.05	1 – 50	25 or SB	110.0 (P)	16.0 (P)
Iron	20	0.4	200 – 500,000	2000 or SB	4% (P)	2% (P)
Lead	0.6	0.1	200 – 500*	SB ****	110.0 (L)	31.0 (P)
Magnesium	1000	0.7	100 – 5,000	SB	1100 (L)	460 (P)
Manganese	35	0.02	50 – 5,000	SB	--	--
Mercury	0.02	0.08	0.001 – 0.2	0.1	1.3 (L)	0.15 (L)
Nickel	8	0.3	0.5 – 25	13 or SB	50 (L)	16 (P)
Potassium	1000	5.1	8,500 – 43,000 (NY)	SB	--	--
Selenium	1.0	0.4	0.1 – 3.9	2 or SB	--	--
Silver	2	0.08	N/A	SB	2.2 (L)	1.0 (L)
Sodium	1000	0.3	6,000 – 8,000	SB	--	---
Thallium	2	0.5	N/A	SB	--	--

Table 2-4B
Method CRQLs and O'Brien & Gere Labs IDLs and screening criteria for soil and sediment samples

Revere Smelting and Refining Site
Wallkill, New York

Parameter	Soil/Sediment CRQL (mg/kg) wet weight	Soil/Sediment IDL (mg/kg) wet weight	Screening Criteria (µg/g)[1]			
			Soil		Sediment	
			Soil Background	TAGM 4046	SEL	LEL
Vanadium	10	0.05	1 – 300	150 or SB	--	--
Zinc	4	0.1	9 – 50	20 or SB	270 (L)	120 (P/L)
Hexavalent chromium	1	0.26	--	--	--	--
Total Cyanide	2	0.4	N/A	***	--	0.1 (Eisler 1991)
Amenable cyanide	0.5	0.112	N/A	--	--	--
TOC	1000	NA	--	--	--	--

Table 2-4B

Method CRQLs and O'Brien & Gere Labs IDLs and screening criteria for soil and sediment samples

Revere Smelting and Refining Site
Wallkill, New York

Parameter	Soil/Sediment CRQL (mg/kg) wet weight	Soil/Sediment IDL (mg/kg) wet weight	Screening Criteria (µg/g)[1]			
			Soil		Sediment	
			Soil Background	TAGM 4046	SEL	LEL

Notes:

Readily available NYSDEC screening criteria are presented in the table. Additional criteria that require derivation using site-specific data are not present. The screening criteria in this table are presented to assist in the evaluation of data quality objectives. Additional criteria may be applicable for assessment of site risks.

NYSDEC. Determination of Soil Cleanup Objectives and Cleanup Levels Proposed Values. Division Technical and Administrative Guidance Memorandum. Soil Cleanup Objectives for protection of ground water; soil cleanup objectives assume an organic carbon content of 1% and should be adjusted for the actual soil organic content if it is known.

NYSDEC. 2000. Technical Guidance for Screening Contaminated Sediments. Division of Fish & Wildlife and Marine Resources.

Sediment screening values H = human health bioaccumulation; A = benthic aquatic life acute toxicity; C = benthic aquatic life chromic toxicity; W = Wildlife bioaccumulation

* indicates that sediment CRQLs were generated using water methods CRQLs and assuming for metals one gram of sample is digested and diluted up to 200 milliliters and for mercury 0.2 grams of sample is digested and diluted up to 100 milliliters.

Background soil concentrations for eastern USA, except as noted by "NY" indicating values for New York State

** Urban values background highly variable

*** Site-specific forms or cyanide should be considered to evaluate cleanup standard.

**** Recommended soil cleanup objectives are average background concentrations as reported in a 1984 survey of reference material by E. Carol McGovern, NYSDEC.

SB indicates soil background

LEL – Lowest effect level

SEL – Severe effect level

L – Long & Morgan (1990)

P – Persand et. al (1992)

CRQL indicates contract required quantitation limit.

IDL indicates instrument detection limit.

IDLs are based on IDL study performed by O'Brien & Gere Labs on 11/20/99.

mg/Kg indicates milligrams per kilogram or parts per million (ppm).

- indicates constituent-specific screening value is not available.

NA indicates that value was not available.

Table 2-5
Quality Control Requirements and Corrective Actions

Revere Smelting and Refining Site
Wallkill, New York

	Frequency	Control Limits	Corrective Action
Holding Times	Samples must be digested and analyzed within holding time.	Metals – Preserved at 4°C (± 2°C); HNO_3 to pH of less than 2 for aqueous samples. Analyze 6 months from verified time of sample receipt. Mercury - Preserved at 4°C (± 2°C); HNO_3 to pH of less than 2 for aqueous samples. Analyze 26 days from verified time of sample receipt. Cyanide – Preserved at 4°C (± 2°C); NaOH to pH greater than 12. Analyze 12 days from verified time of sample receipt. Hardness - HNO_3 to pH of less than 2. Analyze within 6 months. TSS - Analyze within 5 days. TOC -Analyze within 26 days for aqueous samples, 14 days for solid samples. DOC- Analyze within 28 days from collection. Alkalinity- Analyze within 14 days from collection.	If holding times are exceeded for initial or any reanalyses required due to QC excursions, **notify the QAO immediately since resampling may be required.**

Table 2-5
Quality Control Requirements and Corrective Actions

Revere Smelting and Refining Site
Wallkill, New York

	Frequency	Control Limits	Corrective Action
Calibration Verification (ICV, CCV)	Calibrate daily or once every 24 hours. For ICP, one standard and one blank. For mercury, minimally 4 standards and one blank. For cyanide, a blank and 3 standards. For Atomic Absorption (AA), one blank and three standards in the calibration range. One AA standard and one cyanide standard must be at the CRQL. After calibration, ICV is performed. The ICV is from a source independent of the calibration standards. For cyanide, the ICV must be distilled. A CCV is analyzed at the beginning of the run and every 2 hours. Also verify at the end of each run. TOC, a minimum of a five-point calibration bracketing the sample concentration range; verify calibration with an independently prepared check standard every 10 samples.	NYSDEC ASP requirements. For hardness and TOC, 80% to 120% of expected true value and correlation coefficient for first or second order curve must be greater than or equal to 0.995.	1. Stop analysis. 2. Identify and correct problem, recalibrate and reanalyze affected samples. 3. Document corrective action - **samples cannot be analyzed until calibration control limit criteria have been met.**
Calibration Blank	After ICV, CCV, at beginning and end of run and at a rate of 10% or every 2 hours during run.	NYSDEC ASP requirements.	1. If CCB or ICB exceeds the CRQL, stop analysis. 2. Identify and correct problem, recalibrate and reanalyze affected samples. 3. Document corrective action - **samples cannot be analyzed until blank control limit criteria have been met.**
Preparation Blank Analysis	1 per batch of samples digested.	NYSDEC ASP requirements.	1. Re-digest, reanalyze samples affected. 2. Document corrective action - **samples cannot be analyzed until blank criteria are met.**

Table 2-5
Quality Control Requirements and Corrective Actions

Revere Smelting and Refining Site
Wallkill, New York

	Frequency	Control Limits	Corrective Action
Field/ Equipment Blank Analysis	Every 20 samples, where applicable, or at frequency listed in the QAPP.	Criteria as listed in NYS DEC ASP method for blanks must be met.	1. Investigate problem and contact QAO. 2. Document in case narrative.
LCS Analysis	Every 20 samples or each digestion batch. Prepared independently from calibration standards.	Recovery within method or laboratory control limits.	1. Stop analysis. 2. Correct problem. 3. Re-digest and reanalyze samples since last satisfactory LCS. 4. Document corrective action.
ICP Serial Dilution Analysis	1. Every group of 20 samples of similar matrix. 2. Only required when analyte concentration is >50 times the IDL in the original sample.	NYSDEC ASP requirements.	1. Report result
ICP Interference Check Sample Analysis	Beginning and end of each analytical run or twice during every 8 hours, whichever is more frequent for ICP.	NYSDEC ASP requirements.	1. Stop analysis. 2. Correct problem and recalibrate. Reanalyze samples analyzed since last satisfactory ICS. 3. Document corrective action.
MS Analysis	1 per group of similar concentration and matrix.	Recovery within NYSDEC ASP limits.	1. For ICP, AA and cyanide, analyze post-digestion/post-distillation spike at two times the CRQL or two times the indigenous level, whichever is greater. 2. Document corrective action.
Laboratory Duplicate Analysis	1 per group of similar concentration and matrix.	NYSDEC ASP requirements	1. Investigate problem and reanalyze. 2. Report results. 3. Document corrective action.
Field Dup. Analysis	1 per matrix and analytical batch and every 20 samples of similar matrix	50% RPD for waters and 100% RPD for soil. Otherwise within ± two times the CRQL.	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case by case basis during the validation process.

Table 2-5
Quality Control Requirements and Corrective Actions

Revere Smelting and Refining Site
Wallkill, New York

	Frequency	Control Limits	Corrective Action
Furnace AA Analysis	Analysis must fall within the calibration range. Duplicate injections are required for all analysis but MSA. CCV and CCB are analyzed every 10 samples. Analytical spikes are analyzed at two times the CRQL.	Duplicate injection must be within 20% RSD or CV. Spike must be within 85-115%.	1. Reanalyze duplicate injection once. 2. For spike, see NYS DEC ASP correction actions.
IDL Determination	Within 30 days of the start of analysis and semiannually.	As per NYS DEC ASP Exhibit E procedures.	NA
Linear Range Analysis	Every 6 months.	Within 5% of the true value.	NA
Interelement Correction For ICP	Within 6 months of the start of analysis and annually. Correction factors for Al, Ca, Fe, and Mg must be reported and for others if they are applied.	As per NYS DEC ASP procedures.	NA
CRDL Standard for ICP (CRI), and AA (CRA)	For ICP, CRI is two times the CRQL at the beginning and end of each run for all elements but Al, Ba, Ca, Fe, Mg, Na, and K. For AA the CRA is the CRQL at the beginning of each run.	Not established in method.	Report results.
Sample Batching	The laboratory will batch project samples together along with QC samples specified from the project. Non-project information will not be included in the data packages.	Not applicable	Not applicable
Percent solids	For soil samples, the percent solids will be determined and sample results will be corrected for percent solids.	Not applicable	Not applicable

Table 2-5
Quality Control Requirements and Corrective Actions

Revere Smelting and Refining Site
Wallkill, New York

	Frequency	Control Limits	Corrective Action
Deliverables	1. NYSDEC ASP Superfund or Category B deliverables must be provided to document each audit item for easy reference and inspection. 2. An example calculation will be provided for each analysis, for each type of matrix in the data package using samples from the project. 3. Any laboratory abbreviations or notations presented in the raw data or summary information will be explained or referenced in the case narrative. 4. Final spiking concentrations will be presented in summary form. 5. Standard tracing information will be provided. 6. Cooler temperatures will be provided in the data packages. 7. Run logs will be provided in the data packages.	Not applicable	Provide missing or additional deliverables for validation purposes within 5 calendar days of the request.
Method and QAPP requirements	The laboratory will perform the method as presented in NYSDEC ASP and will adhere to the QAPP requirements presented herein. Otherwise the laboratory will specifically note any procedures that differ from the method or the QAPP in the data package case narrative.	Not applicable	Not applicable

Table 2-5
Quality Control Requirements and Corrective Actions

Revere Smelting and Refining Site
Wallkill, New York

	Frequency	Control Limits	Corrective Action
Note: 1- The laboratory will document and provide that documentation in the data package each time the laboratory contacts the QAO. 2 - NYSDEC ASP Methods 200.7M, 245-M, 335-M, 130.2, 160.1, 9010B/9014, 9060, Lloyd Kahn requirements, as listed in Exhibit D, and Exhibit E quality control requirements are used to perform the sample analysis. The corrective action presented in this table presents only selected method requirements along with additional requirements for this project.			

Figure 2-1

O'Brien & Gere Laboratories, Inc.

5000 Hiltonfield Parkway
East Syracuse, New York 13057
(315) 437-0200

Chain of Custody

Client:	Analysis/Method
Project:	
Sampled by:	
Client Contact: Phone #	

Sample Description

Sample Location	Date Collected	Time Collected	Sample Matrix	Comp. or Grab	No. of Containers								Comments

Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by:	Date:	Time:
Relinquished by:	Date:	Time:	Received by Lab:	Date:	Time.
Shipment Method:			Airbill Number:		

Turnaround Time Required:
Routine_____
Rush (Specify)_____

Comments:

Cooler Temperature:_____

Original-Laboratory Copy-Client

O'Brien & Gere Laboratories, Inc.
QA/QC Document

Quality Assurance Program

Analytical Services
Quality Assurance/Quality Control
Description of Policy and Programs

Effective January 1, 2000

O'BRIEN & GERE
LABORATORIES, INC.

O'Brien & Gere Laboratories, Inc.

Quality Assurance Program

Address:	5000 Brittonfield Parkway P.O. Box 4942 Syracuse, New York 13221
Telephone:	315-437-0200
Facsimile:	315-463-7554
Internet:	http://www.obg.com/labs
President:	David R. Hill
Vice President:	Michael N. Petterelli
Quality Assurance Coordinator:	Joseph C. Houser
Manual Version:	Revision #7
Effective Date:	January 1, 2000
Approved:	

David R. Hill
President

Michael N. Petterelli
Vice President

Joseph C. Houser
QA/QC Coordinator

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APPENDIX

1. Statement of Policy

O'Brien & Gere Laboratories, Inc. (Laboratories) is located in the corporate headquarters of O'Brien & Gere Limited in Syracuse, New York. The firm is engaged in the chemical, radiological and microbiological analysis of contaminants in a variety of matrices. The ability of the laboratory to accurately identify and quantify these contaminants is important. The decisions or conclusions based on these data are only as good as the documented quality of the data. The purpose of this Quality Assurance Program (QAP) is to describe the procedures used to verify the high quality of the data. This QAP is designed to satisfy the applicable requirements of several regulatory agencies. Additionally, this QAP is designed to meet both ANSI/ASQC E-4 and draft NELAC standards.

O'Brien & Gere Laboratories management is committed to fully supporting the policies and procedures described and required by this QAP. Management acknowledges and is committed to having a managerial staff with the authority and resources in order to facilitate the production of analytical data of documented quality. Management shall provide the facilities, training and time necessary for employees to complete necessary tasks. Employees are responsible for performing work for clients in the most efficient manner possible, avoiding waste of resources. It is also the responsibility of the employees to proactively communicate to the appropriate member of management when unsafe or poor quality work practices exist. Management is responsible for investigating each allegation. It is against O'Brien & Gere Laboratories policy to improperly manipulate or falsify data. Any employee who knowingly manipulates and/or falsifies data or documents is subject to immediate release from employment.

O'Brien & Gere Laboratories clients' are served with impartiality and integrity. O'Brien & Gere Laboratories also recognizes that all employees of O'Brien & Gere Laboratories may be exposed to privileged information and materials of clients. All O'Brien & Gere Laboratories employee's sign a pledge of confidentiality and are expected to uphold O'Brien & Gere's Ethics Policy Statement of June 21, 1998.

1.1 Mission Statement

O'Brien & Gere Laboratories' purpose is to contribute to environmental improvement by:

- Providing analytical data that is on time, clear, accurate and concise.
- Anticipating client needs through a workplace that promotes improvement.
- Making a commitment to personal and professional growth.

1.2 Quality Assurance/Quality Control Program Objectives

Quality control is the routine monitoring of processes performed in the laboratory. Quality assurance is the systematic evaluation and review of quality control data.

The goal of the laboratory Quality Assurance Program is to verify that data has been produced of adequate quality and to provide documentation to verify which results. The information which verifies adequate quality includes a measurement of consistency (precision) and measurement of uncertainty (accuracy) when compared to specific requirements. These

objectives are accomplished through the review of quality control samples such as duplicates, spikes, blanks, surrogates, tracers and laboratory control samples. The laboratory performs an initial demonstration of accuraey and precision for specific methods when required. Method Detection Limits (MDLs) are determined yearly for most analytes of interest. The goal of this program is to provide information which clients may use for data validation. An effort of the QA Program is to provide control charts and control limits for monitoring the laboratory's daily performance and to plot trends over a period of time. These charts provide an easily interpretable visual documentation showing that data collected, reported, or used by the laboratory are of known precision and accuracy.

The QA/QC activities performed at Laboratories are designed to be consistent with established federal and state protocols and guidelines as well as client-specified requirements.

1.3 Laboratory Policy on QA/QC

Laboratories fully supports the QA/QC program outlined in this QAP. This program has been implemented and is maintained to demonstrate that data reported by the laboratory are of known and documented quality. The technical and support personnel who contribute to any portion of the laboratory analyses follow the QA/QC procedures outlined in this manual.

The QA/QC manual is an integral part of routine laboratory practice. It is primarily intended to set control guidelines and direction for the chemical, physical, radiological and microbiological measurements performed by the laboratory for non-CLP analyses. When NYSDEC or U.S. EPA CLP protocol is required, QA/QC procedures and documentation are performed according to CLP guidelines. The contents of this manual will be reevaluated and revised annually. Additionally, requirements listed in a project specific Quality Assurance Project Plan may override this document.

2. Organizational Chart

Figure 2-1 is an organization chart of the laboratory staff.

O'Brien & Gere Laboratories
Organization Chart

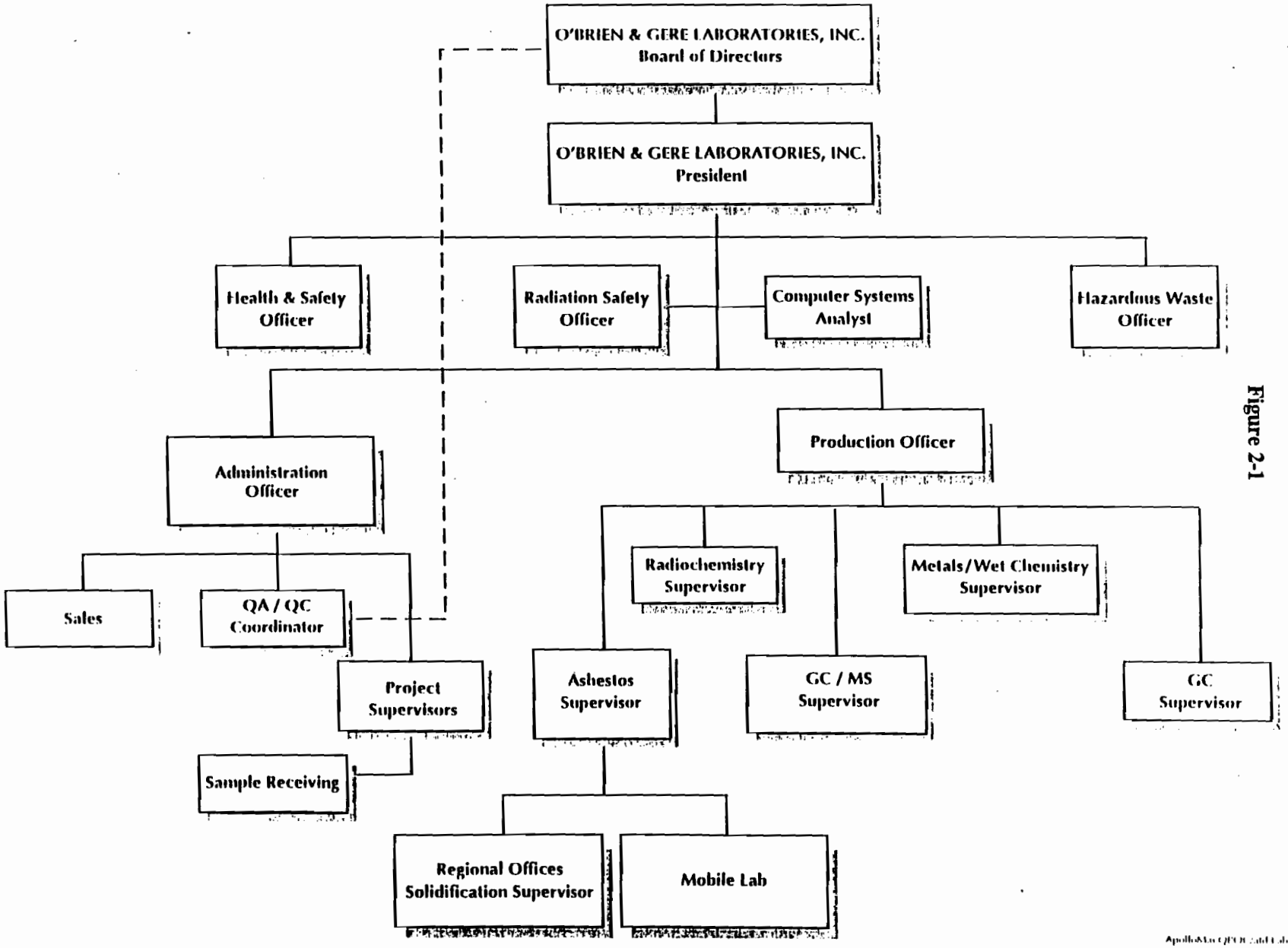


Figure 2-1

2.1 Organization and Responsibility

Any organization consists of a number of people whose skill and responsibilities determine the quality of the final product. The product of Laboratories is analytical services. The laboratory functions as a qualitative and quantitative laboratory only. Personnel have sufficient training in their appointed positions to contribute to the analysis and reporting of high quality data. The training is achieved through formal education, selected specialty courses, internal classes, or on-the-job training.

The laboratory functions in two distinct operations, production and administrative. Administrative includes sales, marketing, QA/QC and project management with all units reporting to the Administrative Officer. All production sections report to the Production Officer. Bimonthly meetings occur between QA/QC and the Administrative Officer. This meeting focuses on operational issues; federal, state and client requirements; internal and external audits; and data quality issues including trending. The minutes of this meeting are summarized in writing and serve as a "QA Report to Management." The QA Report to Management is distributed to all officers and supervisors.

All officers and the President meet on a monthly basis to discuss a variety of issues including QA/QC. Officers and supervisors meet weekly to discuss customer expectations, the progress of in-house programs, prospective opportunities, current and anticipated workload, resource allocation, safety, and QA/QC related issues. The QA/QC agenda item for this weekly meeting addresses proficiency evaluations, SOP and MDL requirements, internal and external audit responses, project specific QA/QC requirements, and general comments related to QA/QC. The agenda for the weekly meeting is distributed to all employees. This serves as an additional tool (and transfer of information) to communicate the issues itemized above to all employees. This agenda can be used to confirm the delivery schedule, data deliverables, QA levels, and project specific requirements that are incorporated onto an individuals' worklist. It is through these meeting and discussions that we resolve problems with candor and mutual confidence. This process also allows laboratory personnel to be free from undue pressures that could adversely affect the quality of their work.

Officers' responsibilities include the development and monitoring of the internal systems necessary to assure quality of the analytical data. Their duties include the planning necessary to support method development and for the acquisition of personnel and instrumentation.

Production Supervisors responsibilities include the monitoring of daily work loads and the redirection of laboratory resources to complete project deadlines. They help coordinate the distribution of the project information and manage the day-to-day scheduling and operation of their analytical areas. They report to the Production Officer. Their responsibilities include verification that analyses are conducted within method/contract holding times and implementation of corrective action procedures recommended by the QA/QC Coordinator. The Production Supervisors work daily with the QA/QC Coordinator to keep the quality control procedures accurate and up to date. Together the Production Supervisors and the QA/QC Coordinator work on revisions of procedures. In addition, Production Supervisors coordinate with the Project Supervisor to answer any questions related to the analytical requirements of the projects.

Project Supervisors are responsible for monitoring individual projects and communicating project specific QC. They handle client contact from proposal preparation through product delivery. Project Supervisors also work with the Production Supervisors to coordinate sample receipt schedules and required turn around times. Project Supervisors report to the Administrative Officer.

The QA/QC Coordinator is responsible for the implementation, monitoring, and supervision of the QA/QC program. The QA/QC Coordinator reports to the Administrative Officer. In the absence of the QA/QC Coordinator, the Administrative Officer will assume the QA/QC Coordinator's responsibilities. The QA/QC Coordinator verifies that the analyses are conducted in strict adherence to the procedures set forth in this manual. The QA/QC Coordinator's duties include:

- Developing and implementing new QA/QC programs, including statistical techniques and procedures
- Conducting regular audits and inspections of analytical procedures and applications
- Daily monitoring of analytical parameter accuracy and precision
- Discussing necessary corrective action procedures with laboratory manager and section supervisors
- Verification of corrective action implementation
- Generating control charts and setting control and warning limits
- Advising management of the status of the QA/QC program and giving recommendations for improvement
- Writing, submitting and updating Quality Assurance Plans

The QA/QC Coordinator has the authority to stop any laboratory process that does not meet the requirements of this Quality Assurance Program.

The sample custodians, who are part of the administrative staff, are responsible for initiating chain of custody procedure process. Upon receipt of samples, they verify that the samples have been properly preserved. After receipt, they are responsible for maintaining samples in a secure and restricted location.

Laboratories has both a Safety Officer and an Radiation Safety Officer (RSO) who are responsible for the distribution of the Laboratory Safety Manual and Radiation Safety Manual and the scheduling of safety training sessions for new employees. The Safety Officer and the Radiation Safety Officer report to the President. The Safety Officers, Administrative Officer, Production Officer, Production Supervisors and Project Supervisors meet periodically to review and update manuals as necessary. Both the Laboratory Safety Manual and the Radiation Safety Manual are available upon request.

In addition to key personnel, O'Brien & Gere Laboratories, Inc. has many chemists/support personnel that are directly responsible for the production of quality analytical results and deliverables. Chemists and support personnel perform analyses according to specified methods and SOPs. They are responsible for implementing the requirements of this QAP.

3. Personnel Training and Qualifications

Laboratories training program was developed to enable laboratory personnel to perform their assigned responsibilities in a manner that contributes to the analysis and reporting of high quality data.

3.1 Qualifications

Many positions in the lab require some level of experience or knowledge through the acquisition of either a high school or college degree. Depending on the position, a high school degree may be sufficient or someone with an advanced degree in chemistry or a scientific/engineering discipline (masters or doctorate) may be desired.

3.2 Training

Training is performed in accordance with SOP # AP800-05.

3.3 Documentation

The QA/QC section maintains a training file on every employee. This file will include copies of the employee's internal resume, transcript and diploma, any certificates from outside training classes, the SOP reading record (Figure 3-1), and the training and proficiency record (Figure 3-2). Both the supervisors and employees are responsible for keeping training records up to date. The file is accessible to employees for this purpose.

The file will be reviewed on a routine basis. QA/QC will review the file as part of the internal section audit process. Management may review the file as they deem necessary.

3.4 Retraining and Upgrades

Employees will undergo retraining annually or more frequently if it is determined to be necessary as evidenced by a failing result on a proficiency sample or repeated failures on a laboratory control sample. Retraining may consist of reviewing the processes and techniques with the analyst. The purpose of retraining is to determine that the analyst is following details of procedures and understands the procedure accurately.

Employees will also successfully analyze a blind sample (Laboratory Control Sample, Proficiency or QA/QC internal audit) on an annual basis. Documentation of this analysis will be placed in the Training and Proficiency Record (Figure 3-2). Another facet of retraining will consist of all employees reading appropriate, revised SOPs and updating their SOP Reading Record (Figure 3-1).

Management is committed to providing the resources (*i.e.* external training classes, software and reference materials) necessary for initial training and training upgrades that are required to maintain analyst proficiency.

Figure 3-1

SOP Reading Record

Name: _____

I have read and understand the following SOPs:

AP #	Rev. #	SOP Title	Employee Initials/Date	Supervisor Initials/Date

c:\wpwin\wpdocs\training\train.wpd

Figure 3-2

Training and Proficiency Record

Name: _____

Procedure (Method/AP #)	**QA/QC Check*/ Supervisor Comments**	**Employee** Initials/Date	**Supervisor** Initials/Date

* Attach results of QC Check. A QC Check can be an LCS, single blind or double blind proficiency.

c:\wpwin60\wpdocs\training\train.wpd

4. QA Limits for Precision and Accuracy

O'Brien & Gere Laboratories utilizes statistical, method, and client limits. If sufficient data does not exist for the determination of statistical limits, method based limits are used. The accuracy and precision limits listed in the tables are derived from in-house data. Sufficient points for some parameters may not be available at the time the limits are set due to the laboratory having analyzed only a reduced number of samples for a particular parameter. For these parameters, either the limits have been set based on previous lab experience or are derived from the applicable method. Limits that are not derived from laboratory data are flagged with an asterisk (*). As more points are added to the data base, the laboratory limits for these parameters will be established. The QA/QC Coordinator is responsible for updating the QA/QC limits in the laboratory's LIMS system. Limits are updated annually, at a minimum.

Laboratory control limits are included to give an indication of the laboratory capabilities. Method control limits, when required, will be used if they are more stringent than the laboratory limits. Limits included in the table may not be the most up-to-date limits since they are continually being updated. Laboratory SOP: AP # 800-10 "Generating Control Limits" explains the generation and updating of control limits. The most recent control limits are available from the QA/QC Coordinator.

Contract, method or QAPP specific control limits may take precedence over laboratory control limits. Production Supervisors and Project Supervisors are responsible for reviewing proposed Contract/QAPP control limits and determining if the laboratory is capable of achieving these limits. The Project Supervisors are responsible for notifying clients if the Contract/QAPP control limits are not achievable. The QA/QC Coordinator is responsible for the input and review of Contract/QAPP control limits into the LIMS system.

Practical quantitation limits (PQLs) and methods used in the laboratory are included in Appendix A. PQLs are the minimum quantities routinely reported by Laboratories. PQLs are listed for guidance only. The required limits vary depending upon the governing regulation and matrix. Lower detection limits may be achieved and are available upon request. Method Detection Limit (MDL) and Instrument Detection Limit (IDL) studies are available from the laboratory.

Completeness may be described as a measure of the actual amount of usable data obtained from an analytical procedure to the expected amount. The goal of Laboratories' QA/QC program is to maintain a 90% completeness rate as defined in QAPP preparation guidelines.

5. Sample Receipt and Chain of Custody

A critical concern in any project, especially those where large numbers of samples and analyses are required, is the timely maintenance of sample integrity. A sample is physical evidence of a situation at a specific place and time. Therefore, an essential part of sampling projects is proper collection and handling of the samples. Representative samples are collected through well-defined protocols. The client performs most of the sampling and thus assumes responsibility for properly obtaining, handling, and shipping the sample. Laboratories provides sampling kits to the client upon request. These sampling kits contain sufficient packing material, instructions, site ID labels, sample containers properly labeled with preservative (if required), and chain-of-custody forms. Laboratory Standard Operating Procedure (SOP), AP #800-15 "Sample Management System," describes sample receipt and sample management procedures.

5.1 Sample Containers

When the laboratory ships sample containers, the containers will already contain the proper preservatives, unless otherwise requested by the client. The containers are labeled with the type of preservative added. The client is responsible for verifying that the proper containers were received.

Each sample is collected in a new, pre-cleaned container to minimize contamination except for bacteriological samples. For these samples sterilized plastic bottles are used. I-Chem 300 pre-cleaned containers, or equivalent, are purchased on a project by project basis. When utilizing I-Chem 300 containers, the Certificate of Analysis Form for each lot of containers utilized is retained for future reference. Their use is documented in report case narratives and identified on the sample bottle request form (SOP: AP #800-15 "Sample Management System", Attachment #1).

5.2 Holding Times and Preservatives

Laboratories follows the holding time requirements outlined in the method/protocol being utilized, if applicable. Holding times vary depending upon matrix, protocol, and regulatory requirements. Expedient delivery and scheduling are paramount to obtain compliance with holding times. The LIMS assists in the monitoring of holding times by incorporating a due date on the schedule queue. The analysts, when reviewing their schedule, are aware not only of the workload, but also of holding time requirements.

If samples are received over their holding times, the client is notified so that resampling can be scheduled.

The lab will provide, at the client's request, the appropriate preservative in the sample containers. If preservatives are added to the sample container, it is noted on the sample bottle request form. When preservatives are added, ACS grade reagents are used. If the client requires additional preservatives, the amount requested (compliant with DOT regulations) will be put into a separate container at the same time the sample containers are prepared and shipped with the sample containers. A table of sample containers, preservatives and holding times are included in Appendix B.

Aqueous samples that required preservation at a specific pH, with the exception of volatile samples, are pH checked upon receipt in the laboratory to verify proper preservation. If samples are improperly preserved, the client will be notified and a corrective action determined and documented.

5.3 Shipment

Sample containers are shipped in coolers to the clients by common carrier or are picked up at the lab by the client. Glass bottles are wrapped in styrofoam or placed in bubble bags to prevent breakage. VOA vials are put into a vial holder to minimize breakage. Styrofoam sheets or similar packing material are used for glass jars. When the samples are returned to the lab, they are expected to be repacked into the coolers in the same manner in which they were shipped and crushed ice is added to maintain the temperature at 4°C.

Laboratories adheres to regulations governing the shipment of hazardous materials.

5.4 Chain of Custody Procedures

The laboratory follows a strict chain of custody procedure. This procedure creates an accurate and legally defensible document that can be used to trace possession of a sample from its collection through analysis and final disposal. The chain of custody form is signed by handlers of the sample. An example of a chain of custody is included as Figure 5-1. Chain of custody procedures are outlined in laboratory SOP: AP #800-15 "Sample Management System".

A sample is considered in custody if it is:

- In actual physical possession
- In view after being in physical possession
- In a locked repository
- In a secure, restricted area

During non-business hours, the storage cooler is locked, and the lab is monitored by professional security. The delivery and receipt of samples during non-business hours is addressed in laboratory SOP: AP #800-15 "Sample Management System".

Formal custody begins with the shipment of pre-cleaned properly preserved containers. The client contacts a Project Supervisor for sample bottles, and the Project Supervisor submits to the sample custodian a form requesting the proper containers. After the request is completed and signed, the form is filed in a binder and kept in the sample tagging room for future reference.

Chain of custody forms are shipped with sample bottles. The field sampler/client is responsible for filling in the sample location, date and time sampled, sample matrix, and analysis required on the chain of custody. The field sampler signs the chain of custody when relinquishing custody and includes the form with the sample containers. Any comments that the sampler has are also listed on the chain of custody form. The field sampler is also responsible for filling in the sample labels that are provided with every shipment.

If required by the project, evidence tape can be applied to each sample container in the field. At a minimum, the cooler should be sealed with evidence tape or custody seal prior to shipping to the lab.

For CLP analyses, sample custody and handling are performed as required by NYSDEC and U.S. EPA CLP protocol.

5.5 Control of Incoming Samples

Laboratories employs a sample custodian who is responsible for verifying the receipt of samples. Sample acceptance criteria are outlined in laboratory SOP: AP #800-15 "Sample Management System". When samples are received, the sample custodian follows the general steps outlined below.

1. Coolers are checked to verify that the samples listed on the chain of custody were received. A notation is made of any missing or mislabeled samples

2. Samples are checked and a notation is made of any samples that were received broken or damaged.

3. The Chain of Custody is signed and dated to verify time of sample receipt.

4. The sample custodian records the temperature of the cooler when received and verifies proper preservation. The preservation is verified by checking and recording the pH of each aqueous sample that required preservation at a certain pH. Samples for volatile analyses are not pH checked upon receipt, but are checked at the time of analysis.

5. Suspect coolers are checked for low level radiation with a Geiger counter. The procedure for screening, identifying, handling and documenting radioactive materials is found in sections 6.0 and 7.0 of the Radiation Safety Manual and laboratory SOP: AP#800-32 "Categorizing, Handling and Waste Handling Radioactive Materials".

6. Each sample is assigned a unique laboratory identification number to make tracking of samples easier. Each project is also assigned a unique project number that contains the client ID and job number.

7. Samples are logged into the LIMS, and the analyses are scheduled.

The observations by the sample custodians and any comments related to cooler/sample condition are noted on the chain-of-custody form or on the case file form. An example of the case file form is included as Figure 5-2. Samples are not routinely rejected by the laboratory. When problems arise, the client is notified of the deficiency, and a decision is made to continue or resample by the client. The case file form will document any decision to proceed with the analysis of samples not meeting acceptance criteria. The decision is also noted on the final report.

The sample custodian inputs each sample into the LIMS, which assigns a unique, sequential number to the sample. Laboratory sample labels are printed and affixed to the sample containers. The package/sample schedule, which is generated by the LIMS (SOP: AP #800-15 "Sample Management System", Attachment #11), is printed and filed in a three-ring

binder. This form functions as a sample receipt log book. Package/sample schedules are subsequently bound the following month.

Samples are stored in a locked, secured walk-in cooler. Samples for volatile analyses are stored separately from other samples to prevent cross contamination. When samples are removed from the cooler, the analyst signs the sample control record (SOP: AP #800-15 "Sample Management System", Attachment #10). This documents the sample location and who handled the sample throughout the analytical process.

The chain-of-custody form, bill of lading, case file form, sample control record, and original package/sample schedule are kept on file outside the walk-in cooler.

5.6 Scheduling

The purpose of scheduling is to notify appropriate personnel of the arrival of a sample; the tests to be performed; QC levels; deliverables; and expected delivery dates.

Analyses are scheduled on the LIMS by the sample custodians. A work schedule is printed every morning listing sample numbers, tests required, due dates, days left until the holding time expires, and location of a sample in storage. The analysts use the work schedule to identify what samples they are required to analyze and if there are any project specific requirements for the samples. The section supervisors review the work schedule with the analysts to confirm these priorities and holding times are being met and monitor that all questions have been answered.

5.7 Sample Tracking

Our tracking system relies on project numbers and sample numbers. Samples (including individual containers) are primarily tracked using the laboratory sample numbers. Project status is tracked using project numbers and sample numbers. The status of samples and projects can be obtained by utilizing the LIMS system. Laboratory SOP: AP #800-16 "Sample Tracking System" outlines the sample tracking system.

5.8 Storage and Disposal

All non-volatile water and solid samples are stored in a locked, walk-in cooler away from potentially contaminating sources (standards, reagents and food). A separate refrigerator is used for samples requiring volatile analysis. Air and biological samples are stored in a freezer. The temperatures of these systems are monitored twice each day. When required, samples are signed in and out of the cooler on the sample control record by the analyst performing the analysis. Sample extracts or digestates may be stored in refrigerators in the appropriate lab section. All storage systems are locked at the close of business hours.

Once analysis is completed and the results reported to the client, the samples are stored for one additional month. After one month of storage, the sample is removed from the cooler for return to the client or ultimate disposal. The samples may be stored longer if required by a client agreement or QAPP. Sample storage and disposal is addressed in laboratory SOP: AP #800-15 "Sample Management System".

5.9 Sample Transfer

If analysis of the samples is not possible at Laboratories, then the samples will be subcontracted to another approved laboratory (See Item 8, Procurement of Items and Services). The samples will be packed in coolers at 4°C and shipped by common carrier or delivered by Laboratory personnel. A subcontract letter and a chain of custody listing Laboratories sample number, sample preparation date and tests required will accompany the samples.

Figure 5-1

Chain of Custody

O'Brien & Gere Laboratories, Inc.

5000 Brittonfield Parkway
East Syracuse, New York 13057
(315) 437-0200

Chain of Custody

Client

Project

Sampled by

Client Contact

Phone #

Analysis/Method

Sample Description

Sample Location	Date Collected	Time Collected	Sample Matrix	Comp or Grab	No. of Containers	Comments

Relinquished by Date Time: Received by: Date Time

Relinquished by Date Time: Received by Date: Time

Relinquished by Date Time: Received by Lab Date Time

Shipment Method Airbill Number

Turnaround Time Required:
Routine
Rush (Specify)

Comments:

Cooler Temperature

Original Laboratory Copy Client
GOBROMISTNOC FORM

Figure 5-2

Case File Form

O'BRIEN AND GERE LABORATORIES, INC.
CASE FILE FORM

PROGRAM INFORMATION

Client: _____ Div. _____ Ref. No. _____

Program: _____

Custody Seal: _____ Intact _____ Not Intact _____ NA

AFTER HOURS CUSTODY

RELINQUISHED BY:	DATE	TIME	RECEIVED BY SECURITY GUARD:	DATE	TIME
RELINQUISHED BY SECURITY GUARD TO COOLER:	DATE	TIME	RECEIVED BY SAMPLE CUSTODIAN:	DATE	TIME

COMMENTS/DISCREPANCY:

RESOLUTION/CLIENT COMMENT:

Signed: _____

Date: _____ QA/QC Approval: _____

Signed: _____

Date: _____

c:\wpwin60\wpdocs\corract\casefile.frm

COMMENTS/DISCREPANCY: (continued)

PROPOSED RESOLUTION: (continued)

CLIENT COMMENTS: (continued)

Signed: _____ Project Manager Approval: _____

Date: _____ QA/QC Approval: _____

c:\wpwin60\wpdocs\corract\casefile.frm

6. Analytical Procedures

6.1 Analytical Methods

A list of analytical methods used in the laboratory is included in Appendix A. Method numbers are cited from the following manuals:

- U.S. EPA, *Methods for Chemical Analysis of Water and Wastewater*, Revised March 1983, EPA 600/4-79-020, including all promulgated updates.
- U.S. EPA, *Test Methods for Evaluating Solid Waste, 3rd Ed.*, EPA SW-846, December 1996, including all promulgated updates.
- APHA, AWWA, WPCF. *Standard Methods for the Examination of Water and Wastewater, 18th Ed.*, 1992.
- U.S. EPA, *Methods for the Determination of Organic Compounds in Drinking Water*, December 1988, EPA 600/4-88/039, including all promulgated updates.
- U.S. EPA, Federal Register, 40CFR, Part 136, October 1984.
- U.S. EPA, Federal Register, 40CFR, Part 136, (1-1-87 edition).
- U.S. EPA, Federal Register, Appendix A, 29 CFR 1926.58.
- New York State Department of Health, *Environmental Laboratory Approval Program - Certification Manual*.
- NIOSH - NIOSH Manual of Analytical Methods, Fourth Edition.
- U.S. EPA, *Interim Method for the Determination of Asbestos in Bulk Insulation Samples*, 40CFR, Part 763, Subpart F, Appendix A.
- U.S. EPA, *Method for the Determination of Asbestos in Bulk Building Materials*, 1993, EPA/600/R-93/116.
- U.S. EPA, *Interim Transmission Electron Microscopy Analytical Methods - Mandatory and Non-mandatory to Determine Completion of Response Actions*, 40CFR, Part 763, Subpart E, Appendix A.
- U.S. EPA, Environmental Monitoring and Support Laboratory: Cincinnati, OH, *Prescribed Procedures for the Measurement of Radioactivity in Drinking Water*, August 1980, EPA 600/4-80-032.
- U.S. EPA, Environmental Monitoring and Support Laboratory: Las Vegas, NV, *Radiochemical Analytical Procedures for Analysis of Environmental Samples*, March 1979, EMSL-LV-0539-17.
- U.S. EPA, Eastern Environmental Radiation Facility: Montgomery AL, *Radiochemistry Procedures Manual*, August 1984, EPA 520/5-84-006.
- U.S. DOE, Las Alamos National Laboratory: Las Alamos, NM, *Health and Environmental Chemistry: Analytical Techniques, Data Management, and Quality Assurance*, updated yearly, LA-10300-M (Volumes 1 - 4).

The laboratory also analyzes samples that require various CLP protocols including:

- United States Environmental Protection Agency Contract Laboratory Program, Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration, Document Number OLM03.2.
- United States Environmental Protection Agency Contract Laboratory Program, Statement of Work for Inorganic Analysis, Multi-Media, Multi-Concentration, Document Number ILM04.0.

- New York State Department of Environmental Conservation Analytical Services Protocol, Contract Laboratory Protocol, October 1995 update.

The laboratory maintains current Standard Operating Procedures for procedures performed within the laboratory. A list of laboratory SOPs is included in Appendix C.

6.2 Waste Disposal

Laboratory workers are trained to be cautious when handling samples, spent chemicals, toxic, or dangerous materials. Laboratories has a Hazardous Waste Officer who is responsible for coordinating and overseeing the disposal of waste and the cleanup of any accidental spills. The laboratory has a hazardous waste room where waste is stored in DOT-approved drums until disposal. Hazardous wastes are currently separated into five waste streams: chlorinated solvents, non-chlorinated solvents, PCB (liquid), PCB (solid) and mineral acid. Solvent waste is collected in chemically resistant plastic coated bottles and stored in a well ventilated area until they are transferred to the appropriate labeled drum. Mineral acid wastes are collected in a polyethylene DOT-approved drum. Laboratory hazardous wastes are manifested and disposed off-site at NYSDEC- and U.S. EPA-approved disposal facilities. Sample extracts and sample digestates are handled in the same manner as solvent and acid wastes.

The method of sample disposal depends on the analytical data generated. The results are compared to RCRA criteria and local disposal ordinances, and a decision is made in coordination with the hazardous waste officer as to the means of disposal. If the sample is classified as hazardous, it is placed in the appropriate drum in the hazardous waste room. Upon filling the drum, the hazardous waste officer manifests the drum, arranges for disposal and files the disposal logs. The Radiation Safety Manual and Laboratory Standard Operating Procedure (SOP): AP #800-31 "Laboratory Hazardous Waste Management System" detail hazardous waste management and disposal procedures.

6.3 Cleaning of Glassware

The method of glassware cleaning is adopted to both the substances that are to be removed and the determinations to be performed. Class A volumetric glassware is not baked.

6.3.1 Organic Glassware

6.3.1.1 Volatile Analysis

Glassware used for volatile analysis is cleaned in a soapy Alconox solution and then rinsed four times with carbon column water. The glassware is then rinsed with methanol and baked at 180°C overnight. Clean glassware for volatile analysis is stored in drawers in the volatile organic lab. Laboratory SOP: AP# 100-18 "Trace Organics Glassware Cleaning"details cleaning procedures.

6.3.1.2 Semivolatile Analysis

Dirty glassware is pre-rinsed in solvent and then washed with an Alconox solution and rinsed with deionized water. Allow the glassware to air dry. After the glassware is dry it is placed in a muffle furnace and is heated to

550°C. This ashing should vaporize any organics on the glassware. Clean glassware is stored in the appropriate drawers. Before use, the glassware will be solvent rinsed. Laboratory SOP: AP# 100-18 "Trace Organics Glassware Cleaning"details cleaning procedures.

6.3.2 Metals and Radiochemistry Glassware

Metals glassware is soaked in and scrubbed with an Alconox solution, followed by a deionized water rinse. The glassware is then soaked in 1:1 HNO_3 at a minimum of 2 hours and a final rinse is done with deionized water. Glassware is stored inverted in the metals digestion lab in the appropriate drawer. Pipets and volumetric flasks are stored in the metals lab. Laboratory SOP: AP# 400-41 "Trace Metals Glassware Cleaning" details cleaning procedures.

6.3.3 Inorganic Glassware

The glassware is cleaned in an Alconox solution. It is then rinsed with tap water followed by deionized water and allowed to dry. Glassware is stored inverted in drawers or a cabinet in the wet chemistry lab.

Glassware for phosphorus analysis is washed separately from other inorganic glassware. It is rinsed in an HCl solution and then rinsed with distilled water and allowed to dry. It is stored inverted in the appropriate drawer in the wet chemistry lab.

6.3.4 Asbestos Glassware

NOB Bulk Asbestos crucibles are cleaned in an Alconox solution. They are then rinsed with asbestos free deionized water and allowed to dry. Crucibles are stored in the appropriate drawer in the asbestos lab.

6.4 Quality of Lab Water

The Inorganic and Radiochemistry Sections of the laboratory use Reagent Grade (laboratory pure), deionized water. The conductivity of the deionized water is less than 1.5 micromho/cm and is used in the final rinses of glassware and to prepare reagents. The pH and conductivity of the deionized water for the wet chemistry and microbiology sections are recorded into a logbook on a daily basis. A chlorine residual test and standard plate count are performed monthly. Suitability and heavy metals analysis are done yearly and documented in the Microbiology Reagents & Quality Control laboratory notebook.

A resistance reading is taken daily from the DI water system meter of reagent grade water used in the trace metals section. The pH and conductivity is tested weekly. These readings are documented in the Trace Metals logbook.

The Organic Sections of the laboratory use organic-free water in the preparation of samples for organic analysis. Deionized water is passed through a carbon filter system and then a carbon column to remove organic compounds. The water is monitored daily for contamination from any organic compounds through the analysis of blanks.

6.5 Reagents/Solvents and Standards

ACS reagent grade chemicals and solvents shall be used unless otherwise specified by approved procedure. Reagents, solvents, and solutions not stored in commercial containers must be adequately labeled. At minimum, the label shall contain the following information: identification of contents, concentration or purity, date received, dated prepared or opened and expiration dates (if applicable), notification of special precautions or requirements, and the initials of the responsible person. If it is impractical to record the required information on the label, the label shall have a unique identifier and reference to a reagent logbook which shall contain the necessary information.

Standards are either purchased commercially or prepared from certified stock materials. Pedigrees are maintained on all purchased or prepared standards linking the working standard to a National Institute of Standards and Technology (NIST) certificate or reference. Commercially prepared standards or neat stock will have a standardized label with the following information: date received, date opened and expiration date. Labels for laboratory prepared standards will contain the following information: method reference/title, expiration date, date of preparation, preparer's initials and lot number. Standard label information, lot numbers and concentrations are logged into a standards logbook that is maintained by each section.

Stock standard solutions, intermediate standards and working standards are stored at 4 °C and protected from light, if required.

All reagents, solvents, and standards shall be documented, labeled and handled according to the specifications of one of the following applicable procedures.

> SOP AP# 100-02, *Standards: Preparation, Storage, and Disposal*
> SOP AP# 600-02, *The Acquisition, Preparation, and Use of Standard Reference Materials in the Radiochemistry Laboratory*

Hazardous reagents and solvents shall be handled in accordance with the Laboratories' Safety Manual. Hazardous materials are stored in locations which afford ventilation, fire barriers, and segregation from incompatible materials, as required. The handling of radioactive standards and samples is covered by procedures in the Radiation Safety Manual.

7. Calibration Procedures and Frequency

7.1 Instrumentation

The laboratory is 14500 sq. ft. in size with 9600 sq. ft. dedicated to the preparation and analysis of samples and 1200 sq. ft. dedicated to the receiving and storage of samples. Laboratories maintains state-of-the-art instrumentation. The following equipment is currently

in use:

- Two Hewlett Packard 5890/5972 GC/MS systems for semivolatile analysis, and one Hewlett Packard 5890/5970A GC/MS system for semivolatile sample screening. The GC/MS's are connected to a PC with ChemStation software.
- One Hewlett Packard 5890/5970 GC/MS system with Tekmar ALS 2016 and LCS 3000 concentrator and one Hewlett Packard 6890/5973 GC/MS system with Tekmar Precept closed-loop autosampler and LCS 3000 concentrator for volatile analysis. The GC/MS's are connected to a PC with ChemStation software.
- One Tracor 540 GCs with PID and HECD detectors and one Tracor 9001 GC with PID and HECD detectors for volatile analysis. The GCs are connected to PCs with Perkin Elmer TurboChrom software.
- Three Hewlett Packard HP5890 Series II GCs, one Hewlett Packard HP5880A GC and one Hewlett Packard HP5890A GC and six Hewlett Packard ECD detectors and two Hewlett Packard FID detectors for semivolatile analysis. The GCs are connected to PCs with Perkin Elmer TurboChrom software.
- One Thermo-Jarrell Ash ICAP-61E-S Trace Vacuum Spectrometer, 32 channel 0.75 meter direct reading simultaneous spectrometer for metals analysis.
- One Perkin-Elmer 5100-PC Graphite Furnace Atomic Absorption Spectrometer, Zeeman system with an optical interface for metals analysis.
- One Perkin-Elmer Model 3100 Atomic Absorption Spectrometer, used predominantly for mercury analysis by cold vapor atomic absorption techniques. Can also be used for flame atomic absorption.
- One Lachat QuikChem AE multi-channel analyzer for automated determination of nutrients and other inorganic parameters.
- One Rosemont Analytical Dohrmann DC-190 for TOC analysis.
- One ABC model 1002B GPC with UV detector.
- Hewlett Packard model 7680T supercritical fluid extractor (SFE) with controlling software, utilized for solid organic sample preparation.
- Forty continuous one-step liquid-liquid extractors.
- Model 200 Wilt Electric Glass Annealing Oven, ID: 60" X 18" X 21" temperature range 0 to 800 °C, utilized to remove trace organics from sample preparation glassware.
- One 12-vessel rotary agitation apparatus from Associated Design and Manufacturing Company, Model 3740-12, capable of rotating in an end-over-end fashion at 30 $\pm$ 2 rpm used for volatile TCLP extractions. Zero-headspace extraction vessels of stainless steel from Associated Design and Manufacturing Company, model #3745-ZHE.

- One 24-vessel rotary agitation apparatus from Associated Design and Manufacturing Company, Model 3740-24-BRE-TM, capable of rotating in an end-over-end fashion at 30 ± 2 rpm used for non-volatile TCLP extractions. Extraction vessels of borosilicate glass, 2.2 liters from Associated Design and Manufacturing Company, Model #3740-PWGB or Nalgen, fluorinated, 2 liter bottle, model BTl LRG W/M HDPE 2120-0005 (used for metals analysis only).
- One HACH 2100A turbidimeter.
- One YSI Model 32 conductivity meter.
- One YSI 51B dissolved oxygen meter.
- One Orion SA-720 and one Orion SA-710A pH meters with Corning electrodes (Corning reference electrode 476350 for fluoride analysis).
- One B&L Spectonic 21 UV-VIS spectrometer.
- One Buck Scientific fixed wavelength (3.42 μm) total hydrogen analyzer Model #404, IR spectrometer.
- One HACH DR100 colorimeter, model #41100-02 for residual chlorine analysis.
- One Lab-Crest midi distillation system, Andrews Glass Company, model 11010R.
- One Pensky-Martens closed-cup tester for flashpoint determinations.
- One Mettler AE163 and one Mettler AE200 analytical balances.
- One Philips CM-12 transmission electron microscope equipped with an EDAX PV9800 x-ray detector.
- Two Olympus BH-2 polarized light microscopes.
- One Nikon Labophot-Pol polarized light microscope.
- Four Olympus CH-2 phase contrast microscopes.
- One Denton Vacuum DV-502A Carbon Coater.
- One BioRad PT7150 RF Plasma Barrel Etcher.
- One Mettler AE100 analytical balance.
- One Retsch ZM-1 centrifical grinder.
- One Denver Instruments TR-403 top-loading balance.
- One Canberra 2401 Gas Flow Proportional Counter and detector.
- One Protean MDS Multi-Position Gas Flow Proportional Counter with four detectors.
- Four Ludlum Model 182 Lucas Cell Counters.
- One Canberra Genie Workstation with all operations and QC software required for alpha and gamma spectrometry.
- Two HPGe (p-type) Canberra gamma spectrometry detectors.
- One HPGEe (n-type) EG&G gamma spectrometry detector.
- Forty-eight Canberra 7404 alpha spectrometers and PIPS detectors.
- One Waters HPLC with UV and scanning fluorescence detectors.

7.2 Calibration

Accurately calibrated instruments are a prerequisite to perform accurate analyses. A brief explanation of the calibration procedures for the instruments used at Laboratories are summarized in Table 7-1. Detailed calibration procedures are described in the laboratory Standard Operating Procedures.

7.2.1 Wet Chemistry

There are many different types of analyses handled by the wet chemistry section. The wet chemistry section performs potentiometric, colorimetric, and titrametric analysis. The QC requirements vary from test to test. For colorimetric analyses, there is a standard curve consisting of 5 to 7 points, depending on the test. The correlation coefficient (r) of the standard curve must be greater than or equal to 0.997. A reference sample and a blank are analyzed at the beginning of each run to verify that the method is in control. In addition, continuing calibration standards are run at a 10% frequency to monitor that calibration is maintained throughout the analytical sequence. The continuing calibration check is generally analyzed at a level at the mid point of the detection limit.

Titrating solutions are standardized once per month or whenever the titrant is prepared. The procedures outlined in *Standard Methods, 18th Edition* are followed. The standardization is written up by the analysts in laboratory logbooks, and is checked by the group's section supervisor. A reference standard is analyzed each analysis day to verify the concentration of the standard titrant.

7.2.2 Thermometers

Thermometers used in the lab are calibrated against an NIST-certified thermometer on site once a year. They are checked at the freezing point(if applicable), boiling point(if applicable), and point of use (the temperature at which they are used). Correction factors for each thermometer are calculated and the thermometers are tagged listing the thermometer number and the correction factors. Correction factors, date calibrated, calibration temperature, temperature recordings, and initials of person performing the calibration are documented in notebook maintained by the QA/QC Coordinator.

7.2.3 Balances

Analytical balances are professionally calibrated and cleaned once a year. When the balances are professionally calibrated, a document stating the specific balance model and serial number and the date calibrated is provided by the company doing the calibration. The balances are checked daily or as used with Class S weights. The analyst's initials, date, calibration check results, room temperature, and the weights at which the balance was checked are recorded in the daily readings laboratory notebook. The acceptance range for the weights are listed on the logbook pages. If the weight is out of the control limits, the balance will be recalibrated.

7.2.4 pH Meter

A two-point calibration bracketing the pH of the samples analyzed is done daily on pH meters. The calibration is then verified with a third pH buffer. The calibration date, analyst's initials, calibration data, room temperature and pH of verification buffer are recorded in a laboratory notebook.

Table 7-1 ***Instrument Calibration***

Instrument	Measurement or Check	Frequency
GC/MS	PFTBA Autotune	If Tune Check fails
	DFTPP or BFB Tune Check	Every 12 hours
	Initial Calibration	As per method
	Continuing Calibration	Every 12 hours and after Tune Check
GC Volatiles	Initial calibration	New column, instrument conditions change and/or instrument acceptance criteria are not met
	Continuing Calibration	The start of an analytical sequence (if initial calibration is not performed), 10% of an analytical run and at the end of an analytical sequence
	Retention Time Windows	Set at the first Calibration Check Standard of the day
GC Semivolatiles	Initial Calibration	New column, instrument conditions change and/or instrument acceptance criteria are not met
	Continuing Calibration	The start of an analytical sequence (if initial calibration is not performed), 10% of an analytical run and at the end of an analytical sequence
	Retention Time Windows	Set at the first Calibration Check Standard of the day
	Endrin and 4,4'-DDT (Pesticide)	Daily (during analysis)
ICP	Initial Calibration (2 point)	Daily and/or instrument acceptance criteria are not met
	Initial Calibration Verification	After each initial calibration

Table 7-1 ***Instrument Calibration***

Instrument	Measurement or Check	Frequency
	Continuing Calibration	10%
	Interference Check Sample	At the start and end of each analytical sequence
GFAA	Initial Calibration (4 point)	Daily and/or instrument acceptance criteria are not met
	Initial Calibration Verification	After each initial calibration
	Continuing Calibration	10%
Cold Vapor AA	Initial Calibration (6 point)	Daily and/or instrument acceptance criteria are not met
	Initial Calibration Verification	After each initial calibration
	Continuing Calibration	10%
TEM	X-ray Detector Check (Amosite standard analysis)	Daily
	Camera Constant/Magnification	Monthly
	Spot size	Quarterly
	Beam current	Quarterly
	X-ray Detector Check for: Sodium Peak in Crocidolite Magnesium and Silicon Peaks in Chrysotile	 Quarterly Quarterly
	X-ray k-factors and Manganese Resolution	Semi-annual
PCM	Resolution	Daily
	Graticle Diameter	Daily
	Centering of Phase Rings	Daily
PLM	Iris and Condenser diaphragms: focused & centered	Daily
	Polarizer and Crosshairs Alignment Check	Daily
	Objectives centered	Daily
	Refractive index oils calibrated using refractometer	Monthly
Gamma Spectroscopy	Efficiency Calibration for all Geometries (Efficiency Check/Verification)	Annually (Weekly or Prior to use)

Table 7-1 *Instrument Calibration*

Instrument	Measurement or Check	Frequency
	Energy Calibration (Energy Check/Verification)	Monthly or Prior to use (Daily or Prior to use)
	Resolution Check [3keV(FWHM) Max.@ 1.4 MeV	Daily or Prior to use
	Background Measurement(500 min. minimum) Background Check/Verification	Monthly Weekly or Prior to use
Alpha Spectroscopy	Efficiency Calibration (Efficiency Check/Verification)	Annually (Monthly or Prior to use)
	Energy Calibration (Energy Check/Verification)	Quarterly or Prior to use (Weekly or Prior to use)
	Resolution Check [100 keV(FWHM) Max.]	Weekly or Prior to use
	Background Measurement	Weekly or Prior to use
Alpha/Beta Proportional Counters	Efficiencies for Specific Radionuclides	Annually
	Efficiency Check	Daily or Prior to use
	Self-absorption Curves	Annually
	Plateau (Plateau Check [$\pm \geq$50V from operating voltage])	Annually (Every Gas Change)
	Background Measurement(150 min. minimum)	Weekly or Prior to use
Liquid Scintillation	Efficiencies for Specific Radionuclides (Efficiency Check/Verification)	Annually (Daily or Prior to use)
	Quench Curves	Annually
	Interference Corrections	Annually
	Background Measurement	Daily or Prior to use
Laser Phosphorimetry	Calibration Curve over Sample Concentration Range	Semi-Annually
	Verification of Calibration (three points, one each, at extremes and center of concentration range)	Weekly or Prior to use
	Calibration Check	Each Batch

8. Procurement of Items and Services

Various customer needs and expectations dictate the probability that no one vendor is able to totally service all customers. Our laboratory must procure additional services and material from outside contractors and vendors. Laboratories is responsible for maintaining the same level of quality throughout this process. To assure this quality, the QA Coordinator and Management are responsible for reviewing a potential contractor's:

- QA/QC Manual and procedures
- Certifications
- Deliverables (report format)
- Audits (External and Internal)

Records and documentation of these items will be retained at Laboratories. In addition any on-site inspections of a contractor's facility by Laboratories will also be kept on file.

Project Supervisors identify the need to subcontract services and are responsible for notifying clients of the intent to subcontract in the form of a written and/or faxed letter. The decision to subcontract services is reviewed on a case by case basis with the Administrative Officer. The terms and conditions of the request for services letter and subcontract agreements may also be reviewed by O'Brien & Gere Limited's Office of General Counsel, the Administrative Officer and/or the President.

Project Supervisors must notify the prospective subcontractor of their responsibilities by documenting the requirements in the form of a letter. Project Supervisors are responsible for coordinating the shipment of samples to the subcontractor and the return of documented results. When subcontractor data packages are received, they are reviewed by the Project Supervisor to confirm all appropriate requirements were met prior to submission to the client.

Any service or testing that is covered under NELAP and requires sub-contracting will be submitted only to a NELAP accredited laboratory for the service or test to be performed.

Supplies provided from outside vendors are procured through purchase orders generated by the person/section requesting the product. The Production Supervisors sign off on the purchase order. Upon receipt of a product the material is disseminated by the sample custodian to the appropriate section. The Production Supervisor and chemist verify that the specified quality level or design specifications were met for the items received.

The sample custodian is notified of non-compliant products. Non-compliant products are returned to the sample custodian and documented in a logbook. The sample custodian is responsible for returning non-compliant materials back to the vendor or place of origin. The logbook is maintained by the sample custodian and is located in sample receiving.

9. Preventive Maintenance

9.1 Instrument Maintenance

The prevention of instrument failure is important to laboratory operation. The laboratory needs to meet certain analytical schedules and holding times, and this can only be accomplished by keeping instrument downtime to a minimum. Instruments are cleaned and maintained on a regular basis to help limit downtime. A preventive maintenance schedule is followed and a maintenance log is kept on major instruments. Routine maintenance is performed to the manufacturers specifications. A list of routine maintenance is included as Table 9-1.

The lab has maintenance contracts on several major pieces of equipment. If the lab experiences a problem with an analytical instrument, a service call is made, and a certified technician is sent to correct the problem. The analysts are also trained in "troubleshooting" their instruments to determine if outside assistance is needed.

In the event that an instrument or piece of equipment cannot be calibrated or becomes inoperable, the item will be tagged "Out of Service" and removed from service until repair. Instruments are not placed into service until performance is satisfactory as demonstrated through an acceptable calibration, verification or test. (1) Equipment that cannot be repaired is permanently removed from service. (2) In many cases there is an alternate piece of equipment that can be substituted. If there is no alternate equipment available, the sampling will be delayed if possible, or samples will be subcontracted to an alternate approved laboratory (Section 8).

9.2 Maintenance Records and Logs

Maintenance records and logs are kept on every major instrument in the lab. Instrument records and logs are located near their respective instruments. Production Supervisors shall be responsible for maintaining records and all reference materials significant to each major piece of equipment. Records include:

- Name of Item
- Manufacturer's name, model and serial number
- Date received
- Condition when received (new, used)
- Date placed in service
- Current location
- Manufacturer's instructions/specifications (instrument manuals)
- Contract, maintenance service receipts for work performed
- Documented history of damage, malfunction and modifications
- Calibration/verification records

Maintenance, whether performed by laboratory personnel or by professional maintenance personnel, is documented as an entry in the appropriate logbook. All logbook sheets will contain the name of the instrument, manufacturer's name, model and serial number. Entries into the logbook include:

- Date of maintenance activity
- Description of maintenance activity
- Individual performing maintenance

9.3 Equipment Monitoring

Where procedures dictate, the operating temperatures of ovens, incubators, water baths, refrigerators, coolers and freezers are checked daily and recorded in a laboratory notebook. A specific analyst is assigned the responsibility to perform and record these temperature checks. The initials of the analyst, date, time performed and temperature reading are recorded for ovens, refrigerators, etc. A table of the types of equipment that is monitored and the frequency that it is monitored is included as Table 9-2.

Table 9-1 *Preventive Maintenance*

Instrument	Activity	Frequency
Atomic Absorption - Furnace	Clean furnace windows	Daily
	Change graphite tube	As needed
	Check gases	Daily
	Check autosampler and tubing	Daily
ICAP	Check vacuum pump oil level	Daily
	Clean Filters	Monthly
	Record vacuum reading	Daily
	Change pump tubing	Weekly
	Clean Nebulizer/Torch	As needed
	Check Autosampler and tubing	Daily
Gas Chromatograph - Volatiles	Check Hall propanol flow	Daily
	Check Hall furnace temp.	Daily
	Check PID sensitivity	Daily
	Change lamp	As needed
	Rinse purge devices	Daily
	Bake purge devices	Daily
	Check carrier gases	Daily
	Change carrier gases	As needed
	Check column flows	Daily
	Check for gas leaks	At each column change
	Replenish electrolytic conductivity detector solvents	As needed
	Check Tekmar transfer lines	Daily
	Check valve temperatures	Daily
	Clean transfer lines	As needed
Gas Chromatograph - Volatiles	Check Hall propanol flow	Daily
	Check Hall furnace temp.	Daily
	Check PID sensitivity	Daily
	Change lamp	As needed
	Rinse purge devices	Daily
	Bake purge devices	Daily
	Check carrier gases	Daily
	Change carrier gases	As needed
	Check column flows	Daily
	Check for gas leaks	At each column change
	Replenish electrolytic conductivity detector solvents	As needed
	Check Tekmar transfer lines	Daily
	Check valve temperatures	Daily
	Clean transfer lines	As needed

Table 9-1 *Preventive Maintenance*

Instrument	Activity	Frequency
Gas Chromatograph - Semi-volatiles	Change septum	Every 100 shots or as needed
	Change carrier gas	When pressure reaches 250 psi
	Remove first foot of capillary column	As needed
	Clean ECD	As needed
	Clean Nitrogen-Phosphorous Detector	As needed
	Check system for gas leaks	At each column, liner or injection port seal change
	Replace column	As needed
	Clean FID	As needed
	Replace capillary injection port liner	At column change or as needed
	Replace capillary injection port seal	At column change or as needed
	Measure gas flow	After changing column
	Change syringe	As needed
Gas Chromatograph/ Mass Spectrometer	Change septum	Daily/as needed
	Change carrier gas	Before pressure reaches 200 psi
	Change gas filters	As needed
	Change trap on Tekmar	As needed/poor sensitivity
	Change GC column	As needed/poor sensitivity
	Clean MS ion source	As needed/poor sensitivity
	Replace ion source parts	When worn/poor sensitivity
	Check pump oil leaks	Weekly
	Check gas flows	Before initial calibration
	Cut capillary column	As needed/contamination susp.
	Replace liner	As needed/contamination susp.
	Replace BNA seal	As needed/contamination susp.
	Bake VOA autosampler	After high samples
	Clean Precept syringe	As needed
	Replace Precept sample filter	Annually/as needed
	Replace syringe plungers	When worn
	Replace Tekmar transfer lines	As needed/poor sensitivity
	Clean or replace GC weldment	As needed/poor sensitivity
	Clean or replace split vent	As needed/poor sensitivity
	Clean injector housing	As needed/poor sensitivity
	Clean electron multiplier	As needed/poor sensitivity
	Manufacturer P.M. program	Semi-annually
Lachat QuikChem AE	Coat rollers of pump with silicon spray	Weekly
	Replace pump tubes	As needed
	Clean flares at port of valve module	As needed
	Replace O-rings	As needed
	Replace unions	As needed
TOC	Replace water in IC Chamber	Daily
	Clean IC chamber	As needed
	Repack quartz wool and copper in combustible tube	As needed
	Clean TC inlet valve	As needed
	Refill acid bottle	When 2/3 empty

Table 9-1 *Preventive Maintenance*

Instrument	Activity	Frequency
GPC	Change seals and oil motor on positive displacement pump	Every 1500-2000 hours of use or bi-annually
	Repack column	When resolution criteria is not met
	Check system pressure	Check daily when operating
	Replace mesh at column effluent/influent	If torn or wrinkled
	Check calibration and solvent flow	Check weekly
IR Analyzer	Clean and inspect quartz tubes	With each use
Mercury Analyzer	Check tubing	Daily
	Record air flow rate	Daily
	Change desiccant	Daily
Proportional Counters	Check gas pressure and flow	Daily
	Change gas	As needed
	Check for leaks	When gas cylinders are changed
	Check gas line dryer	When moisture is visually present
	Clean fan filter	Annually
Gamma Spectrometers	Fill LN2	Weekly
Alpha Spectrometers	Clean NIM rack filters	Semi-annually
	Change vacuum pump oil	Semi-annually
Support Computers	Clean fan filters	Annually
Transmission Electron Microscope - Asbestos	*Fill LN2*	*Daily*
	Check vacuum status	*Daily*
	Check water temperature and pressure	*Daily*
	Check air temperature and pressure	*Daily*
Polarized Light Microscopes - Asbestos	*Check light source*	*Daily*
	Clean stage, condenser, objectives, field iris, oculars	*Weekly*
Phase Contrast Microscopes - Asbestos	*Check light source*	*Daily*
	Clean condenser, stage, objectives, oculars	*Weekly*

Table 9-2 *Equipment Monitoring*

Equipment Type	Activity	Frequency
Ovens	Temperature Monitoring	Twice Daily
Refrigerators	Temperature Monitoring	Twice Daily
Incubators	Temperature Monitoring	Twice Daily
Walk-in Cooler	Temperature Monitoring	Twice Daily

10. Quality Control Checks, Routines to Assess Precision and Accuracy, and Calculation of Method Detection Limits

When analyzing samples, the accuracy and precision of the data generated are determined through the analysis of replicates, spiked samples, laboratory control samples, and laboratory blanks with each set of samples. Results of QC samples are charted against control limits established for the current year.

10.1 Method Detection Limits

Method detection limits (MDL) are calculated for each instrument in the lab requiring MDLs. They are calculated following the procedures outlined in 40 CFR Part 136, Appendix B. Seven replicate measures are used to determine the method detection limits. MDLs are calculated and are updated yearly. A standard at a concentration near the MDL value is analyzed each time a calibration curve is generated.

10.2 Method Accuracy and Precision

Method accuracy is the ability to determine that the measurement of a known reference standard will be acceptably close to the defined true value. This is measured by the analysis of an external reference standard. The analytical method accuracy and matrix effects are determined by spiking a known amount of analyte into a sample. The percent recoveries are then calculated. The amount of analyte recovered from the sample reflects how the matrix effects the accuracy of the method. An acceptable trend over time indicates control of accuracy.

Method precision is the measurement of the spread of replicate measurements relative to their established value. One would expect the distribution to be random and therefore follow normal statistics. The analytical method precision is determined by analyzing equal amounts of a split sample. Ideally, the analytical results will be identical; however, differences occur due to random variations in the procedure. A quantitative measure of these differences is assessed by calculating the relative percent differences or relative error ratios between duplicate results for each analyte.

10.3 Intralaboratory QA/QC Program

An integral part of a QA program includes participating in interlaboratory QC programs which provide an independent mechanism where QC procedures can be documented for review.

A quality control program is a systematic attempt to monitor the precision and accuracy of analyses by detecting and preventing the recurrence of errors. By identifying the sources of errors, confidence in the precision and accuracy of analytical results can be established, and improvements in the analytical methods can be made.

In general, Laboratories quality control program incorporates the concepts of: a) calibration to attain accuracy, b) replication to establish precision limits, and c) use of independently prepared traceable standards and spikes to confirm accuracy.

Table 10-1 contains a list of laboratory QC checks and the frequency at which they are done. If method QC requirements are more stringent than O'Brien & Gere Laboratories QC requirements, the method QC requirements will be followed.

10.3.1 Definitions of Basic Terms

There are some basic terms that are frequently used when discussing QA/QC. Below are the definitions of some common terms.

Preparation Blank - The preparation or method blank is an aliquot of deionized water, organic free water, or organic reagents used in the analysis of samples. The preparation blank is passed through the entire analytical procedure (including glassware and other materials that come into contact with the samples). These blanks are analyzed along with the samples to monitor: a) occurrences of false positives, or b) occurrences of cross-contamination.

Reagent Blanks - A matrix free blank which includes all reagents used during analysis. Reagent blanks are used instead of preparation blanks for analyses where deionized water may produce an analytical response.

Trip Blank - Trip blanks are water blanks sent from the laboratory to the sampling site and are returned to be analyzed in the same manner as the samples. They are treated in the same manner as the field samples during sampling. If the samples are to be analyzed for purgeable organics, the analysis of trip blanks provides a check on possible contamination of the samples by permeation of volatiles through the septum seal. At least one trip blank for each volatile organic method will be prepared and analyzed for each cooler used to transport the volatile samples.

Matrix Spike - Spikes are prepared by adding a known amount of analyte to a randomly selected field sample. Evaluation of analytical results provides a quantitative measure of accuracy (spiked blanks) or percent recovery (spiked samples). The spike percent recovery reflects matrix effects upon the analytical method accuracy.

Matrix Duplicate - Duplicates are prepared by splitting a field sample into equal amounts and treating them as two unique samples throughout the analytical procedure. The results of duplicate analyses provide information on overall precision of the analytical methodology. Quantitative results are obtained by calculating the relative percent difference (RPD) or relative error ratio (RER) for each analyte in the sample matrix. RPDs can only be calculated if both the sample and duplicate have results above the detection limit. RERs may be calculated and evaluated for all results.

Replicates - Replicates are the reanalysis of a field sample by a different analyst. The results of replicate analyses provide information on overall precision of the analytical methodology. Quantitative results are obtained by calculating the percent difference of the samples.

Matrix Spike Duplicates - Matrix Spike Duplicates are the result of splitting a field sample into three parts and adding the same known amount of analyte into two of them. One is used as the matrix spike and the other is used as the matrix spike duplicate. The RPD or RER is calculated on the two concentrations. The advantage of performing a matrix spike duplicate analysis is that there will always be a calculable RPD since there should never be a result less than the detection limit.

Surrogate Spike/Tracers - Surrogate spikes/tracers are prepared by adding known amounts of standards to every sample prior to sample preparation in some organic and radiochemistry analyses. The standards are chemically similar to the compounds of interest. For GC/MS analysis, deuterated compounds are often used. In radiochemistry, isotopes are used which are not present in nature or are not expected to be present in the samples. The analysis of surrogate spikes or tracers provides quality control on every sample by constantly monitoring unusual matrix effects.

Internal Standard - Internal standards are compounds added to all standards and samples after sample preparation procedures for GC/MS analysis. Internal standards are used as the basis for quantitation of the target compounds.

Laboratory Control Sample - An external reference standard solution obtained from a source different than the source of the calibration standards. The external reference samples are used for monitoring the complete analytical method. A laboratory control sample is analyzed on every run or with each batch of samples to verify calibration. The laboratory control sample is passed through the entire analytical procedure.

Continuing Calibration Check Standard - A standard used to verify calibration throughout the analytical sequence. They are typically analyzed at a frequency of 10%.

Performance Evaluation Samples - Performance Evaluation (PE) samples are a set of samples sent to the laboratory by a certifying agency to be analyzed. The laboratory is unaware of the concentration of the compounds in the samples and the results must fall within certain limits. Several sets of Performance Evaluation (PE) samples are analyzed per year. If PE sample analyses are unacceptable, investigations and corrective actions will be documented in a QA report.

Interlaboratory Exchange - Routinely, samples analyzed by the laboratory are submitted to an independent laboratory for reanalysis as a measure of accuracy. Results are evaluated and discrepancies are resolved between the laboratories. In the case of PCM samples, the laboratory participates in a round robin program managed by an independent laboratory in which "typical" airborne samples are submitted for analysis.

Knowns - A known is a performance evaluation sample which is routinely analyzed by the laboratory as a measure of overall accuracy. Results for a known are compared to the acceptable results for that performance evaluation sample.

Verified Asbestos Analysis - Verified asbestos analysis is a procedure in which a TEM grid opening is independently analyzed for asbestos by two or more TEM operators and in which a comparison and evaluation of the correctness of the analyses are made by a verifying analyst.

10.3.2 Analytical Errors

The laboratory is dedicated to minimizing errors that cause inaccurate results. There are two categories of errors which may occur in analytical measurements: systematic and random. Systematic errors are caused by an incorrect or faulty procedure; these errors produce biased results. Having a rigorous QA/QC data evaluation program will allow the detection of these errors, and assist the analyst in making the necessary corrections.

There can be many causes of random errors, and they may relate to the skill of the analyst. Random errors affect precision more than they affect accuracy, and they are difficult to correct. The quality control program can assess the magnitude of error, and it can assign a level of confidence to the data.

QC results are plotted as they are entered into the LIMS system and are compared to established criteria in order to aid in the detection of situations which are out-of-control or trending towards out-of-control. Guidance on the evaluation of QC data and interpretation of QC charts is provided to the analyst in SOP AP# 800-09, Evaluation of Quality Control Data.

Errors are reduced by properly training the analysts and having written standard operating procedures for the analysts to use. The analysts are trained in good laboratory practices. Every effort is made to keep contamination to a minimum. Blanks are run with every group of samples to check for contamination from glassware or standards.

10.4 Statistical Quality Control

Statistical calculations form the basis of the QC evaluation program. They are the foundation for the generation of control charts and the setting of warning and control limits. The definitions of some widely used statistical terms follows:

Mean - The average of n values is calculated by taking the sum of n values and dividing by n.

$$\bar{x} = \frac{\sum_{i=1}^{n} x_i}{n}$$

Sample Standard Deviation - A parameter used to measure the dispersion of a data set. It is calculated by the following:

$$s = \sqrt{\frac{\sum_{i=1}^{n} (\bar{x}-x_i)^2}{n-1}}$$

Relative standard deviation (RSD) or coefficient of variation (CV) is the standard deviation divided by the mean and multiplied by 100.

$$CV = \frac{s}{\bar{x}} \cdot 100$$

Relative Percent Difference - The relative percent difference of two numbers is calculated by dividing the absolute value of their differences by the average of the two numbers.

$$RPD = \frac{|x_1-x_2|}{((x_1+x_2)/2)} \cdot 100$$

Percent Recovery - Percent recovery is calculated by dividing the spike sample result by the spike added for or by dividing the spike sample result minus the sample by the spike added.

$$\%R = \frac{SS}{SA} \cdot 100$$

$$\%R = \frac{SS-S}{SA} \cdot 100$$

Where: SS = Spike sample
SA = Spike added
S = Sample

Relative Error Ration (RER) - RER values are calculated as follows:

$$RER = \frac{|x_1 - x_2|}{\sqrt{TPU_{(1\sigma)1}^2 + TPU_{(1\sigma)2}^2}}$$

Where: x_1 = original sample result
x_2 = duplicate sample result
$TPU_{(1\sigma)1}$ = total propagated uncertainty of the original sample result (1σ)
$TPU_{(1\sigma)2}$ = total propagated uncertainty of the duplicate sample result (1σ)

10.5 Control Charts

Control charts provide the necessary tools for detecting quality variations in the various analytical methodologies used. They are a continuous graphic indication of the state of an analytical procedure with respect to quality. Control charts indicate when corrective action procedures are necessary and often assist in defining what corrective action procedures should be taken. The generation of quality control charts is detailed in laboratory SOP: AP# 800-13 "Generating Quality Control Charts".

The control limits on QC charts set the criteria for assessing the significance of variations in the analytical results. When the plotted QC data fall within these limits, the analytical methodologies are considered under control. If a data point falls outside the control limits, there is an indication that some assignable cause is present which has thrown the system out of control.

Laboratory QC data are entered in the LIMS. A statistical program on the LIMS computes control and warning limits. Control limits are generated once a year by taking a minimum of six data points from the previous year and calculating the mean, standard deviation, and warning and control limits for the current year. Control limits can be updated more frequently if deemed statistically necessary. The generation and updating of control limits are detailed in laboratory SOP: AP# 800-10 "Generating Control Limits".

Control limits can be considered action limits. They enable the laboratory to detect significant deviations in analytical procedures and to take corrective action before producing erroneous results. Warning limits are used as a warning that the analytical system is approaching "out of control" conditions and that the cause should be investigated and corrected before the system is out of control.

Warning limits (WL) are set at $\pm$ 2 standard deviations and control limits (CL) at $\pm$ 3 standard deviations from the mean. The WLs and CLs correspond, respectively, to the 95% (2s) and 99.7%(3s) confidence limits of a normal distribution curve.

10.5.1 Precision QC Charts

Precision QC charts are used for graphing the RPDs of duplicate samples. Once the data points have been collected, the warning and control limits on the QC charts are calculated by using the following method:

1. For each pair of duplicate samples calculate the RPD.
2. Calculate the mean RPD by summing the RPDs and divide by the total number (n) of duplicate sets.
3. Calculate the standard deviation(s).

4. Calculate the warning and control limits.

$$UCL = \overline{RPD} + 3s$$
$$UWL = \overline{RPD} + 2s$$
$$LWL = \overline{RPD} - 2s$$
$$LCL = \overline{RPD} - 3s$$

The LCL is always zero since it is impossible to have a negative RPD.

10.5.2 Accuracy QC Charts

Accuracy QC charts are used for graphing the percent recoveries of laboratory control samples. The warning and control limits are calculated by using the following procedures:

1. For each laboratory control sample, calculate the percent recovery (%R).
2. Calculate the mean %R by taking the %Rs and dividing by the total number (n) of %Rs.
3. Calculate the standard deviation (s) of the percent recoveries.
4. Set the warning and control limits by the following:

$$UCL = \overline{\%R} + 3s$$
$$UWL = \overline{\%R} + 2s$$
$$LWL = \overline{\%R} - 2s$$
$$LCL = \overline{\%R} - 3s$$

10.5.3 Matrix Spike Recovery QC Charts

Matrix spike recovery QC charts are used for graphing the percent recoveries of spiked samples. The warning and control limits are calculated by using the following procedures:

1. For each spiked sample, calculate the percent recovery (%R).
2. Calculate the mean %R by taking the %Rs and dividing by the total number (n) of %Rs.
3. Calculate the standard deviation (s) of the percent recoveries.
4. Set the warning and control limits using the procedure as stated for accuracy QC charts.

Table 10-1 *Laboratory QC Checks and Frequency*

Laboratory Section	QC Sample	Frequency
GC/MS Volatiles	Laboratory Control Sample	Daily or every batch
	BFB	Every 12 hours
	Continuing Cal. Check	After BFB
	Matrix Spike	5% or Every batch
	Matrix Spike Duplicate	5% or Every batch
	Preparation Blank	Daily or every batch
	Surrogates	Every sample
	Internal Standards	Every sample
	P.E. Samples	Semi-annually
GC/MS Semivolatiles	Laboratory Control Sample	Every batch
	DFTPP	Every 12 hours
	Continuing Cal. Check	After DFTPP
	Matrix Spike	5% or Every batch
	Matrix Spike Duplicate	5% or Every batch
	Preparation Blank	Every batch
	Surrogates	Every sample
	Internal Standards	Every sample
	P.E. Samples	Semi-annually
GC Volatiles	Laboratory Control Sample	5%
	Continuing Cal. Check	10%
	Matrix Spike	5%
	Matrix Spike Duplicate	5%
	Preparation Blank	Daily or every batch
	Surrogates	Every sample
	P.E. Samples	Semi-annually
GC Semivolatiles	Laboratory Control Sample	5%
	Continuing Cal. Check	10% or 5% or every 12hrs. as per method
	Matrix Spike	5%
	Matrix Spike Duplicate	5%
	Preparation Blank	5% or every batch
	Surrogates	Every sample
	P.E. Samples	Semi-annually
Metals	Laboratory Control Sample	5% or every batch
	Continuing Cal. Check	10%
	Matrix Spike	5%
	Duplicate	5%
	Preparation Blank	5% or every batch
	P.E. Sample	Semi-annually
Wet Chemistry	Laboratory Control Sample	5% or every batch
	Continuing Cal. Check	10%
	Matrix Spike	5%
	Duplicate	5%
	Preparation Blank	5% or every batch
	P.E. Samples	Semi-annually

Table 10-1 *Laboratory QC Checks and Frequency*

Laboratory Section	QC Sample	Frequency
PCM	Known	Daily
	Duplicate	5%
	Field Blank	Every batch
	Interlaboratory Exchange	Quarterly
	P.E. Samples	Up to ten/year
PLM	Known	Daily
	Duplicate	10%
	Replicate	10%
	Interlaboratory Exchange	Quarterly
	Blank	Daily
	P.E. Samples	Up to eight/year
NOB	Duplicate	5%
	Replicate	5%
	Known	Each batch
	Blank	Each batch
	Interlaboratory Exchange	0.5%
	P.E. Samples	As submitted
TEM - Airborne	Duplicate	10%
	Replicate	10%
	Verified Count	0.5%
	Laboratory Blank	10% - (4% analyzed)
	Interlaboratory Exchange	0.5%
	P.E. Sample	Up to eight/year
Actinides	Laboratory Control Sample	Each batch or 5%
	Preparation Blank	Each batch or 5%
	Matrix Duplicate	Each batch or 5%
	Matrix Spike	Upon client's request
	Tracers (if appropriate tracer is not available, matrix spike duplicate also performed)	Each sample
Gross Alpha/Beta	Laboratory Control Sample	Each batch or 5%
	Preparation Blank	Each batch or 5%
	Matrix Duplicate	1 every 20 Samples or 5%
	Matrix Spike	1 every 20 Samples
Gamma Spectrometry	Laboratory Control Sample	Each batch or 5%
	Preparation Blank	Each batch or 5%
	Matrix Duplicate	Each batch or 5%
Radium-226/228	Laboratory Control Sample	Each batch or 5%
	Preparation Blank	Each batch or 5%
	Matrix Duplicate	Each batch or 5%
	Carriers	Every Sample
	Matrix Spike	Upon client's request

Table 10-1 *Laboratory QC Checks and Frequency*

Laboratory Section	QC Sample	Frequency
Other	Laboratory Control Sample	Each batch or 5%
	Preparation Blank	Each batch or 5%
	Matrix Duplicate	Each batch or 5%
	For all analyses where an extraction is performed, either a carrier, tracer, or matrix spike analysis shall be performed	Each batch or 5 %

11. Computers, Data Reduction, Validation and Reporting

11.1 Computers and Software

The laboratory uses computers and various types of software for the collection, processing, recording, reporting and storage of environmental data. Procedures for software verification and validation are currently being developed to comply with the EPA's Good Automated Laboratory practices. External software is validated through the manufacturer. Copies of manufacture's validation documentation are obtained when software is purchased.

Laboratories has an on-site dedicated Computer Systems Analyst. The Computer Systems Analyst is responsible for the maintenance and security of data. Various levels of system access are designated to employees through the distribution of passwords by the Computer Systems Analyst. The Computer Systems Analyst is also responsible for the generation and review of electronic deliverable data specifications. Data and information on the LIMS is backed up daily. The server is backed up on a monthly basis.

11.2 Data Reduction

Data are generated from several different sources (scientific equipment, manual calculations, or computer generated). Some of the raw data are stored in hard copy form and some of the raw data are stored on electronic media (floppy disks or tapes).

Analytical results are either calculated manually, by computer program, or a combination of the two in accordance with the method employed. Calculations include such factors as sample matrix, sample size, method detection limits, client requested detection limits and dilutions or concentrations that may have been performed.

The analysts for all sections of the laboratory are responsible for documenting observations, measurements, and data in appropriate logbooks and are also responsible for entering their field sample and QC data into the LIMS. To ensure client confidentiality all client's are assigned a client number which is solely used for identification purposes. The usage of a client's name in all logbooks is prohibited.

11.3 Data Verification

The first step of the data verification process is when QC data are entered into the LIMS. The computer automatically compares the results to the established control limits. The analyst informs the section supervisor of an out-of-control situation. The section supervisor monitors the corrective action taken by the analyst. An exception report can be printed daily listing QC that failed to meet established criteria. The exception report can be used as a summary of the percentage of QC data that do not meet established criteria.

The second step is after the data had been entered into the LIMS system. The data is checked as required by project specific requirements by the section supervisor in charge of the laboratory section that generated the data. The section supervisor checks calculations, chromatograms, raw data, calibration curves, QC samples, and holding times. Any errors detected are reviewed with the analyst who made the error, documented and acknowledged.

The next level of review is performed by the QA/QC Coordinator. Data is checked as required by project specific requirements by the QA/QC Coordinator. The QA/QC Coordinator checks for adherence to method protocol. The QA/QC Coordinator also checks for use of the proper quality control limits, proper documentation of corrective actions and adherence to any specific requirements in the Quality Assurance Program. Calculations, whether performed manually or by computer, are also verified by the QA/QC Coordinator.

A flow chart outlining sample analysis and data validation procedures performed at Laboratories has been included as Figure 11-1.

11.4 Data Reporting and Report Format

In general, the project supervisor collects the LIMS reports of samples, associated QC samples, and raw data if required, checks them for completeness and compiles them into the client-specified report format. A case narrative is written that describes methods used and any QC excursions or anomalies. The final report is approved and signed by the project supervisor and the QA/QC Coordinator.

Appendix D outlines the order and contents of a typical validatable data package.

As a general rule, sample results are reported to two significant figures down to the PQL. Radiochemistry data are reported as calculated regardless of activity levels. EPA rounding rules are followed. That is, if the number to the right of the digit to be kept is greater than five, the number is rounded up. If the number to the right of the digit to be kept is less than five, the number is rounded down. If the number to the right is equal to five and there are no numbers to the right of the five, then the number is rounded up if is odd or rounded down if it is even.

Quality control sample results are not rounded. Raw numbers are presented on the QC sheets (solid samples will be corrected for percent solids). The percent recoveries and relative percent differences reported are rounded to whole numbers.

The lab provides, where appropriate, several different levels of reporting. Each level has different documentation requirements. The analysis report format, regardless of level includes the following information:

- Title
- Name, address and phone number of laboratory
- Client name, project and client identification number
- Client description and laboratory identification number of the sample
- Dates of sample collection, receipt, preparation and analysis
- Time of sample preparation and/or analysis for samples that have a required holding time of 48 hours or less
- Identification of method used and modifications to an accepted method
- Description of quality control failures and deviations from methods
- Identification of samples that do not meet sample acceptance criteria
- The minimum reporting limit for the test result
- The test result and any supporting measurements and units
- Date of issue
- Identification of subcontracted laboratories and results
- Signature and title of person responsible for the quality of data and how the contents of the report were produced

Reports are issued as a single identifiable document. Reports that include raw data are paginated. No logos other than the O'Brien & Gere corporate logo is used on any report.

11.5 Data Review

Laboratory data goes through various levels of review prior to being released to the client. The purpose of this review is to verify the results reported are accurate and meet the client's data quality objectives. The internal review of laboratory data is detailed below.

11.5.1 Criteria

Data is reviewed against the requirements listed in the laboratory standard operating procedures.

Individual projects may have specific QA/QC criteria or variances that are applicable. These program specific requirements are communicated through a combination of codes and comments which have been integrated into the LIMS by Laboratories' Project Supervisor. This communication will often direct the analyst to a Project Supervisor provided hard copy of appropriate requirements to be followed. For example, applicable AFCEE Version 3.0 requirements and variances can be found in the binder labeled "Program Specific Requirements" that is located with the SOP binders.

11.5.2 Procedure

11.5.2.1 Section Responsibilities

The analyst is responsible for reviewing the data after it is analyzed. They are required to check that QC results are within QC limits. If the data is not within acceptance limits corrective action is initiated.

The analyst will complete a corrective action log (see Section 12) for analytical sequences. If there are any excursions or discrepancies, they will be listed on the corrective action log. The corrective action log is forwarded to section supervisors, QA/QC, and project management for review and signature.

The section supervisor is responsible for reviewing the data before it is submitted to QA/QC or to the Project Supervisor. The Production Supervisor should review 100% of the data.

The Production Supervisor will check calculations, chromatograms, raw data, calibration curves, calibration check standards, QC samples, and holding times.

11.5.2.2 QA/QC Responsibilities

QA/QC will review the data for compliance with internal, method and/or QAPP criteria. They will verify that batch related QC was performed and acceptable. Calculations and chromatograms will be spot checked. In cases where there are excursions, QA/QC will write a draft case narrative listing the anomalies. QA/QC will review, at a minimum, 10% of the data, or the amount required by project specific requirements.

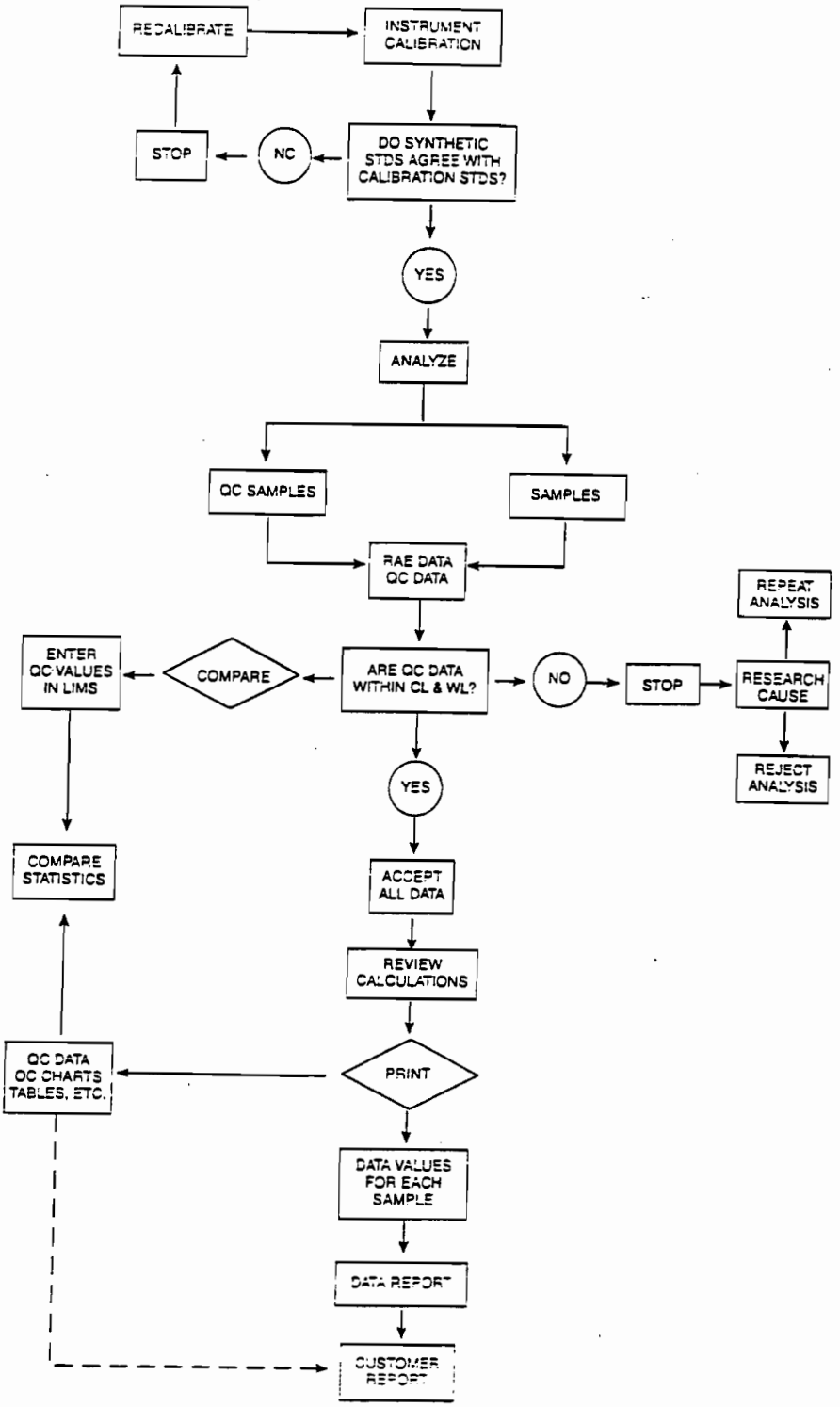
If any deficiencies are noted, the data will be returned to the section for correction.

11.5.2.3 Project Supervisor Responsibilities

Project Supervisors will check for reasonableness of the data and completeness of the results reported. They will verify that data requested by the client on the chain-of-custody was performed and is included in the report. The Project Supervisor or designee is responsible for approving reports via their signature.

Figure 11-1

Data Analysis & Verification Flow Chart



12. Corrective Actions and Complaints

12.1 Corrective Actions

Corrective actions are procedures or steps taken in response to QC data not meeting acceptance criteria, procedures not followed properly, client-specified requirements not met, or regulatory guidance not followed or met. QC samples must meet established criteria. If they fail to meet these criteria, corrective actions are taken. Corrective action procedures are discussed below and in Table 12-1.

If the calibration data fail to meet QC criteria, the problem is identified, corrected, documented and the system recalibrated. Samples cannot be analyzed until the calibration meets the QC criteria. If matrix spikes or duplicates are out of control, the data may be rejected and the samples reanalyzed or reextracted. Alternatively, the sample data may be accepted, depending upon many circumstances, including sample matrix, level of analytes, etc. The Project Supervisor is responsible for communicating QA/QC excursions to the client and documenting that project specific criteria is met. QC anomalies will be addressed in a case narrative, which is included with validatable reports or if requested.

The analyst who is responsible for running the samples is the first to assess the quality of the data. If a problem is detected, the section supervisor is immediately notified. The quality of the data is checked by the Production Supervisor, followed by the QA/QC Coordinator, the Project Supervisor and the Administrative Officer. If samples need to be reanalyzed or reextracted, the Production Supervisor is first consulted, the Project Supervisor is notified, and the procedure is rescheduled. The analyst will compare the new result with the old one and note any differences. The results are then discussed with the Production Supervisor. If the new results meet the QC criteria, the results are then reported. If QC criteria still are not met, the results are reviewed with the Project Supervisor and the QA/QC Coordinator. The review process should not exceed twenty-four hours. The Production Supervisor, Project Supervisor, QA/QC Coordinator and Administrative Officer may recommend corrective actions. Corrective actions that are recommended during the review process and carried out are documented. The client is notified by the Project Supervisor of the QC deficiency and any resulting corrective actions. The decision is then made to accept the data or to resample. Decisions and/or instructions by the client are documented by the Project Supervisor. The decision-making process varies depending on the type of project and the ultimate use of the data. In all cases, good communication is required in order to meet data quality objectives.

There are certain corrective actions that are routinely followed by the laboratory. A list of the common QC activities, acceptance criteria, and corrective actions are included as Table 12-1.

QC data that does not meet criteria and resulting corrective actions are documented on the corrective action log. A corrective action log is filled out for each analysis, each day. An example copy of a corrective action log is included as Figure 12-1. If QC data fails any of the limits, a corrective action log is filled out by the analyst and signed by the section supervisor, the QA/QC Coordinator and the Project Supervisor. The corrective action logs are then filed in a three-ring binder and kept in the laboratory. Copies of the corrective action logs are also kept in the QA/QC Coordinator's office. A copy is sent with the final report if requested by the client.

Deficiencies and excursions discovered during on-site assessments by a client or certifying agency warrant corrective actions. Internal audit findings also require corrective action. Corrective action procedures for audit findings are discussed in section 13.2.

Corrective actions are also required for Performance Evaluation (PE) sample deficiencies. Detailed corrective action procedures for PE sample deficiencies are discussed in section 13.3.

12.2 Complaints

If a client or related business entity questions the validity of data, methods or related activities of the laboratory, procedures are followed and documented to resolve the complaint. Project Supervisors document a complaint on a Complaint Resolution Form (Figure 12-2). The Complaint Resolution Form is submitted to the appropriate Production Supervisor. The QA/QC Coordinator and Administrative Officer will also review the complaint and recommend and document on the Complaint Resolution Form corrective actions. The Production Supervisor documents corrective actions in an internal memo and forwards it to the Project Supervisor. A copy of the response is forwarded to the QA/QC Coordinator and Administrative Officer. The Project Supervisor will contact the client responsible for initializing the compliant by phone and/or fax and inform them of any corrective actions. A copy of the complaint and response is filed in a three-ring binder labeled "Client Complaints." Complaints are filed by project number for client confidentiality purposes. The Client Complaints file is available for review during external audits if requested.

The QA/QC Coordinator will review corrective action logs and complaints on a quarterly basis. The purpose of this review is to verify the outcome of the corrective actions. A summary of this review will be included as an agenda item in the QA/QC Section Meeting.

Table 12-1 *Corrective Actions*

QC Activity	Acceptance Criteria	Corrective Action
Initial Calibration	Must be within limits set by the method and/or project	Prepare new standards Recalibrate instrument
Calibration Check Standard	Must be within limits set by the method and/or project	Rerun standard Prepare new standard Recalibrate instrument

Table 12-1 *Corrective Actions*

QC Activity	Acceptance Criteria	Corrective Action
Matrix Spike	Must be within laboratory QC limits or method limits and/or project	Investigate problem, document and qualify data
Lab Duplicate	Must be within laboratory QC limits or method limits and/or project	Investigate problem, document and qualify data
Method Blank	Must be less than the reporting limit	Investigate problem and reanalyze or reextract
Laboratory Control Sample	Must be within laboratory QC limits or method limits and/or project	Investigate problem and reanalyze or reextract
Surrogate Recoveries	Must be within laboratory QC limits or method limits and/or project	Investigate problem and reanalyze or reextract
Internal Standards	Must be +100% or -50% of the initial calibration and/or greater than 10% of the continuing calibration response	Investigate problem and reanalyze or reextract
Result over highest std.	Results must be within the range of the instrument	Dilute and reanalyze
P.E. Samples	Results must be within preestablished limits	Investigate problem and document corrective action
Field Duplicate	Must be within limits specified by the client	Document
Field Blank	Must be less than the detection limit	Document

Figure 12-1

Example Corrective Action Form

CORRECTIVE ACTION LOG
TRACE METALS

Analyst: _____ Instrument: _____

Date of Analysis _____ Method: _____

PROJECT NUMBER(S)/BATCH NUMBER(S)	EXCURSIONS	AFFECTED SAMPLES	CRITERIA COMPARISON	REASON/CORRECTIVE ACTION

Reviewed by:

Section Supervisor _____ Date _____

QA/QC Officer _____ Date _____

Project Supervisor _____ Date _____

C:\wpwin60\wpdocs\contract\cora.frm

Figure 12-2

Complaint Resolution Form

O'BRIEN AND GERE LABORATORIES, INC.
Complaint Resolution Form

Client Information

Client/Project ID#: _____ Project Manager: _____

Date of Complaint: _____

Form of Complaint: Fax _____ Letter _____ Phone Call _____

Person Receiving complaint: Signature: _____

Description of Complaint (Problem):

Submit & Discuss with Production Supervisor

Copy to QC Coordinator

Copy to Administrative Supervisor

Source/Cause of the Problem:

Corrective Action Taken:

Final Resolution/Client Comment:

Date Client Contacted and form of contact: _____

Production Supervisor Signature: _____ **Date:** _____

Project Supervisor Signature: _____ **Date:** _____

QA/QC Approval: Signed: _____ **Date:** _____

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13. Performance and Systems Audits

13.1 Internal System Audits

An internal audit is performed at least annually on each section of the laboratory for overall adherence to the guidelines and procedures outlined in this manual. Follow-up audits are performed if necessary. Typically a follow up audit is performed in response to a PE failure or external audit finding. Laboratory notebooks are checked to verify signatures and dates. Calibration curves and QC samples are checked for the proper frequency and compliance with established control limits. Procedures are reviewed to verify compliance with specific methods and SOPs.

The QA/QC Coordinator is responsible for scheduling each audit. The results of the audit are presented to the Production Supervisor in an internal memo. Responses or corrective actions, if required are submitted to the QA/QC Coordinator. Officers receive a copy of each internal audit. Audits are discussed with the Production Supervisors. Changes or updates are implemented as needed. Copies of each internal audit are filed by laboratory section in the QA/QC Coordinators office. If internal audit findings cast doubt on the validity of data, clients whose work may have been affected will be notified in writing by the Project Supervisor.

13.2 External System Audits

External system audits are performed yearly by several certifying agencies including New York State Department of Health, New Jersey Department of Environmental Protection, Pennsylvania Department of Environmental Regulation and United States Air Force Center for Environmental Excellence and third party auditors. Some audits are unannounced, while others are scheduled in advance. The laboratory will allow audits, either planned or unplanned, during normal business hours.

Any excursions or deficiencies that are noted during an external audit are resolved to the satisfaction of the agency conducting the audit under management consent. Corrective actions and recommendations by the client or certifying agency are implemented and documented. An internal memo is sent out by the QA/QC Coordinator to each laboratory section notifying them of an agency's findings. Audit findings are reviewed with laboratory management and the QA/QC Coordinator. Production Supervisors submit, in memo format, corrective actions and implementation dates to the QA/QC Coordinator. A final response, complete with corrective actions and implementation dates is sent to the agency or client conducting the audit. A copy of the audit report and our laboratory's responses is kept on file in the laboratory. Audits performed by certifying agencies are filed in an agency specific three-ring binder, while client audits are filed in a "Client Audits" three-ring binder.

13.3 Performance Audits

The laboratory also participates in the analysis of Performance Evaluation (PE) samples. These are sent out by the U.S. EPA, U.S. DOE, a certifying state agency or a third party, or EPA approved PE provider. Results must fall within certain limits in order to be acceptable. It is by successfully completing the PE sample analysis that the laboratory obtains

certification to perform sample analysis. The PE sample analysis also serves as a means of comparison with other laboratories performing similar work. The laboratory participates in a variety of PE studies, which are listed in Section 13.4.

PE samples are typically addressed to the QA/QC Coordinator, who hand delivers the samples to Sample Receiving. The QA/QC Coordinator acts as Project Supervisor for all PE samples. The PE samples are integrated into the laboratory as routine samples. Data related to the PE sample analysis and the results of the analysis are maintained by the QA/QC Coordinator and filed in three-ringed binders. If any parameters are deficient, the QA/QC Coordinator submits an internal memo to the laboratory section that analyzed the PE sample. The deficiency is investigated and a response/corrective action is generated in a return memo to the QA/QC Coordinator. A copy of the section's response is forwarded to the Production Officer. The laboratory responses are filed with the PE sample results.

13.4 PE Studies

1. New York State Department of Health for air emissions, potable water, wastewater and hazardous waste
2. New York State Department of Environmental Conservation - State Superfund
3. U.S. DOE Idaho Mixed Analyte Performance Evaluation Program
4. Corps of Engineers - Project specific approval
5. U.S. EPA - Project specific approval
6. New York State Department of Health Asbestos in Air by TEM Proficiency Tests, Fibers in Air (PCM) Proficiency Test, and Asbestos in (Bulk) Friable Material (PLM) Proficiency Test
7. American Industrial Hygiene Association Asbestos Analyst Registry and Bulk Asbestos Quality Assurance Program
8. National Institute for Occupational Safety & Health Proficiency Analytical Testing Program
9. National Voluntary Laboratory Accreditation Program Bulk Asbestos Analysis and Airborne Asbestos Analysis.
10. U.S. DOE Environmental Measurements Laboratory Radiochemistry Quality Assessment Program.

13.5 Certifications

Appendix E, is a table listing the agencies with which Laboratories holds certifications. Complete certification information is available from the laboratory.

14. Quality Assurance Reports and Management Assessment

14.1 Quality Assurance Reports

The QA/QC Coordinator is responsible for making periodic reports to management concerning QA activities. These reports serve to document lab personnel adherence to QA requirements and to discuss any updates or changes necessary to the QC program. There are informal oral reports, formal written reports and QA/QC section meeting reports. Oral reports are given weekly during a meeting with the administrative manager. Formal written

reports are given periodically and contain results of section audits and review of control charts. The QA/QC Coordinator keeps a copy of quality assurance reports, whether informal or formal.

Any significant trends in the QC data, such as data points running significantly above or below the average, may be discussed with Officers and Production Supervisors (at any time) to detect any possible problems before data gets out of control.

The QA/QC Coordinator meets with the Administrative Officer at a minimum of every six weeks to discuss several quality assurance issues. The following topics are covered every meeting:

- Section Audits
- Data Trends
- Corrective Actions
- Proficiency Samples
- QA Manual/SOP updates
- Quality Systems Issues
- Upcoming QA Events/Initiatives
- Other Laboratory Related Issues

A summary of the QA/QC section meeting minutes and any attachments becomes a "QA Report to Management" and is distributed to the President, Officers, Production Supervisors and Project Supervisors. A copy of this summary is filed in the QA/QC Coordinator's office.

External QA reports may be submitted to state or federal agencies and clients as required by contract. These reports may contain results of internal system audits, performance evaluation sample results, review of control charts and control limits, any QA/QC problems that were detected and the results of any corrective actions related to these problems.

14.2 Management Review

The Officers regularly assesses the laboratory's quality system and operations. Several tools are used to assure that program implementation is effective and that the quality for all technical work is achieved.

A weekly meeting with the President, Officers, Production Supervisors, Project Supervisors and QA/QC personnel is held. QA/QC issues are identified as a separate agenda item at these meetings. Additionally, in-house analytical programs, resource management concerns of individual groups and pending projects are reviewed and discussed. Minutes of this meeting are distributed to all O'Brien and Gere Laboratories, Inc. employees.

External and internal audits, section responses to audit findings, effectiveness of the document control program, client complaints, corrective actions, proficiency samples and personnel training and SOP reading records will be reviewed, at a minimum annually by management. This review will be documented and filed in QA/QC.

The President will present all employees with a "State of the Laboratory" address annually.

15. Document Control and Records

15.1 Record Storage

A copy of the final laboratory report is retained by the laboratory. Laboratory reports are filed by client ID number and project number. This allows for data belonging to a specific client and project to be filed together. Reports are kept at the laboratory for one year and are then stored at an access-restricted, environmentally up-kept warehouse for a minimum of five years. To ensure client confidentiality, reports may only be signed out by an O'Brien & Gere Laboratories employee.

The original chain of custody forms and case file forms are filed with the final report. If the client requested specific QC be performed, copies of the QC will also be filed with the report.

QC data is input into the LIMS. At the end of every year, QC data are copied onto disc and retained by the QA/QC Coordinator.

Raw data for lab sections is organized by date and instrument. The data are maintained in the laboratory for a period of up to 2 years. They are then stored in the secured warehouse for up to five years or as defined by project specific requirements.

Corrective action logs are maintained at the lab for one year and then stored in the secured warehouse for up to five years.

Electronic data and records are stored indefinitely in both the laboratory and secured warehouse. This data is stored away from other electronic and magnetic sources.

Current Standard Operating Procedures are maintained in the Quality Control Office. Archived SOPs are maintained by QC and stored indefinitely. This document is also maintained by QC and archived manuals are stored indefinitely.

15.2 Document Control

Laboratories has instituted a document control procedure on this document, the Radiochemistry Safety Manual and all laboratory SOPs. This is to ensure the staff is using the most current version of these documents. The QA/QC Coordinator is responsible for the distribution and maintenance of laboratory controlled documents.

SOPs that are not stamped with a controlled document stamp (in red) and numbered are not considered final versions ready for use. Any electronic copy of an SOP is not considered a final version. Laboratory SOP: AP #800-3 "Document Control" further details document control procedures.

Appendix A

Practical Quantitation Limits, Minimum Detectable Concentrations and Methods

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 305.1	Water	Acidity as $CaCO_3$	1. mg/L
EPA 310.1	Water	Alkalinity as $CaCO_3$	10. mg/L
EPA 350.1	Water	Ammonia as N	.05 mg/L
EPA 350.1 M	Solid	Ammonia as N	5. mg/L
EPA 405.1	Water	5-day BOD	5. mg/L
SM 5210 B	Water	5-day CBOD	5. mg/L
EPA 410.4	Water	COD	10. mg/L
EPA 410.4 M	Solid	COD	1000. mg/kg
EPA 325.2 EPA 9251	Water	Chloride	1. mg/L
EPA 9251 M	Solid	Chloride	100. mg/kg
EPA 330.5	Water	Total residual chlorine	.1 mg/L
EPA 110.2	Water	Color	5. PCU
EPA 335.2 EPA 9010B/9014	Water	Cyanide	.01 mg/L
EPA 335.2 EPA 9010B/9014	Solid	Cyanide	.5 mg/kg
EPA 335.1 EPA 9010B/9014	Water	Amenable cyanide	.01 mg/L
NYSDOH 310-30	Water	Ethylene Glycol	.1 mg/L
EPA 340.2	Water	Fluoride, total	.1 mg/L
EPA 340.2	Solid	Fluoride, total	10. mg/kg
NIOSH 3500	Water	Formaldehyde	.1 mg/L
NIOSH 3500	Solid	Formaldehyde	10. mg/kg
SM2340B	Water	Hardness as $CaCO_3$	6.6 mg/L
EPA 130.2	Water	Hardness as $CaCO_3$	10. mg/L
SM3500-Cr-D EPA 7196A	Water	Hexavalent Chromium	.01 mg/L
EPA 7196A M	Solid	Hexavalent Chromium	1. mg/kg
EPA 150.1 EPA 9040B	Water	Hydrogen Ion (pH)	.1 std. units
EPA 9045C	Solid	Hydrogen Ion (pH)	.1 std. units
EPA 351.2	Water	Kjeldahl nitrogen, total as N	.4 mg/L
EPA 351.2	Solid	Kjeldahl nitrogen, total as N	40. mg/kg
EPA 353.2	Water	Nitrite plus nitrate	.05 mg/L
EPA 353.2	Solid	Nitrite plus nitrate	5. mg/kg
EPA 353.2	Water	Nitrite	.05 mg/L
EPA 353.2 M	Solid	Nitrite	5. mg/kg
Subtraction	Water	Nitrate	.05 mg/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
Subtraction	Solid	Nitrate	5. mg/kg
EPA 140.1	Water	Odor	1. TON
EPA 413.1 EPA 9070	Water	Oil and grease, total recoverable	5. mg/L
EPA 9071 A	Solid	Oil and grease, total recoverable	500. mg/kg
EPA 415.1	Water	Organic carbon, total	1. mg/L
EPA 365.1	Water	Orthophosphate	.05 mg/L
EPA 365.1 M	Solid	Orthophosphate	5 mg/kg
EPA 360.1	Water	Oxygen dissolved	.1 mg/L
EPA 420.1 EPA 9065	Water	Phenols	.005 mg/L
EPA 9065 M	Solid	Phenols	.5 mg/kg
EPA 365.4	Water	Phosphorus, total	.1 mg/L
EPA 365.4 M	Solid	Phosphorus, total	10. mg/kg
SW846 Ch.7 Vol 1C Sec 7.3.3.2	Waste	Reactive Cyanide	25. mg/kg
SW846 Ch.7 Vol 1C Sec 7.3.4.2	Waste	Reactive Sulfide	50 mg/kg
EPA 160.1	Water	Residue, dissolved	10. mg/L
EPA 160.3	Water	Residue, total	10. mg/L
SM2540-G	Solid	Residue, total	1. %
EPA 160.2	Water	Residue, suspended	5. mg/L
EPA 160.4	Water	Residue, volatile	10. mg/L
SM2540-G	Solid	Residue, volatile	1 %
EPA 160.5	Water	Residue, settable	.1 ml/L
EPA 370.1	Water	Silica	.5 mg/L
EPA 120.1	Water	Specific Conductance	1 umho/cm
SM2710-F	Water	Specific Gravity	.001
SM2710-F	Solid	Specific Gravity	.001
EPA 375.4	Water	Sulfate, as SO_4	5. mg/L
EPA 375.4 M	Solid	Sulfate, as SO_4	500. mg/kg
EPA 376.1	Water	Sulfide	.2 mg/L
EPA 376.1 M	Solid	Sulfide	20. mg/kg
EPA 377.1	Water	Sulfite, as SO_3	2. mg/L
EPA 425.1	Water	Surfactants	.1 mg/L
EPA 425.1 M	Solid	Surfactants	10. mg/kg
EPA 170.1		Temperature	
EPA 180.1	Water	Turbidity	.1 NTU

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 200.7	Water	Aluminum	.1 mg/L
EPA 6010B		Antimony	.06 mg/L
		Arsenic	.005 mg/L
		Barium	.1 mg/L
		Beryllium	.01 mg/L
		Boron	.05 mg/L
		Calcium	1. mg/L
		Chromium	.01 mg/L
		Cobalt	.05 mg/L
		Copper	.01 mg/L
		Cadmium	.01 mg/L
		Iron	.05 mg/L
		Lead	.005 mg/L
		Magnesium	1. mg/L
		Manganese	.05 mg/L
		Molybdenum	.05 mg/L
		Nickel	.05 mg/L
		Potassium	5. mg/L
		Selenium	.005 mg/L
		Silver	.01 mg/L
		Sodium	1. mg/L
		Thallium	.01 mg/L
		Tin	.05 mg/L
		Vanadium	.05 mg/L
		Zinc	.01 mg/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 6010B	Solid	Aluminum	10. mg/kg
		Antimony	6. mg/kg
		Arsenic	.5 mg/kg
		Barium	10. mg/kg
		Beryllium	1. mg/kg
		Boron	5. mg/kg
		Calcium	100 mg/kg
		Chromium	1. mg/kg
		Cobalt	5. mg/kg
		Copper	1. mg/kg
		Cadmium	1. mg/kg
		Iron	5. mg/kg
		Lead	.5 mg/kg
		Magnesium	100. mg/kg
		Manganese	5. mg/kg
		Molybdenum	5. mg/kg
		Nickel	5. mg/kg
		Potassium	500. mg/kg
		Selenium	.5 mg/kg
		Silver	1. mg/kg
		Sodium	100. mg/kg
		Thallium	1. mg/kg
		Tin	5. mg/kg
		Vanadium	5 mg/kg
		Zinc	1. mg/kg

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 206.2 EPA 7060A EPA 200.9	Water	Arsenic	.002 mg/L
EPA 7060A	Solid	Arsenic	.2 mg/kg
EPA 239.2 EPA 7421 EPA 200.9	Water	Lead	.002 mg/L
EPA 7421	Solid	Lead	.2 mg/kg
EPA 245.1 EPA 7470A	Water	Mercury	.0002 mg/L
EPA 245.5 EPA 7471A	Solid	Mercury	0.1 mg/kg
EPA 270.2 EPA 7740 EPA 200.9	Water	Selenium	.002 mg/L
EPA 7740	Solid	Selenium	.2 mg/kg
EPA 279.2 EPA 7841 EPA 200.9	Water	Thallium	.002 mg/L
EPA 7841	Solid	Thallium	.2 mg/kg

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 8021B	Water	Chloromethane	10. ug/L
		Bromomethane	10. ug/L
		Vinyl Chloride	1. ug/L
		Chloroethane	1. ug/L
		Methylene Chloride	1. ug/L
		Trichlorofluoromethane	1 ug/L
		1,1-Dichloroethene	1 ug/L
		1,1-Dichloroethane	1. ug/L
		cis-1,2-Dichloroethene	1. ug/L
		trans-1,2-Dichloroethene	1. ug/L
		Chloroform	1. ug/L
		1,2-Dichloroethane	1. ug/L
		1,1,1-Trichloroethane	1. ug/L
		Carbon Tetrachloride	1. ug/L
		Bromodichloromethane	1. ug/L
		1,2-Dichloropropane	1. ug/L
		cis-1,3-Dichloropropene	1. ug/L
		Trichloroethene	1. ug/L
		Dibromochloromethane	1. ug/L
		1,1,2-Trichloroethane	1. ug/L
		Benzene	1. ug/L
		trans-1,3-Dichloropropene	1. ug/L
		2-Chloroethylvinylether	10. ug/L
		Bromoform	10. ug/L
		Tetrachloroethene	1. ug/L
		1,1,2,2-Tetrachloroethane	1. ug/L
		Toluene	1. ug/L
		Chlorobenzene	1. ug/L
		Ethylbenzene	1. ug/L
		Xylene (total)	3. ug/L
		1,2-Dichlorobenzene	5. ug/L
		1,3-Dichlorobenzene	5. ug/L
		1,4-Dichlorobenzene	5. ug/L
		Dichlorodifluoromethane	10. ug/L
		Bromobenzene	5. ug/L
		2-Chlorotoluene	5. ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
		4-Chlorotoluene	5. ug/L
EPA 8021B	Water	Dibromomethane	10 ug/L
		1,1,1,2-Tetrachloroethane	1 ug/L
		1,2,3-Trichloropropane	1. ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 601/602	Water	Chloromethane	10. ug/L
		Bromomethane	10. ug/L
		Dichlorodifluoromethane	10. ug/L
		Vinyl Chloride	1. ug/L
		Chloroethane	1. ug/L
		Methylene Chloride	1 ug/L
		Trichlorofluoromethane	1. ug/L
		1,1-Dichloroethene	1. ug/L
		1,1-Dichloroethane	1. ug/L
		cis-1,2-Dichloroethene	1. ug/L
		trans-1,2-Dichlorothene	1. ug/L
		Chloroform	1. ug/L
		1,2-Dichloroethane	1. ug/L
		1,1,1-Trichloroethane	1. ug/L
		Carbon Tetrachloride	1. ug/L
		Bromodichloromethane	1. ug/L
		1,2-Dichloropropane	1. ug/L
		cis-1,3-Dichloropropene	1. ug/L
		Trichloroethene	1. ug/L
		Benzene	1. ug/L
		Dibromochloromethane	1. ug/L
		1,1,2-Trichloroethane	1. ug/L
		trans-1,3-Dichloropropene	1. ug/L
		2-Chloroethyl vinyl ether	10. ug/L
		Bromoform	10. ug/L
		1,1,2,2-Tetrachloroethane	1. ug/L
		Tetrachloroethene	1. ug/L
		Toluene	1. ug/L
		Chlorobenzene	1. ug/L
		Ethylbenzene	1. ug/L
		Xylene (total)	3. ug/L
		1,2-Dichlorobenzene	5. ug/L
		1,3-Dichlorobenzene	5. ug/L
		1,4-Dichlorobenzene	5. ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 502.2	Water	1,1,1,2-Tetrachloroethane	.5 ug/L
		1,1,1-Trichloroethane	.5 ug/L
		1,1,2,2-Tetrachloroethane	.5 ug/L
		1,1,2-Trichloroethane	.5 ug/L
		1,1-Dichloroethane	.5 ug/L
		1,1-Dichloroethylene	.5 ug/L
		1,1-Dichloropropene	.5 ug/L
		1,2,3-Trichlorobenzene	.5 ug/L
		1,2,3-Trichloropropane	.5 ug/L
		1,2,4-Trichlorobenzene	.5 ug/L
		1,2,4-Trimethylbenzene	.5 ug/L
		1,2-Dibromo-3-chloropropane	.5 ug/L
		1,2-Dibromoethane	.5 ug/L
		1,2-Dichlorobenzene	.5 ug/L
		1,2-Dichloroethane	.5 ug/L
		1,2-Dichloropropane	.5 ug/L
		1,3,5-Trimethylbenzene	.5 ug/L
		1,3-Dichlorobenzene	.5 ug/L
		1,3-Dichloropropane	.5 ug/L
		1,4-Dichlorobenzene	.5 ug/L
		2,2-Dichloropropane	.5 ug/L
		2-Chlorotoluene	.5 ug/L
		4-Chlorotoluene	.5 ug/L
		4-Isopropyltoluene	.5 ug/L
		Benzene	.5 ug/L
		Bromobenzene	.5 ug/L
		Bromochloromethane	.5 ug/L
		Bromodichloromethane	.5 ug/L
		Bromoform	.5 ug/L
		Bromomethane	.5 ug/L
		Carbon tetrachloride	.5 ug/L
		Chlorobenzene	.5 ug/L
		Chloroethane	.5 ug/L
		Chloroform	.5 ug/L
		Chloromethane	.5 ug/L
		Dibromochloromethane	.5 ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
		Dibromomethane	.5 ug/L
EPA 502.2	Water	Dichlorodifluoromethane	.5 ug/L
		Dichloromethane	.5 ug/L
		Ethylbenzene	.5 ug/L
		Hexachlorobutadiene	.5 ug/L
		Isopropylbenzene	.5 ug/L
		Naphthalene	.5 ug/L
		Styrene	.5 ug/L
		Tetrachloroethylene	.5 ug/L
		Toluene	.5 ug/L
		Trichloroethylene	.5 ug/L
		Trichlorofluoromethane	.5 ug/L
		Vinyl chloride	.5 ug/L
		cis-1,2-Dichloroethylene	.5 ug/L
		cis-1,3-Dichloropropylene	.5 ug/L
		m-Xylene	.5 ug/L
		n-Butylbenzene	.5 ug/L
		n-Propylbenzene	.5 ug/L
		o-Xylene	.5 ug/L
		p-Xylene	.5 ug/L
		sec-Butylbenzene	.5 ug/L
		tert-Butylbenzene	.5 ug/L
		trans-1,2-Dichloroethylene	.5 ug/L
		trans-1,3-Dichloropropylene	.5 ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 8021B	Solid	Chloromethane	10. ug/kg
		Bromomethane	10. ug/kg
		Vinyl Chloride	1. ug/kg
		Chloroethane	1. ug/kg
		Methylene Chloride	1. ug/kg
		Trichlorofluoromethane	1. ug/kg
		1,1-Dichloroethene	1. ug/kg
		1,1-Dichloroethane	1. ug/kg
		cis-1,2-Dichloroethene	1. ug/kg
		trans-1,2-Dichloroethene	1. ug/kg
		Chloroform	1. ug/kg
		1,2-Dichloroethane	1. ug/kg
		1,1,1-Trichloroethane	1. ug/kg
		Carbon Tetrachloride	1. ug/kg
		Bromodichloromethane	1. ug/kg
		1,2-Dichloropropane	1. ug/kg
		cis-1,3-Dichloropropene	1. ug/kg
		Trichloroethene	1 ug/kg
		Dibromochloromethane	1. ug/kg
		1,1,2-Trichloroethane	1. ug/kg
		Benzene	1. ug/kg
		trans-1,3-Dichloropropene	1. ug/kg
		2-Chloroethylvinylether	10. ug/kg
		Bromoform	10. ug/kg
		Tetrachloroethene	1. ug/kg
		1,1,2,2-Tetrachloroethane	1. ug/kg
		Toluene	1. ug/kg
		Chlorobenzene	1. ug/kg
		Ethylbenzene	1. ug/kg
		Xylene (total)	3. ug/kg
		1,2-Dichlorobenzene	5. ug/kg
		1,3-Dichlorobenzene	5. ug/kg
		1,4-Dichlorobenzene	5. ug/kg
		Dichlorodifluoromethane	10. ug/kg
		Bromobenzene	5. ug/kg
		2-Chlorotoluene	5. ug/kg

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
		4-Chlorotoluene	5. ug/kg
EPA 8021B	Solid	Dibromomethane	10. ug/kg
		1,1,1,2-Tetrachloroethane	1. ug/kg
		1,2,3-Trichloropropane	1. ug/kg

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 624	Water	Chloromethane	10. ug/L
		Bromomethane	10. ug/L
		Vinyl Chloride	10. ug/L
		Chloroethane	10. ug/L
		Methylene Chloride	5. ug/L
		Trichlorofluoromethane	5. ug/L
		1,1-Dichloroethene	5. ug/L
		1,1-Dichloroethane	5. ug/L
		cis-1,2-Dichloroethene	5. ug/L
		trans-1,2-Dichloroethene	5. ug/L
		Chloroform	5. ug/L
		1,2-Dichloroethane	5. ug/L
		1,1,1-Trichloroethane	5. ug/L
		Carbon Tetrachloride	5. ug/L
		Bromodichloromethane	5. ug/L
		1,2-Dichloropropane	5. ug/L
		cis-1,3-Dichloropropene	5. ug/L
		Trichloroethene	5. ug/L
		Benzene	5. ug/L
		Dibromochloromethane	5. ug/L
		trans-1,3-Dichloropropene	5. ug/L
		1,1,2-Trichloroethane	5. ug/L
		2-Chloroethylvinyl ether	10. ug/L
		Bromoform	5. ug/L
		Tetrachloroethene	5. ug/L
		1,1,2,2-Tetrachloroethane	5. ug/L
		Toluene	5. ug/L
		Chlorobenzene	5. ug/L
		Ethylbenzene	5. ug/L
		Xylene (total)	5. ug/L
		1,3-Dichlorobenzene	5. ug/L
		1,2-Dichlorobenzene	5. ug/L
		1,4-Dichlorobenzene	5. ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 8260B	Water	Dichlorofluoromethane	1. ug/L
	25 mL purge	Chloromethane	1. ug/L
		Bromomethane	1. ug/L
		Vinyl Chloride	1. ug/L
		Chloroethane	1. ug/L
		Trichlorofluoromethane	1. ug/L
		Methylene Chloride	2. ug/L
		Acetone	10. ug/L
		Carbon Disulfide	.5 ug/L
		1,1-Dichloroethene	.5 ug/L
		1,1-Dichloroethane	.5 ug/L
		cis-1,2-Dichloroethene	.5 ug/L
		trans-1,2-Dichloroethene	.5 ug/L
		Chloroform	.5 ug/L
		1,2-Dichloroethane	.5 ug/L
		2-Butanone	10. ug/L
		1,1,1-Trichloroethane	.5 ug/L
		Carbon Tetrachloride	.5 ug/L
		Vinyl Acetate	2. ug/L
		Bromodichloromethane	.5 ug/L
		1,2-Dichloropropane	.5 ug/L
		cis-1,3-Dichloropropene	.5 ug/L
		Trichloroethene	.5 ug/L
		Dibromochloromethane	.5 ug/L
		1,1,2-Trichloroethane	.5 ug/L
		Benzene	.5 ug/L
		trans-1,3-Dichloropropene	.5 ug/L
		Bromoform	.5 ug/L
		Tetrachloroethene	.5 ug/L
		1,1,2,2-Tetrachloroethane	.5 ug/L
		Toluene	.5 ug/L
		Chlorobenzene	.5 ug/L
		Ethylbenzene	.5 ug/L
		Styrene	.5 ug/L
		4-Methyl-2-pentanone	5. ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
		2-Hexanone	5 ug/L
		2,2-Dichloropropane	.5 ug/L
EPA 8260B	Water	Bromochloromethane	.5 ug/L
	25 mL purge	1,1-Dichloropropene	.5 ug/L
		Dibromomethane	.5 ug/L
		1,2-Dibromoethane	.5 ug/L
		1,3-Dichloropropane	.5 ug/L
		1,1,1,2-Tetrachloroethane	.5 ug/L
		Isopropylbenzene	5 ug/L
		1,2,3-Trichloropropane	.5 ug/L
		Xylene (total)	.5 ug/L
		Bromobenzene	.5 ug/L
		n-Propylbenzene	.5 ug/L
		2-Chlorotoluene	.5 ug/L
		4-Chlorotoluene	.5 ug/L
		1,3,5-Trimethylbenzene	.5 ug/L
		tert-Butylbenzene	.5 ug/L
		1,2,4-Trimethylbenzene	.5 ug/L
		sec-Butylbenzene	.5 ug/L
		1,3-Dichlorobenzene	.5 ug/L
		p-Isopropyltoluene	.5 ug/L
		1,4-Dichlorobenzene	.5 ug/L
		n-Butylbenzene	.5 ug/L
		1,2-Dichlorobenzene	.5 ug/L
		1,2-Dibromo-3-chloropropane	1 ug/L
		1,2,4-Trichlorobenzene	1. ug/L
		Hexachlorobutadiene	1. ug/L
		Naphthalene	1. ug/L
		1,2,3-Trichlorobenzene	1. ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 8260B	Water	Dichlorofluoromethane	5. ug/L
	5 mL purge	Chloromethane	5. ug/L
		Bromomethane	5. ug/L
		Vinyl Chloride	5. ug/L
		Chloroethane	5. ug/L
		Trichlorofluoromethane	5. ug/L
		Methylene Chloride	5. ug/L
		Acetone	10. ug/L
		Carbon Disulfide	2.5 ug/L
		1,1-Dichloroethene	2.5 ug/L
		1,1-Dichloroethane	2.5 ug/L
		cis-1,2-Dichloroethene	2.5 ug/L
		trans-1,2-Dichloroethene	2.5 ug/L
		Chloroform	2.5 ug/L
		1,2-Dichloroethane	2.5 ug/L
		2-Butanone	10. ug/L
		1,1,1-Trichloroethane	2.5 ug/L
		Carbon Tetrachloride	2.5 ug/L
		Vinyl Acetate	5. ug/L
		Bromodichloromethane	2.5 ug/L
		1,2-Dichloropropane	2.5 ug/L
		cis-1,3-Dichloropropene	2.5 ug/L
		Trichloroethene	2.5 ug/L
		Dibromochloromethane	2.5 ug/L
		1,1,2-Trichloroethane	2.5 ug/L
		Benzene	2.5 ug/L
		trans-1,3-Dichloropropene	2.5 ug/L
		Bromoform	2.5 ug/L
		Tetrachloroethene	2.5 ug/L
		1,1,2,2-Tetrachloroethane	2.5 ug/L
		Toluene	2.5 ug/L
		Chlorobenzene	2.5 ug/L
		Ethylbenzene	2.5 ug/L
		Styrene	2.5 ug/L
		4-Methyl-2-pentanone	5. ug/L
		2-Hexanone	5. ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
		2,2-Dichloropropane	2.5 ug/L
EPA 8260B	Water	Bromochloromethane	2.5 ug/L
	5 mL purge	1,1-Dichloropropene	2.5 ug/L
		Dibromomethane	2.5 ug/L
		1,2-Dibromoethane	2.5 ug/L
		1,3-Dichloropropane	2.5 ug/L
		1,1,1,2-Tetrachloroethane	2.5 ug/L
		Isopropylbenzene	2.5 ug/L
		1,2,3-Trichloropropane	2.5 ug/L
		Xylene (total)	2.5 ug/L
		Bromobenzene	2.5 ug/L
		n-Propylbenzene	2.5 ug/L
		2-Chlorotoluene	2.5 ug/L
		4-Chlorotoluene	2.5 ug/L
		1,3,5-Trimethylbenzene	2.5 ug/L
		tert-Butylbenzene	2.5 ug/L
		1,2,4-Trimethylbenzene	2.5 ug/L
		sec-Butylbenzene	2.5 ug/L
		1,3-Dichlorobenzene	2.5 ug/L
		p-Isopropyltoluene	2.5 ug/L
		1,4-Dichlorobenzene	2.5 ug/L
		n-Butylbenzene	2.5 ug/L
		1,2-Dichlorobenzene	2.5 ug/L
		1,2-Dibromo-3-chloropropane	5. ug/L
		1,2,4-Trichlorobenzene	5 ug/L
		Hexachlorobutadiene	5 ug/L
		Naphthalene	5. ug/L
		1,2,3-Trichlorobenzene	5. ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 8260B	Solid	Dichlorofluoromethane	5. ug/kg
		Chloromethane	5. ug/kg
		Bromomethane	5. ug/kg
		Vinyl Chloride	5 ug/kg
		Chloroethane	5. ug/kg
		Trichlorofluoromethane	5. ug/kg
		Methylene Chloride	5. ug/kg
		Acetone	10. ug/kg
		Carbon Disulfide	2.5 ug/kg
		1,1-Dichloroethene	2.5 ug/kg
		1,1-Dichloroethane	2.5 ug/kg
		cis-1,2-Dichloroethene	2.5 ug/kg
		trans-1,2-Dichloroethene	2.5 ug/kg
		Chloroform	2.5 ug/kg
		1,2-Dichloroethane	2.5 ug/kg
		2-Butanone	10. ug/kg
		1,1,1-Trichloroethane	2.5 ug/kg
		Carbon Tetrachloride	2.5 ug/kg
		Vinyl Acetate	5. ug/kg
		Bromodichloromethane	2.5 ug/kg
		1,2-Dichloropropane	2.5 ug/kg
		cis-1,3-Dichloropropene	2.5 ug/kg
		Trichloroethene	2.5 ug/kg
		Dibromochloromethane	2.5 ug/kg
		1,1,2-Trichloroethane	2.5 ug/kg
		Benzene	2.5 ug/kg
		trans-1,3-Dichloropropene	2.5 ug/kg
		Bromoform	2.5 ug/kg
		Tetrachloroethene	2.5 ug/kg
		1,1,2,2-Tetrachloroethane	2.5 ug/kg
		Toluene	2.5 ug/kg
		Chlorobenzene	2.5 ug/kg
		Ethylbenzene	2.5 ug/kg
		Styrene	2.5 ug/kg
		4-Methyl-2-pentanone	5. ug/kg
		2-Hexanone	5. ug/kg

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
		2,2-Dichloropropane	2.5 ug/kg
EPA 8260B	Solid	Bromochloromethane	2.5 ug/kg
		1,1-Dichloropropene	2.5 ug/kg
		Dibromomethane	2.5 ug/kg
		1,2-Dibromoethane	2.5 ug/kg
		1,3-Dichloropropane	2.5 ug/kg
		1,1,1,2-Tetrachloroethane	2.5 ug/kg
		Isopropylbenzene	2.5 ug/kg
		1,2,3-Trichloropropane	2.5 ug/kg
		Xylene (total)	2.5 ug/kg
		Bromobenzene	2.5 ug/kg
		n-Propylbenzene	2.5 ug/kg
		2-Chlorotoluene	2.5 ug/kg
		4-Chlorotoluene	2.5 ug/kg
		1,3,5-Trimethylbenzene	2.5 ug/kg
		tert-Butylbenzene	2.5 ug/kg
		1,2,4-Trimethylbenzene	2.5 ug/kg
		sec-Butylbenzene	2.5 ug/kg
		1,3-Dichlorobenzene	2.5 ug/kg
		p-Isopropyltoluene	2.5 ug/kg
		1,4-Dichlorobenzene	2.5 ug/kg
		n-Butylbenzene	2.5 ug/kg
		1,2-Dichlorobenzene	2.5 ug/kg
		1,2-Dibromo-3-chloropropane	5. ug/kg
		1,2,4-Trichlorobenzene	5. ug/kg
		Hexachlorobutadiene	5. ug/kg
		Naphthalene	5. ug/kg
		1,2,3-Trichlorobenzene	5. ug/kg

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 8021A	Water	Benzene	1. ug/L
(V-PET)		Toluene	1. ug/L
		Ethylbenzene	1. ug/L
		m + p Xylene	1. ug/l
		o - Xylene	1. ug/l
		tert-Methyl butyl ether	10. ug/L
		Gasoline	100. ug/L
		Mineral Spirits	200. ug/L
		#1 Kerosone and/or #2 Fuel	1000. ug/l
EPA 8021A	Solid	Benzene	1. ug/kg
(V-PET)		Toluene	1. ug/kg
		Ethylbenzene	1. ug/kg
		m + p Xylene	1. ug/kg
		o - Xylene	1. ug/kg
		tert-Methyl butyl ether	10. ug/kg
		Gasoline	100. ug/kg
		Mineral Spirits	200. ug/kg
		#1 Kerosene and/or #2 Fuel	1000. ug/kg

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 8270C	Water	Phenol	10. ug/L
		Bis(2-chloroethyl)ether	10. ug/L
		2-Chlorophenol	10. ug/L
		1,3-Dichlorobenzene	10. ug/L
		1,4-Dichlorobenzene	10. ug/L
		Benzyl Alcohol	10. ug/L
		1,2-Dichlorobenzene	10. ug/L
		2-Methylphenol	10. ug/L
		Bis(2-chloroisopropyl)ether	10. ug/L
		4-Methylphenol	10. ug/L
		N-Nitroso-di-n-propylamine	10. ug/L
		Hexachloroethane	10. ug/L
		Nitrobenzene	10. ug/L
		Isophorone	10. ug/L
		2-Nitrophenol	10. ug/L
		2,4-Dimethylphenol	10. ug/L
		Benzoic Acid	50. ug/L
		Bis(2-chloroethoxy)methane	10. ug/L
		2,4-Dichlorophenol	10. ug/L
		1,2,4-Trichlorobenzene	10. ug/L
		Naphthalene	10. ug/L
		4-Chloroaniline	10. ug/L
		Hexachlorobutadiene	10. ug/L
		4-Chloro-3-methylphenol	10. ug/L
		2-Methylnaphthalene	10. ug/L
		Hexachlorocyclopentadiene	10. ug/L
		2,4,6-Trichlorophenol	10. ug/L
		2,4,5-Trichlorophenol	50. ug/L
		2-Chloronaphthalene	10. ug/L
		2-Nitroaniline	50. ug/L
		Dimethylphthalate	10. ug/L
		Acenaphthylene	10. ug/L
		2,6-Dinitrotoluene	10. ug/L
		3-Nitroaniline	50. ug/L
		Acenaphthene	10. ug/L
		2,4-Dinitrophenol	50. ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
		4-Nitrophenol	50. ug/L
EPA 8270C	Water	Dibenzofuran	10. ug/L
		2,4-Dinitrotoluene	10. ug/L
		Diethylphthalate	10. ug/L
		4-Chlorophenyl phenyl ether	10. ug/L
		Fluorene	10. ug/L
		4-Nitroaniline	50. ug/L
		4,6-Dinitro-2-methylphenol	50. ug/L
		N-Nitrosodiphenylamine	10. ug/L
		4-Bromophenyl phenyl ether	10. ug/L
		Hexachlorobenzene	10. ug/L
		Pentachlorophenol	50. ug/L
		Phenanthrene	10. ug/L
		Anthracene	10. ug/L
		Di-n-butylphthalate	10. ug/L
		Fluoranthene	10. ug/L
		Pyrene	10. ug/L
		Butylbenzylphthalate	10. ug/L
		3,3'-Dichlorobenzidine	20. ug/L
		Benzo(a)anthracene	10 ug/L
		Chrysene	10. ug/L
		Bis(2-ethylhexyl)phthalate	10. ug/L
		Di-n-octylphthalate	10. ug/L
		Benzo(b)fluoranthene	10. ug/L
		Benzo(k)fluoranthene	10. ug/L
		Benzo(a)pyrene	10. ug/L
		Indeno(1,2,3-cd)pyrene	10. ug/L
		Dibenz(a,h)anthracene	10. ug/L
		Benzo(g,h,i)perylene	10. ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 625	Water	N-Nitrosodimethylamine	10. ug/L
		Phenol	10. ug/L
		bis (2-Chloroethyl) ether	10. ug/L
		2-Chlorophenol	10. ug/L
		1,3-Dichlorobenzene	10. ug/L
		1,4-Dichlorobenzene	10. ug/L
		1,2-Dichlorobenzene	10. ug/L
		bis (2-Chloroisopropyl) ether	10 ug/L
		N-nitroso-di-n-propylamine	10. ug/L
		Hexachloroethane	10. ug/L
		Nitrobenzene	10. ug/L
		Isophorone	10. ug/L
		2-Nitrophenol	10. ug/L
		2,4-Dimethylphenol	10. ug/L
		bis (2-Chloroethoxy) methane	10. ug/L
		2,4-Dichlorophenol	10. ug/L
		1,2,4-Trichlorobenzene	10. ug/L
		Naphthalene	10. ug/L
		Hexachlorobutadiene	10. ug/L
		4-Chloro-3-methylphenol	10. ug/L
		Hexachlorocyclopentadiene	10. ug/L
		2,4,6-Trichlorophenol	10. ug/L
		2-Chloronaphthalene	10. ug/L
		Dimethylphthalate	10. ug/L
		Acenaphthylene	10 ug/L
		Acenaphthene	10. ug/L
		2,4-Dinitrophenol	50. ug/L
		4-Nitrophenol	50. ug/L
		2,4-Dinitrotoluene	10. ug/L
		2,6-Dinitrotoluene	10. ug/L
		Diethylphthalate	10. ug/L
		4-Chlorophenyl phenylether	10. ug/L
		Fluorene	10. ug/L
		1,2-Diphenylhydrazide	10. ug/L
		4,6-Dinitro-2-methyphenol	50. ug/L
		N-Nitrosodiphenylamine	10. ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
		4-Bromophenyl phenylether	10. ug/L
EPA 625	Water	Hexachlorobenzene	10. ug/L
		Pentachlorophenol	50 ug/L
		Phenanthrene	10 ug/L
		Anthracene	10. ug/L
		Di-n-butylphthalate	10. ug/L
		Fluoranthene	10. ug/L
		Benzidine	50. ug/L
		Pyrene	10. ug/L
		Butyl benzylphthalate	10. ug/L
		3,3'-Dichlorobenzidine	20. ug/L
		Benzo (a) anthracene	10. ug/L
		Bis (2-Ethylhexyl) phthalate	10. ug/L
		Chrysene	10. ug/L
		Di-n-octylphthalate	10. ug/L
		Benzo (b) fluoranthene	10. ug/L
		Benzo (k) fluoranthene	10. ug/L
		Benzo (a) pyrene	10. ug/L
		Indeno (1,2,3-cd) pyrene	10. ug/L
		Dibenzo (a,h) anthracene	10 ug/L
		Benzo (g,h,i) perylene	10. ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 8270C	Solid	Phenol	330. ug/kg
		Bis(2-chloroethyl)ether	330. ug/kg
		2-Chlorophenol	330. ug/kg
		1,3-Dichlorobenzene	330. ug/kg
		1,4-Dichlorobenzene	330. ug/kg
		Benzyl Alcohol	330. ug/kg
		1,2-Dichlorobenzene	330. ug/kg
		2-Methylphenol	330. ug/kg
		Bis(2-chloroisopropyl)ether	330. ug/kg
		4-Methylphenol	330. ug/kg
		N-Nitroso-di-n-propylamine	330. ug/kg
		Hexachloroethane	330. ug/kg
		Nitrobenzene	330. ug/kg
		Isophorone	330. ug/kg
		2-Nitrophenol	330. ug/kg
		2,4-Dimethylphenol	330 ug/kg
		Benzoic Acid	1600. ug/kg
		Bis(2-chloroethoxy)methane	330. ug/kg
		2,4-Dichlorophenol	330. ug/kg
		1,2,4-Trichlorobenzene	330. ug/kg
		Naphthalene	330. ug/kg
		4-Chloroaniline	330. ug/kg
		Hexachlorobutadiene	330. ug/kg
		4-Chloro-3-methylphenol	330. ug/kg
		2-Methylnaphthalene	330. ug/kg
		Hexachlorocyclopentadiene	330. ug/kg
		2,4,6-Trichlorophenol	330. ug/kg
		2,4,5-Trichlorophenol	1600. ug/kg
		2-Chloronaphthalene	330. ug/kg
		2-Nitroaniline	1600. ug/kg
		Dimethylphthalate	330. ug/kg
		Acenaphthylene	330 ug/kg
		2,6-Dinitrotoluene	330. ug/kg
		3-Nitroaniline	1600. ug/kg
		Acenaphthene	330. ug/kg
		2,4-Dinitrophenol	1600. ug/kg

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
		4-Nitrophenol	1600. ug/kg
EPA 8270C	Solid	Dibenzofuran	330. ug/kg
		2,4-Dinitrotoluene	330. ug/kg
		Diethylphthalate	330. ug/kg
		4-Chlorophenyl phenyl ether	330. ug/kg
		Fluorene	330. ug/kg
		4-Nitroaniline	1600. ug/kg
		4,6-Dinitro-2-methylphenol	1600. ug/kg
		N-Nitrosodiphenylamine	330. ug/kg
		4-Bromophenyl phenyl ether	330. ug/kg
		Hexachlorobenzene	330. ug/kg
		Pentachlorophenol	1600. ug/kg
		Phenanthrene	330. ug/kg
		Anthracene	330. ug/kg
		Di-n-butylphthalate	330. ug/kg
		Fluoranthene	330. ug/kg
		Pyrene	330. ug/kg
		Butylbenzylphthalate	330. ug/kg
		3,3'-Dichlorobenzidine	660. ug/kg
		Benzo(a)anthracene	330. ug/kg
		Chrysene	330. ug/kg
		Bis(2-ethylhexyl)phthalate	330. ug/kg
		Di-n-octylphthalate	330. ug/kg
		Benzo(b)fluoranthene	330. ug/kg
		Benzo(k)fluoranthene	330. ug/kg
		Benzo(a)pyrene	330. ug/kg
		Indeno(1,2,3-cd)pyrene	330. ug/kg
		Dibenz(a,h)anthracene	330. ug/kg
		Benzo(g,h,i)perylene	330. ug/kg

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 8081A	Water	alpha-BHC	.05 ug/L
		gamma-BHC	.05 ug/L
		beta-BHC	.05 ug/L
		Heptachlor	.05 ug/L
		delta-BHC	.05 ug/L
		Aldrin	.05 ug/l
		Heptachlor Epoxide	.05 ug/L
		Endosulfan I	.05 ug/L
		4,4'-DDE	.1 ug/L
		Dieldrin	.1 ug/L
		Endrin	.1 ug/L
		4,4'-DDD	.1 ug/L
		Endosulfan II	.1 ug/L
		4,4'-DDT	.1 ug/L
		Endosulfan Sulfate	.1 ug/L
		Endrin Aldehyde	.1 ug/L
		Methoxychlor	.5 ug/L
		alpha-Chlordane	.05 ug/L
		gamma-Chlordane	.05 ug/L
		Toxaphene	.5 ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 608	Water	4,4-DDD	.1 ug/L
		4,4-DDE	.1 ug/L
		4,4-DDT	1 ug/L
		Aldrin	.05 ug/L
		Chlordane	.5 ug/L
		Dieldrin	.1 ug/L
		Endosulfan I	.05 ug/L
		Endosulfan II	.1 ug/L
		Endosulfan Sulfate	.1 ug/L
		Endrin	.1 ug/L
		Endrin Aldehyde	.1 ug/L
		Heptachlor	.05 ug/L
		Heptachlor Epoxide	.05 ug/L
		Lindane	.05 ug/L
		PCB-1016	.5 ug/L
		PCB-1221	.5 ug/L
		PCB-1232	.5 ug/L
		PCB 1242	.5 ug/L
		PCB-1248	.5 ug/L
		PCB-1254	.5 ug/L
		PCB-1260	.5 ug/L
		Toxaphene	1. ug/L
		a-BHC	.05 ug/L
		b-BHC	.05 ug/L
		d-BHC	.05 ug/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 8081A	Solid	alpha-BHC	1.666 ug/kg
		gamma-BHC	1.666 ug/kg
		beta-BHC	1.666 ug/kg
		Heptachlor	1.666 ug/kg
		delta-BHC	1.666 ug/kg
		Aldrin	1.666 ug/kg
		Heptachlor Epoxide	1.666 ug/kg
		Endosulfan I	1.666 ug/kg
		4,4'-DDE	3.33 ug/kg
		Dieldrin	3.33 ug/kg
		Endrin	3.33 ug/kg
		4,4'-DDD	3.33 ug/kg
		Endosulfan II	3.33 ug/kg
		4,4'-DDT	3.33 ug/kg
		Endosulfan Sulfate	3 33 ug/kg
		Endrin Aldehyde	3.33 ug/kg
		Methoxychlor	16.66 ug/kg
		alpha-Chlordane	1.666 ug/kg
		gamma-Chlordane	1.666 ug/kg
		Toxaphene	16.66 ug/kg

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 8082	Water	PCB-1016	.5 ug/L
(PCB Only)		PCB-1221	.5 ug/L
		PCB-1232	.5 ug/L
		PCB-1242	.5 ug/L
		PCB-1248	.5 ug/L
		PCB-1254	.5 ug/L
		PCB-1260	.5 ug/L
EPA 8082	Solid	PCB-1016	16.6 ug/kg
(PCB Only)		PCB-1221	16.6 ug/kg
		PCB-1232	16 6 ug/kg
		PCB-1242	16 6 ug/kg
		PCB-1248	16.6 ug/kg
		PCB-1254	16.6 ug/kg
		PCB-1260	16.6. ug/kg

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
EPA 8151A	Water	Dalapon	50. ug/L
		MCPP	2000. ug/L
		Dicamba	2. ug/L
		MCPA	2000. ug/L
		Dichloroprop	20. ug/L
		2,4-D	20. ug/L
		2,4,5-TP (Silvex)	2. ug/L
		2,4,5-T	2. ug/L
		Dinoseb	10. ug/L
		2,4-DB	20. ug/L
EPA 8151A	Solid	Dalapon	1.67 mg/kg
		MCPP	66.7 mg/kg
		Dicamba	.0667 mgkg
		MCPA	66 7 mg/kg
		Dichloroprop	667 mg/kg
		2,4-D	.667 mg/kg
		2,4,5-TP (Silvex)	.0667 mg/kg
		2,4,5-T	.0667 mg/kg
		Dinoseb	.333 mg/kg
		2,4-DB	.667 mg/kg
EPA 504	Water	EDB	.02 ug/l
EPA 418.1	Water	Total Petroleum Hydrocarbons	1. mg/l
EPA 418.1	Solid	Total Petroleum Hydrocarbons	50. mg/kg
FL-PRO	Water	TRPH	.366 mg/l
EPA 8015	Water	Ethane	.004 mg/l
		Ethene	.004 mg/l
		Methane	.002 mg/l

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
Federal Register, Appendix A to Subpart E, Interim Transmission Electron Microscopy Analytical Methods -Mandatory and Nonmandatory - and Mandatory Section to Determine Completion of Response Actions	Air	TEM	0.005 struc/cc
NIOSH 7402	Air	TEM	0.01 fiber/cc
NIOSH 7400 Federal Register, Appendix A, 29 CFR 1926.58, OSHA Reference Method - Mandatory	Air	PCM	12.7 fibers/mm^2
EPA-600/M4-82-020 ELAP 198.1	Friable	Bulk Asbestos	1. %
ELAP 198.1 ELAP 198.4	Non-friable	Bulk Asbestos	1 %
TCLP Volatiles			
EPA 1311/8260B	Leachate	Vinyl Chloride	.1 mg/L
		1,1-Dichloroethene	.05 mg/L
		Chlorobenzene	.05 mg/L
		1,2-Dichloroethane	.05 mg/L
		Chloroform	.05 mg/L
		Benzene	.05 mg/L
		Trichloroethene	.05 mg/L
		2-Butanone	.1 mg/L
		Tetrachloroethene	.05 mg/L
		Carbon Tetrachloride	.05 mg/L
TCLP Semivolatiles			
EPA 1311/8270C	Leachate	Pyridine	.5 mg/L
		1,4-Dichlorobenzene	.1 mg/L
		2-Methylphenol	.1 mg/L
		(3+4)-Methylphenol	.1 mg/L
		Hexachloroethane	.1 mg/L
		Nitrobenzene	.1 mg/L
		Hexachlorobutadiene	.1 mg/L
		2,4,6-Trichlorophenol	.1 mg/L
		2,4,5-Trichlorophenol	.5 mg/L
		Hexachlorobenzene	.1 mg/L

Table A-1 *Practical Quantitation Limits, Minimum Detectable Concentrations and Methods*

Method #	Matrix	Analyte/Component	PQL
		Pentachlorophenol	.5 mg/L
TCLP Herbicides			
EPA 1311/8151A	Leachate	2,4-D	.1 mg/L
		2,4,5-TP (Silvex)	.01 mg/L
TCLP Pesticides			
EPA 1311/8081A	Leachate	Lindane	.00025 mg/L
		Heptachlor	.00025 mg/L
		Heptachlor Epoxide	.00025 mg/L
		Endrin	.0005 mg/L
		Methoxychlor	.0025 mg/L
		Chlordane	.0025 mg/L
		Toxaphene	.0025 mg/L
TCLP Metals			
EPA 1311/6010B	Leachate	Arsenic	5 mg/L
		Barium	.5 mg/L
		Cadmium	.1 mg/L
		Chromium	.5 mg/L
		Lead	.5 mg/L
		Selenium	.1 mg/L
		Silver	.5 mg/L
EPA 1311/7470A/7471A		Mercury	.02 mg/L

Table A-2 *Minimum Detectable Concentrations**

Method #	Matrix	Analyte/Component	MDC
EPA 900.0	Water	Gross Alpha/Beta	2. pCi/L
EPA 900.0	Solid	Gross Alpha/Beta	5. pCi/g
EPA 904.0	Water	Radium-228	3. pCi/L
EPA 901.1	Solid	Radium-228	.5 pCi/g
EPA 903.0	Water	Radium (total alpha)	3. pCi/L
EPA 905.0	Water	Strontium-90 (total)	2. pCi/L
EPA 905.0	Solid	Strontium-90 (total)	.5 pCi/g
EPA 905.0	Water	Strontium-89,90	2. pCi/L
EPA 905.0	Solid	Strontium-89,90	.5 pCi/g
EPA EERF C-01	Water	Carbon-14	2. pCi/L
EPA EERF C-01	Solid	Carbon-14	5 pCi/g
EPA 908.0	Water	Uranium (total)	5. pCi/L
EPA 908.0	Solid	Uranium (total)	1 pCi/g
EPA 907.0	Water	Uranium-233/234, 235/236, 238	1. pCi/L
EPA 907.0	Solid	Uranium-233/234, 235/236, 238	.4 pCi/g
EPA 907.0	Water	Thorium-228, 230, 232	1. pCi/L
EPA 907.0	Solid	Thorium-228, 230, 232	.4 pCi/g
EPA 907.0	Water	Plutonium-238, 239/240	1. pCi/L
EPA 907.0	Solid	Plutonium-238, 239/240	.4 pCi/g
EPA 907.0	Water	Americium-241	1. pCi/L
EPA 907.0	Solid	Americium-241	.4 pCi/g
	Water	Neptunium-237	1. pCi/L
	Solid	Neptunium-237	.4 pCi/g
EPA 901.1	Water	gamma emitters (MDCsrelative to Cs-137)	10. pCi/L
EPA 901.1	Solid	gamma emitters (MDCsrelative to Cs-137)	.1 pCi/g
EPA 402-R-92-004	Air	Radon-222 (charcoal canisters)	50. pCi/L
EPA 906.0	Water	Hydrogen-3 (tritium)	500 pCi/L
EPA 906.0	Solid	Hydrogen-3 (tritium)	1. pCi/g
EPA 913.0	Water	Radon-222	50. pCi/L
	Water	Technetium-99	20. pCi/L
	Solid	Technetium-99	.2 pCi/g
	Water	Plutonium-241	20. pCi/L
	Solid	Plutonium-241	8. pCi/g
EPA 903.1	Water	Radium-226	1. pCi/L
EPA 901.1	Solid	Radium-226	.3 pCi/g
ASTM D5174-91	Water	Uranium(total)	.8 pCi/L
ASTM D5174-91	Solid	Uranium(total)	.2 pCi/g

***Radiochemistry Detection Levels**

Detection levels associated with radiochemistry analyses are generally expressed as minimum detectable concentrations (MDCs). MDCs are determined on a sample-specific rather than method-specific basis. Therefore, each sample in an analytical batch for a given radiochemistry analysis may have a different detection level.

Furthermore, radiochemistry MDCs may be tailored to the client's contract required detection level (CRDL). That is to say, by varying the sample aliquot size and the counting time for example, a particular client's CRDL may be attained and that MDC may be different than the level commonly reported.

Therefore, it shall be understood that, for radiochemistry analyses, we do not determine nor maintain MDLs in a manner similar to stable chemical analyses.

Unless otherwise specified by the client, radiochemistry MDCs are calculated as follows:

$$MDC = \frac{(3.29 \cdot S_{BKG})}{K} + \frac{2.71}{T_S \cdot K}$$

where: S_{BKG} = Standard deviation of the background count rate
K = 2.22 dpm/pCi • EFF • ALI • REC • ABN • e$^{-\lambda t}$
T_S = Sample count time (minutes)

$$S_{BKG} = \sqrt{\frac{2B_{SD}}{T_S}}$$

where: B_{SD} = Sample detector background count rate
T_S = Sample count time (minutes)

Appendix B

Sample Containers, Preservations and Holding Times

Table B-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
		Organics - Drinking Water			
THM Formation Potential	Bost Round/none	mod. EPA 510.1	14 days to dose, 7 days incubation, 14 days analysis after quenching	250 mL (2)	Cool 4° C, set QC trip blanks in dup.
THM	40 ml vial/Ascorbic Acid	EPA 502.2	14 days from coll.	40 mL (2)	Cool 4° C, set QC trip blanks in dup.
EDB/DBCP	40 ml vial/$Na_2S_2O_3$ 1:1 HCl/Teflon Liner	EPA 504	28 days from coll.	40 mL (3)	Cool 4° C, set QC trip blanks in dup.
Pesticides	Glass Liter/none Teflon Liner	EPA 508	7 days extraction (from coll.) 40 days analysis	1 L	Cool 4° C
Herbicides	Glass Liter/none Teflon Liner	EPA 515.1	7 days extraction (from coll.) 40 days analysis	1 L	Cool 4° C
Volatile Organic Chemicals	40 ml vial/Ascorbic Acid [1:1 HCl, pH<2]	EPA 502.2	14 days from coll.	40 mL (3)	Cool 4° C, set QC trip blanks in dup.
		Organics - Non-potable Water and Hazardous Waste			
Volatiles (water)	40 ml vial/1:1 HCl Teflon Lined Septum	EPA 601/602	14 days from coll.	40 mL (2)	Cool 4° C
		EPA 8010/8020\\8021	14 days from coll.		
		EPA 624	14 days from coll.		
		EPA 8240	14 days from coll.		
		EPA 8260	14 days from coll.	40 mL (3)	
		ASP CLP 95-1	10 days VTSR	40 mL (2)	
		EPA CLP OLM03.2	10 days VTSR		
		ASP CAT A or B (all methods)	10 days VTSR		
Volatiles (solid)	4 oz glass/none Teflon Lined Cap	EPA 8010/8020\\8021	14 days from coll.	Fill with minimal headspace without compaction	Cool 4° C
		EPA 8240	14 days from coll.		
		EPA 8260	14 days from coll.		
		ASP CLP 95-1	10 days VTSR		
		EPA CLP OLM03.2	10 days VTSR		
		ASP CAT A or B (all methods)	10 days VTSR		

Table B-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
AE/BN (water)	Glass Liter/none Teflon Liner	EPA 625	7 days extraction (from coll.) 40 days analysis from extr.	1 L	Cool 4° C
		EPA 8270	7 days extraction (from coll.) 40 days analysis from extr.		
		ASP CLP 95-2	5 days extraction (from VTSR) (start) 40 days analysis (from coll.)		
		EPA CLP OLM03.2	5 days extraction (from VTSR) (start) 40 days analysis (from coll.)		
		ASP CAT A or B (all methods)	5 (7) days extraction (from VTSR) 40 days analysis (from coll.)		
AE/BN (solid)	Sed. Jar/none Teflon Liner	EPA 8270	14 days extraction (from coll.) 40 days analysis from extr.	200 g	Cool 4° C
		ASP CLP 95-2	10 days extraction (from VTSR) (comp.) 40 days analysis from extr.		
		EPA CLP OLM03.2	10 days extraction (from VTSR) (comp.) 40 days analysis from extr.		
		ASP CAT A or B (all methods)	5 (7) days extraction (from VTSR) 40 days analysis from extr.		
Volatile Petroleum Hydrocarbons (water)	40 ml vial/1:1 HCl Teflon Lined Septum	EPA 8021 ASP CAT A or B	14 days from coll. 10 days (from VTSR)	40 mL (2)	Cool 4° C
Volatile Petroleum Hydrocarbons (solid)	4 oz Glass/none Teflon Lined Cap	EPA 8021 ASP CAT A or B	14 days from coll. 10 days (from VTSR)	Fill with minimal headspace without compaction	Cool 4° C
Pesticide/PCB (water)	Glass Liter/none Teflon Liner	EPA 608	7 days extraction (from coll.) 40 days analysis from extr.	1 L	Cool 4° C
		EPA 8080\\8081	7 days extraction (from coll.) 40 days analysis from extr.		
		ASP CLP 95-3	5 days extraction (from VTSR) (start) 40 days analysis from extr.		
		EPA CLP OLM03.2	5 days extraction (from VTSR) (start) 40 days analysis from extr.		
		ASP CAT A or B (all methods)	5 (7) days extraction (from VTSR) 40 days analysis from extr.		

Table B-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
Pesticide/PCB (solid)	Sed. Jar/none Teflon Liner	EPA 8080\\8081	14 days extraction (from coll.) 40 days analysis from extr.	200 g	Cool 4° C
		ASP CLP 95-3	10 days extraction (from VTSR) (comp.) 40 days analysis from extr.		
		EPA CLP OLM03.2	10 days extraction (from VTSR) (comp.) 40 days analysis from extr.		
		ASP CAT A or B (all methods)	5 (7) days extraction (from VTSR) 40 days analysis from extr.		
PCB (oil)	40 ml vial/none Solid Cap	EPA 8080\\8081	14 days extraction (from coll.) 40 days analysis from extr.	5 mL	Cool 4° C
Herbicides (water)	Glass Liter/none Teflon Liner	EPA 8150\\8151	7 days extraction (from coll.) 40 days analysis from extr.	1 L	Cool 4° C
		ASP CAT A or B (all methods)	5 (7) days extraction (from VTSR) 40 days analysis from extr.		
Herbicides (solid)	Sed. Jar/none Teflon Liner	EPA 8150\\8151	14 days extraction (from coll.) 40 days analysis from extr.	200 g	Cool 4° C
		ASP CAT A or B (all methods)	5 (7) days extraction (from VTSR) 40 days analysis from extr.		
PAH (water)	Glass Liter/none Teflon Liner	mod. EPA 8100	7 days extraction (from coll.) 40 days analysis from extr.	1 L	Cool 4° C
PAH (solid)	Sed. Jar/none Teflon Liner	mod. EPA 8100	14 days extraction (from coll.) 40 days analysis from extr.	200 g	Cool 4° C
Petroleum Fingerprint (water)	Glass Liter/none Teflon Liner	NYSDOH 310.13	7 days from coll.	1 L	Cool 4° C
Petroleum Fingerprint (solid)	Sed. Jar/none Teflon Liner	NYSDOH 310.13	14 days from coll.	200 g	Cool 4° C
Alcohols (water)	40 ml vial/none Teflon Liner	mod. EPA 8015	14 days from coll.	40 mL (2)	Cool 4° C
Alcohols (solid)	Sed. Jar/none Teflon Liner	mod. EPA 8015	14 days from coll.	200 g	Cool 4° C
Air - Solvents	Carbon tubes 5 spare for QC and from same Lot #	NIOSH 1501, 1003	Undetermined	1 tube	Freeze

Table B-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
TOX	8 oz. glass/H_2SO_4 Teflon Liner	EPA 9020	28 days from collection	240 mL (2)	Cool 4° C
		Trace Metals			
Trace Metals (water)	P or G/HNO_3 pH < 2	EPA 200 series EPA 6000/7000 series ASP - All methods EPA CLP ILM04.0	6 months from coll. 6 months from coll. 6 months from VTSR 6 months from VTSR	300 mL	Cool 4° C
Trace Metals (solid)	Sed. Jar/none	EPA 6000/7000 series ASP - All methods EPA CLP ILM04.0	6 months from coll. 6 months from VTSR 6 months from VTSR	200 g	Cool 4° C
Mercury (water)	P or G/HNO_3 pH < 2	EPA 245.1 EPA 7470A ASP CLP - All methods EPA CLP ILM04.0	28 days from coll. 28 days from coll. 26 days VTSR 26 days VTSR	300 mL	Cool 4° C
Mercury (solid)	Sed. Jar/none	EPA 7471A ASP CLP - All methods EPA CLP ILM04.0	28 days from coll. 26 days from VTSR 26 days from VTSR	200 g	Cool 4° C
Chromium-Hexavalent (water)	P or G/none	SM3500-Cr-D EPA 7196A	24 hours from coll.	200 mL	Cool 4° C
				100 g	Cool 4° C
		Inorganics - Non-Metallics			
Acidity	P or G/none	EPA 305 1 EPA 305 1 (ASP)	14 days from coll. 12 days from VTSR	100 mL	Cool 4° C
Alkalinity	8 oz. Glass/none Teflon Liner	SM2320B, EPA 310.1 SM2320B, EPA 310.1 (ASP)	14 days from coll. 12 days from VTSR	100 mL	Cool 4° C
Ammonia as N (water)	P or G/1 ml H_2SO_4 pH < 2	EPA 350 1 EPA 350 1 (ASP)	28 days from coll. 26 days from VTSR	400 mL	Cool 4° C
Ammonia as N (solid)	Sed. jar/none	mod. EPA 350.1 mod. EPA 350.1 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C

Table B-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
BOD	P or G/none	EPA 405.1 EPA 405.1 (ASP)	48 hours from coll. 24 hours from VTSR	1000 mL	Cool 4° C
CBOD	P or G/none	EPA 405.1 EPA 405.1 (ASP)	48 hours from coll. 24 hours from VTSR	1000 mL	Cool 4° C
COD (water)	P or G/1 ml H_2SO_4 pH<2	EPA 410.4 EPA 410.4 (ASP)	28 days from coll. 26 days from VTSR	100 mL	Cool 4° C
COD (solid)	Sed. jar/none	mod. EPA 410.4 mod. EPA 410.4 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Chloride (water)	P or G/none	SM4500-Cl-D, EPA 325.2, EPA 9251 ASP - All methods	28 days from coll. 26 days from VTSR	50 mL	Cool 4° C
Chloride (solid)	Sed. jar/none	EPA 9251 EPA 9251 (ASP)	28 days from coll. 26 days from VTSR	50 g	Cool 4° C
Residual chlorine (water)	P or G/none	SM4500-Cl-G, EPA 330.5	Analyze immediately	200 mL	Cool 4° C
Residual chlorine (solid)	Sed. jar/none	mod. EPA 330.5	Analyze immediately	200 g	Cool 4° C
Cyanide (total - water)	Plastic/1 ml NaOH pH > 12 [if res. Cl, then ascorbic acid, NaOH pellets]	EPA 335.2, EPA 335.4 EPA 9010A,EPA 9010B/9014 ASP - All methods EPA CLP ILM04.0	14 days from coll. (24 hrs if S^-) 14 days from coll. (24 hrs if S^-) 12 days from VTSR 12 days from VTSR	500 mL	Cool 4° C
Cyanide (solid)	Sed. jar/none	EPA 9010A,EPA 9010B/9014 ASP - All methods EPA CLP ILM04.0	14 days from coll. 12 days from VTSR 12 days from VTSR	100 g	Cool 4° C
Cyanide - amenable (water)	Plastic/1 ml NaOH pH > 12	EPA 335.1, EPA 9010A EPA 335.1, 9010A (ASP)	14 days from coll. 12 days from VTSR	500 mL	Cool 4° C
Cyanide - amenable (solid)	Sed. jar/none	EPA 9010A,EPA 9010B/9014 EPA 9010A (ASP), EPA 9010B/9014 (ASP)	14 days from coll. 12 days from VTSR	100 g	Cool 4° C
Ethylene Glycol	Glass/HCl pH<2	NYSDOH 310-30	28 days from coll.	20 mL	Cool 4° C
Fluoride (water)	P or G/none	SM4500-F-C, EPA 340.2 ASP - All methods	28 days from coll. 26 days from VTSR	300 mL	Cool 4° C

Table B-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
Fluoride (solid)	Sed. jar/none	mod. EPA 340.2 mod. EPA 340.2 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Kjeldahl nitrogen, total (water)	P or G/1 ml H_2SO_4 pH < 2	EPA 351.2 EPA 351.2 (ASP)	28 days from coll. 26 dyas from VTSR	500 mL	Cool 4° C
Kjeldahl nitrogen, total (solid)	Sed. jar/none	mod. EPA 351.2 mod. EPA 351.2 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Nitrite plus Nitrate (water)	P or G/1 ml H_2SO_4 pH < 2	EPA 353.2 EPA 353.2 (ASP)	28 days from coll. 26 days from VTSR	100 mL	Cool 4° C
Nitrite plus Nitrate (solid)	Sed. jar/none	mod. EPA 353.2 mod. EPA 353.2 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Nitrite (water)	P or G/none	EPA 353.2 EPA 353.2 (ASP)	48 hours from coll. 24 hours from VTSR	100 mL	Cool 4° C
Nitrite (solid)	Sed. jar/none	mod. EPA 353.2 mod. EPA 353.2 (ASP)	48 hours from coll. 24 hours from VTSR	100 g	Cool 4° C
Oil and Grease (water)	Glass Quart/1 ml H_2SO_4 pH < 2; Teflon Liner	EPA 413.1, 9070, 1664 EPA413.1, 9070, 1664 (ASP)	28 days from coll. 26 days from VTSR	1000 mL	Cool 4° C
Oil and Grease (solid)	Sed. jar/none Teflon Liner	EPA 9071 EPA 9071 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Organic Carbon, total	P or G/1 ml H_2SO_4 pH < 2	EPA 415.1, EPA 9060 EPA 415.1, EPA 9060 (ASP)	28 days from coll. 26 days from VTSR	100 mL	Cool 4° C
Orthophosphate (water)	P or G/none Filter immediately	EPA 365.1 EPA 365.1 (ASP)	48 hours from coll. 24 hours from VTSR	100 mL	Cool 4° C
Orthophosphate (solid)	Sed. jar/none	mod. EPA 365.1 mod. EPA 365.1 (ASP)	48 hours from coll. 24 hours from VTSR	100 g	Cool 4° C
Phenols	Glass Quart/1 ml H_2SO_4 Ph < 2; Teflon Liner	EPA 420.1, EPA 9065 EPA 420.1, EPA 9065 (ASP)	28 days from coll. 26 days from VTSR	500 mL	Cool 4° C
Phenols	Sed jar./none Teflon Liner	EPA 9065 EPA 9065 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Total Phosphorous (water)	P or G/1 ml H_2SO_4 pH < 2	EPA 365.4 EPA 365.4 (ASP)	28 days from coll. 26 days from VTSR	500 mL	Cool 4° C

Table B-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
Total Phosphorous (solid)	Sed. jar/none	mod. EPA 365.4 mod. EPA 365.4 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Silica	Plastic only/none	EPA 370.1 EPA 370.1 (ASP)	28 days from coll. 26 days from VTSR	100 mL	Cool 4° C
Sulfate (water)	P or G/none	SM4500-SO4-D, EPA 375.3, 375.4 ASP - All methods	28 days from coll. 26 days from VTSR	100 mL	Cool 4° C
Sulfate (solid)	Sed. jar/none	mod. EPA 375.4 mod. EPA 375.4 (ASP)	28 days from coll. 26 days from VTSR	100 g	Cool 4° C
Sulfide (water)	P or G/1 ml ZnAc+NaOH pH > 9	EPA 376.1 EPA 376.1 (ASP)	7 days from coll. 5 days from VTSR	500 mL	Cool 4° C
Sulfide (solid)	Sed. jar/none	mod. EPA 376.1 mod EPA 376.1 (ASP)	7 days from coll. 5 days from VTSR	100 g	Cool 4° C
Sulfite	P or G/none	EPA 377.1	Analyze Immediately	100 mL	-
Surfactants (MBAS) (water)	P or G/none	EPA 425.1 EPA 425.1 (ASP)	48 hours from coll. 24 hours from VTSR	100 mL	Cool 4° C
Surfactants (MBAS) (solid)	Sed/jar/none	mod. EPA 425.1 mod. EPA 425.1 (ASP)	48 hours from coll. 24 hours from VTSR	100 g	Cool 4° C
Total Petroleum Hydrocarbons (water)	Glass Quart/HCl	EPA 418.1	28 days from coll.	1000 mL	Cool 4° C
Total Petroleum Hydrocarbons (solid)	Sed. jar/none	mod. EPA 418.1	28 days from coll.	200 g	Cool 4° C
		Physical Properties			
Color	Plastic/none	EPA 110.2 EPA 110.2 (ASP)	48 hours from coll. 24 hours from VTSR	100 mL	Cool 4° C
Conductance	Plastic/none	SM2510B, EPA 120.1,9050A SM2510B, EPA 120.1 (ASP)	28 days from coll - filtered 24 hours from coll - unfiltered 26 days from VTSR	100 mL	Cool 4° C

Table B-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
Hardness	Plastic/HNO_3 pH < 2	SM2340B EPA 130.2	6 months from coll.	200 mL	
Odor	Glass/none	EPA 140.1	24 hours from coll.	200 mL	Cool 4° C
pH	P or G/none	EPA 150.1 EPA 9040C & 9045B	Analyze Immediately	100 mL/100 g	-
Residue - Dissolved	Plastic/none	SM2540C, EPA 160.1 SM2540C, EPA 160.1 (ASP)	7 days form coll. 24 hours from VTSR	500 mL	Cool 4° C
Residue - Total	Plastic/none	EPA 160.3 EPA 160.3 (ASP)	7 days from coll. 5 days from VTSR	500 mL	Cool 4° C
Residue - Suspended	Plastic/none	EPA 160.2 EPA 160.2 (ASP)	7 days from coll. 5 days from VTSR	500 mL	Cool 4° C
Residue - Volatile	Plastic/none	EPA 160.4 EPA 160.4 (ASP)	7 days from coll. 5 days from VTSR	500 mL	Cool 4° C
Residue - Settleable	P or G/none	EPA 160.5 EPA 160.5 (ASP)	48 hours from coll. 24 hours from VTSR	1000 mL	Cool 4° C
Turbidity	P or G/none	EPA 180.1 EPA 180.1 (ASP)	48 hours from coll. 24 hours from VTSR	100 mL	Cool 4° C

Characteristic Testing

Table B-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
TCLP	Sed. jar/none Teflon liner	Volatiles	14 days TCLP prep from coll. 14 days analysis from TCLP	200 g	Cool 4° C
	Sed. jar/none Teflon liner (one container for sv & metals)	Semivolatiles	14 days TCLP prep from coll. 7 days extraction from TCLP 40 days analysis from extraction	200 g (one container for sv & metals)	
		Mercury	28 days TCLP prep from coll. 28 days analysis from TCLP		
		Metals	180 days TCLP prep from coll. 180 days analysis from TCLP		
	Sed. jar/none Teflon liner	ASP Volatiles	7 days TCLP prep from VTSR 7 days analysis from TCLP	200 g	
	Sed. jar/none Teflon liner (one container for sv & metals)	ASP Semivolatiles	5 days TCLP prep from VTSR 7 days extraction from TCLP 40 days analysis from extraction	200 g (one container for sv & metals)	
		ASP Mercury	5 days TCLP prep from VTSR 28 days analysis from TCLP		
		ASP Metals	180 days prep extraction from VTSR 180 days analysis from TCLP		
Reactive Cyanide (water)	Plastic/none	SW-846 Ch. 7	Not specified - as soon as possible	500 mL	Cool 4° C
Reactive Cyanide (solid)	Sed. jar/none	SW-846 Ch. 7	Not specified - as soon as possible	100 g	Cool 4° C
Reactive Sulfide (water)	P or G/none	SW-846 Ch. 7	Not specified - as soon as possible	500 mL	Cool 4° C
Reactive Sulfide (solid)	Sed. jar/none	SW-846 Ch. 7	Not specified - as soon as possible	100 g	Cool 4° C
Waste Ignitability (water)	P or G/none	EPA 1010/1030	Not specified - as soon as possible	100 mL	Cool 4° C
Waste Ignitability (solid)	Sed. jar/none	EPA 1010/ASTM	Not specified - as soon as possible	100 g	Cool 4° C
Waste Corrosivity (water)	P or G/none	EPA 1110 EPA 9040B	Not specified - as soon as possible 24 hours	100 mL	Cool 4° C
Waste Corrosivity (solid)	Sed. jar/none	EPA 9045C	24 hours	100 g	Cool 4° C
			Radiological		
Gross Alpha	P or G/HNO_3 pH<2	EPA 900 EPA 9310	6 months	1 L	-
Gross Beta	P or G/HNO_3 pH<2	EPA 900 EPA 9310	6 months	1 L	-

Table B-1 *Sample Containers, Preservations and Holding Times*

Parameter	Container/Pres.	Method Numbers	Holding Time	Volume Required	Comments
Uranium	Plastic/HNO_3 pH<2	SM17th 7500	6 months	1 L	-
		Biological Properties			
Total Coliform & Escherichia Coliform	Plastic 4 oz sterilized/ $Na_2S_2O_3$	SM9222B SM9223 (Colilert)	24 hours	100 mL	Cool 4° C
Fecal Coliform	Plastic 4 oz sterilized/ $Na_2S_2O_3$	SM9222C	6 hours	120 mL	Cool 4° C
Fecal Streptococcus	Plastic 4 oz sterilized/ $Na_2S_2O_3$	SM9230C	6 hours	120 mL	Cool 4° C
Standard Plate Count	Plastic 4 oz sterilized/ $Na_2S_2O_3$	SM9215B	30 hours	120 mL	Cool 4° C
Suitability	Glass autoclave sterilized/none	SM14th 905B paragraph 22	14 days	500 mL	Cool 4° C

Appendix C

Laboratory Standard Operating Procedures

Table C-1 *Laboratory Standard Operating Procedures*

SOP Title	AP #	Rev.
The Toxicity Characteristic Leaching Procedure for Volatile Organic Compounds	100-01	2
Standards- Preparation, Storage and Disposal	100-02	0
Microextractables - EDB and DBCP	100-06	2
Organochlorine Pesticides and PCBs Sample Extraction - Continous Extractor	100-09	4
Organochlorine Pesticides and PCBs Sample Extraction - Continous Extractor	100-09A	1
Organochlorine Pesticides and PCBs Sample Extraction - Sonication	100-12	4
Organochlorine Pesticides and PCBs Sample Extraction - Sonication	100-12A	1
Trace Organics Glassware Cleaning	100-18	2
Petroleum Products in Environmental Matrices by GC FID	100-21	1
Organochlorine Pesticides and Aroclors - USEPA CLP	100-24	2
Extraction of Chlorinated Herbicides - Method 8151A	100-27	1
Organochlorine Pesticides and Aroclors - NYSDEC ASP CLP 91-3	100-33	2
Organochlorine Pesticides and PCBs - Method 608	100-36	1
Chlorinated Herbicides - Method 8150B	100-40	0
Petroleum Hydrocarbon Scan - Continuous Extractor & Sonication	100-43	1
Petroleum Hydrocarbon Scan - Continuous Extractor & Sonication	100-43A	1
Chlorinated Herbicides - Method 8151A	100-46	1
PCBs Sample Extraction - Oil	100-49	1
PCBs Sample Extraction - Surface Area	100-52	1
Organochlorine Pesticides - Method 8081A	100-55A	1
PCBs - Method 8082	100-55B	1
Total Lipid Determination	100-58	0
Method for Determination of Petroleum Range Organics (FL-PRO)	100-61	0
Petroleum Range Organics - FL-PRO - Continous Extractor & Sonication	100-64	0
Waste Dilution	100-67	0
Acidity	200-03	1
Alkalinity (Total, Phenolphthalein, Carbonate, Bicarbonate, and Hydroxide)	200-06	3
Balance	200-09	2
Biochemical Oxygen Demand	200-12	2
Chemical Oxygen Demand (COD)	200-18	1
Chloride	200-21	1

Table C-1 *Laboratory Standard Operating Procedures*

SOP Title	AP #	Rev.
Chlorine, Residual and Free	200-24	2
Chromium-Hexavalent	200-27	2
Color	200-30	2
Total Cyanide - Method 335.2/SM4500-CN-E	200-33	2
Total Cyanide - Method 9010A	200-34	3
Total Cyanide - Method 335.2 CLP-M	200-35	3
Dissolved Oxygen (Winkler Azide Modification)	200-36	1
Deionized Water Production	200-37	0
Flashpoint	200-39	2
Ignitability of Solids	200-40	0
Fluoride	200-42	2
Formaldehyde	200-45	1
Ammonia	200-48	4
Ammonia (Low Level)	200-49	0
Methylene Blue Active Substances (MBAS)	200-54	2
Nitrite Nitrogen	200-57	2
Nitrate-Nitrite Nitrogen	200-60	3
Ethylene Glycol	200-63	1
Odor	200-66	2
Oil and Grease	200-69	2
Orthophosphate	200-72	3
pH	200-75	4
Petroleum Hydrocarbons in Environmental Matrices by Infrared Spectroscopy	200-78	2
Total and Volatile Solids in Solid and Semisolid Samples	200-81	2
Phenol	200-84	2
Reactivity	200-87	2
Reactivity	200-87A	1
Paint Filter Liquids Test - Method 9095A	200-88	0
Specific Gravity	200-90	2
Silica	200-93	2
Settable Matter	200-96	2

Table C-1 *Laboratory Standard Operating Procedures*

SOP Title	AP #	Rev.
Specific Conductance	200-99	5
Total and Volatile Suspended Solids	200-102	3
Sulfate	200-105	1
Sulfate, Turbidimetric	200-106	2
Sulfite	200-108	2
Sulfide	200-111	3
Total Kjeldahl Nitrogen	200-114	4
Digestion Procedure for TKN and TP	200-115	1
Total Organic Carbon	200-117	4
Total Phosphorus	200-120	3
Turbidity	200-123	2
Total and Volatile Dissolved Solids	200-126	3
Total and Volatile Solids	200-129	2
Bacteria - Colilert	200-132	1
Cyanide Amenable to Chlorination/Free Cyanide	200-135	1
Total Coliform - Membrane Filter Procedure	200-138	0
Fecal Coliform - Membrane Filter Procedure	200-141	0
Hardness - Titrimetric, EDTA	200-147	0
Volatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) - Method 624	300-03	3
Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) - Method 8270C	300-12A	2
Semivolatile Organic Compounds by Gas/Chromatography/Mass Spectrometry (GC/MS) Sample Extraction - Continous Extractor	300-15	4
Semivolatile Organic Compounds by Gas/Chromatography/Mass Spectrometry (GC/MS) Sample Extraction - Continous Extractor	300-15A	2
Semivolatile Organic Compounds by Gas/Chromatography/Mass Spectrometry (GC/MS) Sample Extraction - Sonication	300-18	4
Semivolatile Organic Compounds by Gas/Chromatography/Mass Spectrometry (GC/MS) Sample Extraction - Sonication	300-18A	1
Volatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS) - Method 8260B	300-27A	2
Volatile Organics by Gas Chromatography/Mass Spectromtry (GC/MS) - Method NYSDEC 95-1	300-30	4

Table C-1 *Laboratory Standard Operating Procedures*

SOP Title	AP #	Rev.
Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS) - Method 625	300-33	2
Semivolatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS) - Method NYSDEC 95-2	300-36	3
Volatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS) - Method USEPA-CLP	300-39	3
Semivolatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS) - Method USEPA-CLP	300-41	3
Low-Level Volatile Organics by Gas Chromatography/Mass Spectrometry (GC/MS) - Method OLC02.1	300-44	0
Furnace Atomic Absorption (NYSASP Superfund CLP))	400-03	6
Furnace Atomic Absorption (SW-846)	400-06	6
Trace Metals Sample Preparation (NYSASP and USEPA Superfund CLP)	400-09	6
ICP Atomic Emission (NYSASP Superfund CLP)	400-12	5
ICP Atomic Emission - Method 6010B	400-15A	2
Cold Vapor Mercury (NYSASP Superfund CLP)	400-18	5
Cold Vapor Mercury - Methods 7470A and 7471A	400-21	5
Trace Metals Sample Preparation (SW-846 Methods 3005A, 3010A, 3020A and 3050A)	400-24	5
Trace Metals Sample Preparation (SW-846 Methods 3005A, 3010A, 3020A and 3050B)	400-24A	1
Filtering	400-30	2
Jaw Crushing	400-33	1
Trace Metals Air Sample Preparation	400-36	1
Toxicity Characteristic Leaching Procedure (TCLP) - Non-Volatiles	400-39	1
Trace Metals Glassware Cleaning	400-41	1
Turbidity for Trace Metals Drinking Waters	400-53	0
Furnace Atomic Absorption (USEPA Superfund CLP)	400-56	2
ASTM - Shake Extraction of Solid Waste with Water	400-59	1
Synthetic Precipitation Leaching Procedure (SPLP) - Non-Volatiles	400-62	1
ICP Atomic Emission (Superfund CLP)	400-65	2
Cold Vapor Mercury (USEPA - Superfund CLP)	400-68	2
Preparation of Biota Samples for Trace Metals Analysis	400-71	0
Procedure for the Analysis of Volatile Halogenated and Aromatic Hydrocarbons by Purge and Trap/GC - Methods 601/602	500-04	3

Table C-1 *Laboratory Standard Operating Procedures*

SOP Title	AP #	Rev.
Procedure for the Analysis of Volatile Organic Compounds in Water by Purge & Trap/GC. Capillary Column Gas Chromatography with Photoionization and Electrolytic ConductivityDetectors in series. EPA Method 502.2	500-07	1
Procedure for the Analysis of Volatile Halogenated and Aromatic Hydrocarbons by Purge & Trap/GC - EPA Method 8021B	500-24	1
The Acquisition, Preparation, and Use of Standard Reference Materials	600-02	0
Sample Preparation Procedures	600-10	0
Calibration of Low-Background Alpha/Beta Proportional Counters	600-20	0
Calibration of Gamma Spectrometers	600-21	0
Calibration of Alpha Spectrometers	600-22	0
Calibration of Liquid Scintillation Counters	600-23	0
Calibration of Lucas Cell Counters	600-24	0
Determination of Gross Alpha/Beta Activity	600-30	0
Determination of Gross Alpha Radium Activity in Aqueous Samples	600-31	0
Determination of Total Alpha Radium Activity in Aqueous Samples	600-32	0
Determination of Radium-228 Activity in Aqueous Samples	600-33	0
Determination of Strontium-89/90 Activity	600-35	0
Determination of Carbon-14 Activity	600-38	0
Determination of Total Uranium Activity	600-39	0
Determination of Gamma Emitting Isotopes	600-50	0
Determination of Radon-222 Activity in Charcoal Canisters	600-52	0
Determination of Selected Actinide Activities - Ion Exchange Separation	600-60	0
Determination of Radium-226 Activity by Alpha Spectrometry	600-64	0
Determination of Polonium-210 Activity -Galvanic Deposition	600-66	0
Determination of Radon-222 in Aqueous Samples	600-76	0
Determination of Radium-226 Activity in Aqueous Samples	600-80	0
Sequential Determination of Radium-226 and Radium-228 Activity in Aqueous Samples	600-81	0
Determination of Total Uranium Activity - KPA Method	600-90	0
Airborne Asbestos Analysis by Transmission Electron Microscopy	650-01	5
Airborne Asbestos Filter Preparation for Transmission Electron Microscopy Analysis	650-04	5
Non-Friable Organically Bound Materials	650-07	4

Table C-1 *Laboratory Standard Operating Procedures*

SOP Title	AP #	Rev.
Airborne Asbestos by Phase Contrast Microscopy	650-10	5
Asbestos Identification in Bulk Samples	650-13	9
Asbestos by TEM - NIOSH Method 7402	650-19	0
Preparation of Analytical Standard Operating Procedures	800-01	2
Preparation of Administrative Standard Operating Procedures	800-02	0
Document Control	800-03	0
Training	800-05	2
Corrective Action	800-06	0
Complaint Resolution	800-07	0
Non-Conformance/Supply Verification	800-08	0
Evaluation of Quality Control Data	800-09	0
Generating Control Limits	800-10	2
Generating Quality Control Charts	800-13	1
Sample Management System	800-15	4
Sample Tracking System	800-16	0
Disk Deliverable - BEM/IRPIMS 3.0	800-18	0
Disk Deliverable - GIS	800-21	0
Software Validation	800-22	0
LIMS Modification - Verification	800-23	0
Additional Procedures for the Analysis of North Carolina Samples	800-25	0
Method Detection Limits	800-26	0
Thermometer Calibration	800-27	0
Laboratory Hazardous Waste Management System	800-31	0
Classification and Handling Protocols for Radioactive Samples	800-32	0
Preparation of Laboratory Data Reports	800-33	0
Internal Review of Laboratory Data	800-36	0
SW-846 Update III Low/High Level Soil Field Preservation Container Kit	800-39	0

Appendix D

Order of Data Package Deliverables

ORDER OF DATA PACKAGE DELIVERABLES

SAMPLE DATA SUMMARY PACKAGE

All non-CLP results (analytical and quality control) must be entered into the LIMS and LIMS forms submitted with the package.
CLP refers to both EPA and ASP Superfund.

NYSDEC Data Package Summary Forms (Superfund/Cat B)

Narrative

Cross Reference Table (not required if NYSDEC forms are used)

Analytical Results (CLP FORM 1) (in order of sample number by fraction)(include confirmation)

Quality Control Results

Organic Surrogate results (CLP FORM 2) (by fraction) (not required if on LIMS)
MS/MSD (CLP FORM 3 or 5 & 6)
Matrix Spike Blank/Prep Blank Spike (by fraction)
LCS (by fraction)
Prep Blanks (CLP FORM 4 and CLP FORM 1 or CLP FORM 3)
GC/MS Internal Standards (CLP FORM 8)

Laboratory Corrective Action Logs

Chain of Custody

External Chain of Custody (by date received)
Client chain of custody
Case File Form
Sample Control Record
Airbill

Internal Chain of Custody (by fraction)

Record of Communication (where applicable)

SAMPLE DATA PACKAGE

Narrative

Cross Reference Table (not required if NYSDEC forms used)

NYSDEC Data Package Summary Forms (Cat B)

SECTION 1 GC/MS Volatile Data

QC SUMMARY:

Surrogate results (CLP only or if required)
MS/MSD
Matrix spike blank (if required)
LCS
Prep Blanks (CLP FORM 4)
Tune (CLP FORM 5) (CLP only or if required)
Internal Standards
MDLs/IDLs

RAW DATA:

SAMPLE DATA
Sample results and sample raw data
STANDARDS DATA
Initial Calibrations
Continuing Calibrations
Internal Standards
RAW QC DATA
Tune Raw Data
Prep Blanks
Matrix Spike Blank
Matrix Spike
Matrix Spike Duplicate
LCS
LABORATORY WORKSHEETS
Example Calculations
Extraction Log
Injection Log
Standards Log

SECTION 2 GC/MS Semivolatile Data

QC SUMMARY:
Surrogate results (CLP only or if required)
MS/MSD
Matrix spike blank (if required)
LCS
Prep Blanks (CLP FORM 4)
Tune (CLP FORM 5) (CLP only or if required)
Internal Standards
MDLs/IDLs
RAW DATA:
SAMPLE DATA
Sample results and sample raw data
STANDARDS DATA
Initial Calibrations
Continuing Calibrations
GPC UV Trace (CLP only)
Internal Standards
RAW QC DATA
Tune Raw Data
Prep Blanks
Matrix Spike Blank
Matrix Spike
Matrix Spike Duplicate
LCS
LABORATORY WORKSHEETS
Example Calculations
Extraction Log
GPC Log
GPC UV Trace (non-CLP)

Injection Log
Standards Log

SECTION 3 Pesticide/PCB Data

QC SUMMARY:
- *Surrogate results (CLP only or if required)*
- *MS/MSD*
- *Matrix spike blank (if required)*
- *LCS*
- *Prep Blanks*
- *MDLs/IDLs*

RAW DATA:
- SAMPLE DATA
  - *Sample results and sample raw data (primary and conf.)*
- STANDARDS DATA
  - *PEM Summary*
  - *Retention Time Windows*
    - *Initial*
    - *Daily*
  - *DCBP/TCMX Shift (if required)*
  - *Initial Calibrations (primary and conf.)*
    - *Initial Cal Summary & Plots*
    - *Chromatograms (PEM and standards)*
  - *Continuing Calibrations (primary and conf.)*
    - *Cont Cal Summary*
    - *Chromatograms*
  - *GPC UV Trace (CLP only)*
- RAW QC DATA
  - *Prep Blanks*
  - *Matrix Spike Blank*
  - *Matrix Spike*
  - *Matrix Spike Duplicate*
  - *LCS*
- LABORATORY WORKSHEETS
  - *Example Calculations*
  - *Extraction Log*
  - *GPC Log*
  - *GPC UV Trace (non-CLP)*
  - *Injection Log*
  - *Standards Log*

SECTION 4 GC Organic Data

QC SUMMARY:
- *Surrogate results (if required)*
- *MS/MSD*
- *Matrix spike blank (if required)*
- *LCS*
- *Prep Blanks*
- *MDLs/IDLs*

RAW DATA:

SAMPLE DATA
- *Sample results and sample raw data (primary and conf.)*

STANDARDS DATA
- *Retention Time Windows*
  - *Initial*
  - *Daily (if requested)*
- *Initial Calibrations (primary and conf.)*
  - *Initial Cal Summary & Plots*
  - *Chromatograms*
- *Continuing Calibrations (primary and conf.)*
  - *Cont Cal Summary*
  - *Chromatograms*

RAW QC DATA
- *Prep Blanks*
- *Matrix Spike Blank*
- *Matrix Spike*
- *Matrix Spike Duplicate*
- *LCS*

LABORATORY WORKSHEETS
- *Example Calculations*
- *Extraction Log*
- *Injection Log*
- *Standards Log*

SECTION 5 Trace Metals Data

ANALYTICAL RESULTS

QC SUMMARY: (LIMS or WARDS)
- *Initial and Continuing Calibration Verification Summary*
- *CRDL Summary (CLP only)*
- *Initial and Continuing Calibration Blank Summary*
- *Prep Blank*
- *ICP Interference Check Sample Summary*
- *Matrix Spike Recovery*
- *Post Digestion Spike Recovery (CLP only)*
- *Duplicates*
- *Matrix Spike Blank*
- *LCS Summary*
- *MSA Summary (CLP only)*
- *ICP Serial Dilution*
- *MDLs/IDLs*
- *Interelement Correction Factors (CLP only)*
- *Linear Range*
- *Preparation Log (Form 13) (CLP only)*
- *Analysis Run Log (Form 14) (CLP only)*

RAW DATA:
- *ICP Raw Data (by date)*
- *Furnace Raw Data (by element, in date order)*
- *Mercury Raw Data*
- *Cyanide Raw Data (if applicable (ASP/CLP))*

ORDER OF DATA PACKAGE DELIVERABLES

LABORATORY WORKSHEETS
Digestion Log (by method/by date)
Standards Log

SECTION 6 Wet Chemistry Data
ANALYTICAL RESULTS
QC SUMMARY:
Initial and Continuing Calibration Verification/Blank Summary
Prep Blank
Matrix Spike Recovery
Duplicate
LCS Summary
MDLs
RAW DATA:
LABORATORY WORKSHEETS
Analytical Runs (by parameter in alphabetical order by date)
include if applicable:
instrument printouts
copy of curves

Use CLP Forms or LIMS.

Each volume should be preceded by a Cover Page and a Table of Contents.

Items in **BOLD** should be included in the Table of Contents. Number the sections consecutively. If a fraction is not required, skip it and use that section number for the next fraction.

Not all items are required for all reports (i.e. NYSDEC Data Package Summary Forms, matrix spike blank). Include items that are required in the order specified.

NYSDEC forms should be typed on WordPerfect tables available on the H:/ drive.

Individual sections of reports consist of raw data in format specified, internal case narrative (on G drive), corrective action logs, and NYSDEC forms (if applicable).

All items in **bold** in the Sample Data Summary Package (starting with **Analytical Results**) and all items in CAPS in the Sample Data Package should have dividers.

In one volume reports there is no separation of summary and data packages.

For level II reports, just include the sample data summary package information, in the proper order. Narratives are not required. Corrective action logs should be included.

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Appendix E

State Certifications

***Table E-1** State Certifications*

State Agency	Cert. No.	Category*							Comments
		WS	WP	HW	SW	M	R	A	
Connecticut	PH0634	X	X	X	X				
Florida	E87280	X	X	X					
Maryland	239	X							Drinking Water certification only
Massachusetts	NY034	X	X				X		Hazardous/Solid Waste certification not available
Michigan		X							Drinking Water certification only
New Jersey	73361	X	X	X	X				
New York	10155	X	X	X	X	X	X	X	
North Carolina	315	X	X						Hazardous/Solid Waste certification not available
Pennsylvania	68-285	X						X	Drinking Water certification only
South Carolina	91007	X	X	X	X				
Utah	3154370200		X	X	X				
Tennessee	02942	X							Drinking Water certification only
Virginia	00244	X					X		Drinking Water certification only

***Samples for additional states have been analyzed, and may be analyzed in the future via reciprocity.**

WS=Water Supply, WP=Water Pollution, HW=Hazardous Waste, SW=Solid Waste, M=Microbiological, R=Radiochemistry, A=Asbestos

Report

Health & Safety Plan

Revere Smelting and Refining Site
Middletown, New York

July 2001

O'BRIEN & GERE
ENGINEERS, INC.

10653/26408

Report

Health & Safety Plan

Revere Smelting and Refining Site
Middletown, New York

James R. Heckathorne, P.E.
Vice President

July 2001

O'BRIEN & GERE
ENGINEERS, INC.

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1. Introduction

1.1. Purpose and requirements

This health and safety plan establishes mandatory safety practices and procedures to be followed during completion of the remedial investigation. This plan assigns responsibilities, establishes standard operating procedures, sets personnel protection standards and provides for contingencies that may arise while investigation activities are being conducted at the Revere Smelting and Refining site.

This HASP is specifically intended for guiding the conduct of O'Brien & Gere activities defined in the Work Plan in the areas of the Revere Smelting and Refining site specified for these work activities. Although this HASP can be made available to interested persons for informational purposes, O'Brien & Gere does not assume responsibility for the interpretations or activities of any persons or entities other than employees of O'Brien & Gere.

1.2. Site description

The Revere Smelting and Refining site is located at 65 Ballard Road in Middletown, New York. Lead smelting and refining operations are presently and have historically been performed at the site. The site is bordered by Ballard Road to the west, wetlands to the east and north, and a railroad right of way to the south.

1.3. Scope of work

Investigation tasks to be conducted at the site include:

- Movement and covering of existing soil piles, some of which are potentially contaminated with heavy metals including lead, antimony, arsenic, and cadmium.
- Collection of surface soil and sediment samples.
- Completion of test pits and soil boring and collection of subsurface soil samples.

- Collection of ground water samples
- Site reconnaissance and fish and wildlife survey.

1.4. Implementation of Health and Safety Plan

The requirements and guidelines presented in this HASP are based on a review of available information and an evaluation of potential on-site hazards. This HASP incorporates by reference the applicable Occupational Safety and Health Administration (OSHA) requirements in 29 CFR Part 1910 and 29 CFR Part 1926. The protective equipment selection was made according to Subpart I of 29 CFR 1910. O'Brien & Gere personnel are required to read this HASP before beginning work on site. This HASP will be available for inspection and review by O'Brien & Gere employees while work activities are underway.

When conducting the site investigation activities listed in the Work Plan, O'Brien & Gere personnel will comply with this HASP. On-site O'Brien & Gere personnel will notify the O'Brien & Gere Site Safety and Health Coordinator (SSHC) of matters of health and safety. The SSHC is responsible to the Project Manager for monitoring activities, monitoring compliance with the provisions of this HASP, and for modifying this HASP to the extent necessary if site conditions change.

1.5. Project team organization

All personnel involved in the activities at Revere Smelting and Refining Site implicitly have a part in implementing the HASP. Among them, the Project Officer, the Project Manager, the Corporate Associate for Safety and Health, the SSHC, and the Site Supervisor have specifically designated responsibilities. Their names and telephone numbers are listed in Table 1-1. Other key O'Brien & Gere project personnel, the project's organization, and other primary contacts for the project are presented in the Work Plan.

Key project personnel and their responsibilities with regard to the sampling activities are discussed below.

Project Officer

James R. Heckathorne, P.E., is the Project Officer. The Project Officer is responsible for the overall administration and technical execution of the project. The Project Officer is further responsible for the acquisition and delegation of resources necessary for project completion and HASP implementation.

Project Manager

Deborah Wright is the Project Manager. The Project Manager reports to the Project Officer and is directly responsible for the technical progress and financial control of the project.

Associate for Safety and Health

Mr. Saunders E. Wilson, Jr., CIH, CSP, is the Corporate Associate for Safety and Health. Mr. Wilson will be responsible for implementation of this HASP. Mr. Wilson must approve procedural changes and modifications to this HASP.

Site Safety and Health Coordinator

The O'Brien & Gere Site Safety and Health Coordinator (SSHC) for this investigation will be designated by the O'Brien & Gere project manager. The SSHC for O'Brien & Gere employees reports to the O'Brien & Gere Project Manager, coordinates his activities with the O'Brien & Gere Associate for Safety and Health and establishes operating standards and coordinates overall project safety and health activities for the site. The SSHC reviews project plans and revisions to plans to determine that safety and health procedures are maintained throughout the investigation. The SSHC audits the effectiveness of the HASP on a continuing basis and suggests changes, if necessary, to the Project Manager.

Table 1-1 ***Project*** *personnel.*

Name and Title	***Telephone***
James R. Heckathorne, P.E. Project Officer Syracuse, New York	(315) 437-6100
Deborah Y. Wright, CPG Project Manager Syracuse, New York	(315) 437-6100
Saunders E. Wilson, Jr., C.I.H., C.S.P. Associate for Safety and Health Syracuse, New York	(315) 437-6100 (315) 420-0554
Site Safety & Health Coordinator Syracuse, New York	(315) 437-6100
NYSDEC Key Personnel	
Kevin Carpenter, P.E. Project Manager Albany, New York	(518) 457-3376

Specifically, the SSHC is responsible for the conducting the following actions:

- Provide a complete copy of the HASP at the site before the start of activities;
- Familiarize workers with the HASP;

- Conduct on-site health and safety training and briefing sessions;
- Document the availability, use, and maintenance of personal protective and other safety or health equipment;
- Maintain safety awareness among O'Brien & Gere employees onsite and communicating safety and health matters to them;
- Review field activities for performance in a manner consistent with O'Brien & Gere policy and this HASP;
- Monitor health and safety conditions during field activities;
- Coordinate with emergency response personnel and medical support facilities;
- Notify the Project Manager of the need to initiate corrective actions in the event of an emergency, an accident, or identification of a potentially unsafe condition;
- Notify the Project Manager of an emergency, an accident, the presence of a potentially unsafe condition, a health or safety problem encountered, or an exception to this HASP;
- Recommend improvements in safety and health measures to the Project Manager; and,
- Conduct safety and health performance and system audits.
- The SSHC has the authority to recommend that the Project Manager take the following actions:
- Suspend field activities or otherwise limit exposures if the health or safety of any O'Brien & Gere employee appears to be endangered;
- Notify O'Brien & Gere personnel to alter work practices that the SSHC deems to not protect them; and,
- Suspend an O'Brien & Gere employee from field activities for violating the requirements of this HASP.

Site Supervisor

The Site Supervisor, designated by the O'Brien & Gere project manager, will be responsible for the implementation of sampling programs. The site supervisor will be responsible for overall site coordination including field sampling collection and chain-of-custody. The Site Supervisor will report directly to the Project Manager or designee.

2. Hazard analysis

General site chemical, physical and environmental hazards are summarized in Section 2.1. Specific health and safety considerations for field tasks detailed in the RI/FS are presented in separate subsections as outlined below:

- site reconnaissance, mobilizations and observation (Section 2.2.1)
- soil boring field activities (Section 2.2.2)
- surface soil sampling (Section 2.2.3)
- sediment sampling (Section 2.2.4)
- installing test pits (Section 2.2.5)
- ground water field activities (Section 2.2.6)

In addition to the safety hazards specific to the tasks cited above, hazards associated with the operation of vehicles, working near water, and boating will be a concern. Of particular concern during the operation of support vehicles is the backing up of trucks and boat trailers. The hazards associated with working over or near water are discussed in section 2.2.5. Both the potential health and safety hazards and the hazard and contaminant control procedures for each task of the RI/FS are discussed in the sections below.

2.1. General hazards

2.1.1. Chemical Hazards

Soil and water potentially containing lead, arsenic, antimony, and cadmium may be encountered while conducting construction activities at the site.

2.1.2. Environmental Hazards

Environmental hazards, in addition to site contaminants, include site fauna and flora. Aggressive fauna, such as ticks, fleas, mosquitoes, bees, wasps, spiders and snakes may be present at the site. Poison ivy and poison oak may also be present.

2.1.3. Physical Hazards

Physical Hazards involved with field activities are primarily associated with the site environment. Weather related hazard include wet, muddy, slick, walking surfaces and unstable soil, sunburn, lightning, rain, snow, ice, and heat and cold related illnesses. There exists a potential for

incidents involving personnel struck by or struck against objects resulting in fractures, cuts, punctures, or abrasions.

Materials handling and manual site preparation may cause blisters, sore muscles, and joint and skeletal injuries; and may present eye, contusion and laceration hazards. A common type of accident that occurs in material handling operations is the "caught between" situation when a load is being handled and a finger or toe gets caught between two objects. Extreme care must be taken when loading and unloading material. Proper lifting technique must be employed.

The work area presents hazards of slips, trips, and falls from scattered debris and irregular walking surfaces. Working surfaces that are slippery can increase the likelihood of back injuries and overexertion injuries. Walking and working surfaces during activities may involve slip, trip, and fall hazards All personnel should frequently inspect working surfaces and keep working surfaces clear of debris and moisture.

2.1.4. Heat stress

General:
The use of protective equipment, if required, may create heat stress. Monitoring of personnel wearing personal protective clothing should commence when the ambient temperature is 70° F or above. Monitoring frequency should increase as ambient temperature increases or as slow recovery rates are observed. A person who is trained to recognize heat stress symptoms should perform heat stress monitoring.

Monitoring
For monitoring the body's recuperative abilities, one or more of the following techniques will be used. Other methods for heat stress monitoring, such as the wet bulb globe temperature (WBGT) Index from the American Conference of Governmental Industrial Hygienists (ACGIH) TLV Booklet can be used. To monitor the worker, measure:

Heart Rate: Count the radial pulse during a 30-second period as early as possible in the rest period.

- If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.

- If the heart rate still exceeds 110 beats per minute at the beginning of the next rest period, shorten the following work cycle by one third.

Oral temperature: Use a clinical thermometer or similar device for three minutes under the tongue to measure the oral temperature at the end of the work period. Measure before drinking.

- Do not permit a worker to remain in a semi-permeable or impermeable garment when the worker's oral temperature exceeds 100.6°F (38.1°C)

- If the oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one third without changing the rest period.

- If the oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following work cycle by one third.

Prevention

Proper training and preventive measures will aid in averting loss of worker productivity and serious illness. Heat stress prevention is of particular importance because once a person suffers from heat stroke or heat exhaustion, that person is more susceptible to additional heat related illness. To avoid heat stress, the following steps should be taken.

- Adjust work schedules
- Mandate work slowdowns as needed
- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.
- Provide shelter (air conditioned if possible) or shaded areas to protect personnel during rest periods.
- Maintain workers' body fluid at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must equal the amount of water lost in sweat. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace that lost in sweat. When heavy sweating occurs, require workers to increase drinking levels.
- Use the following strategy:
    - Maintain water temperature between 50° and 60° F (10° to 16° C)
    - Provide small individual cups that hold about four ounces of fluid
    - Require workers to drink 4 cups (16 ounces) of fluid before beginning work.
    - Require workers to drink two cups every 20 minutes and at each monitoring break.
    - Require workers to drink at least 42 cups (168 ounces) of fluid per day. More fluid may be necessary to maintain body weight.
- Train workers to recognize the symptoms of heat related illness in themselves and in co-workers.

2.1.5. Work near heavy equipment

Precaution should be taken when working near heavy equipment. Heavy equipment machines include, but are not limited to, tractors, drilling rigs, front-end loaders, bulldozers, compacting rollers, and backhoes. Not included are vehicles, trucks, and tractor-trailers.

- Machine Inspection

  All vehicles in use shall be checked at the beginning of each shift to assure that the following parts, equipment, and accessories are in safe operating condition and free of apparent damage.

  1) Seat Belts are provided on equipment (and used by operators);
  2) Fire Extinguishers (Class A/B/C, 5 lb. or greater) must be on each machine;
  3) Brakes - service brakes, parking/hand brake; emergency stopping brakes;
  4) Signal Devices - lights, reflectors, horn, backup alarm. Backup alarms are required for all heavy equipment.
  5) Tires - proper inflation, tread is acceptable,
  6) Cabs - no broken or cracked glass
  7) Kill switches - must be in working order

- General Machine Safety

  1) Inspect each machine prior to operation on each shift.
  2) Ensure that the manufacturer's operating instructions are in each machine and that safe operating guidelines are followed.
  3) Operators are responsible to ensure that the travel direction and work area is clear of other site personnel or obstructions. For rotating equipment with counterweights, this includes keeping the counterweight area clear.
  4) Operators shall use seatbelts when provided by the manufacturer.
  5) No employee shall ride on any load, in bucket, or on part of machinery not designed for personnel.
  6) Machines shall be equipped with Rollover Protective Structures (ROPS) and Falling Object Protective Structures (FOPS), except for equipment where machines are capable of 360 degree rotation.
  7) Ensure that the guarding is in place at all times the machine is in operation.
  8) Before the operator leaves the machine unattended: place the parking brake on, moving elements (blades, buckets, shears, etc.) shall be lowered to the ground (or blocked/pinned), and release hydraulic and pneumatic pressure as specified by the manufacturer. Control lockout levers shall also be engaged.
  9) Maintain the OSHA required minimum safe distance to overhead powerlines or make arrangements to de-energize powerlines prior to work if these clearances cannot be maintained.
  10) Identify and mark all underground utilities prior to excavation work.

2.1.6. Water hazards and boating safety

Potential health hazards

In land-based field operations, proper training and equipment are essential to completing a project efficiently and safely. This also holds true for operations conducted on or adjacent to bodies of water. O'Brien & Gere is strongly committed to ensuring all employees operating boats or conducting work adjacent to bodies of water are familiar with the hazards of water operations and the proper protective measures that must be taken to prevent injury.

Water related activities at the site might include the use of boats and wading in the excavation, pond and drainage channels. Weather, tides, currents, and other watercraft may pose significant hazards to the crew. Health and safety procedures are intended to reduce these hazardous.

The type of boats to be utilized may include "John" boats, small powerboats (less than 20 feet) or a 24' pontoon boat. This section outlines the precautions that will be taken to ensure the safety of O'Brien & Gere personnel when operating boats.

Water related hazards are also present if wading in the drainage channels, excavation, and the pond. This section provides procedures and precautions for wading safely.

Boating hazard control

Working from a boat presents the obvious hazard of drowning, but several other hazards exist. Powered craft carry a fuel supply, with the potential for fire or explosion if vapors accumulate and reach and ignition source.

Each employee working from a boat must complete a boating safety training session. The training session must provide instruction on the following topics:

- boat and safety equipment inspections;
- content and frequency of equipment safety inspections;
- use of on board safety equipment including fire extinguisher, radio, flares, horns; etc.;
- procedures for the completion and filing of a float plan;
- boating "rules of the road";
- emergency procedures in the event of capsizing or being thrown overboard;
- types of personal flotation devices (PFD) and their inspection and use.

O'Brien & Gere personnel working over, adjacent, or near water, where the danger of drowning exists, must wear an U.S. Coast Guard (USCG) - approved life jacket or buoyant work vests. Prior to and after each use, the buoyant work vests or life preservers must be inspected for defects that would alter their strength or buoyancy. Defective units must be

removed from service. An emergency flotation device (a PFD is sufficient) with at least 90 feet of line must be provided and readily available for emergency rescue operations. Work must be conducted within range of the emergency flotation device. At least one lifesaving boat must be immediately available at locations where employees are working over or adjacent to water.

Prior to each day or shift of operations, a boat inspection must be conducted by the boat operator \ skipper. The inspection shall be conducted in accordance with USCG and applicable state boating safety inspection procedures. The inspection must verify that necessary safety equipment is aboard, is functioning properly, and that all members of the crew are aware of proper procedures to be followed while on the water. This information shall be reviewed during the daily tailgate safety meeting.

Wading hazard control
Wading is permitted in the drainage channels if water depths are three feet or less and the flow velocities are low. Wading is not permitted in the on-site excavation or the pond.

A sediment probe must be used to evaluate water depth and bed conditions before wading A personal floatation device must be worn at all times because bank and bed surfaces may be slippery and uneven. Proceed with caution at all times. A lifeline attached to an accompanying boat or stationary point on shore will be used if wading in water depths of 2.5 feet to 3.0 feet. Additional caution is required when using a lifeline. For this reason, use of a boat is preferred under such circumstances.

2.2. Task hazards

2.2.1. Site reconnaissance, mobilization and observation

The site reconnaissance task will include identifying locations for exclusion, contamination reduction, and support zones for field efforts. Mobilization will require clearing areas for the support and contamination reduction zones. Project personnel will walk the site to observe the existence of anticipated hazards and to identify safety and health issues that may have arisen since the writing of this plan.

Potential health hazards and contaminants
Surveying, site reconnaissance, and observation activities may involve a potential for exposure to physical and health hazards. Hazards may be associated with the site and the environmental conditions. The hazards of this phase of activity are associated with heavy equipment movement, manual materials handling, installation of temporary on site facilities, and manual site preparation.

Hazard and contaminant control

The initial level of protection will be Level D. Coveralls are to be worn when there is the potential for contact with contaminated soil or liquid. Dust masks (N95) will be available should activities result in dust generation. Disposable boot covers will be worn if muddy conditions exist due to the potential presence of contaminated surface soil.

2.2.2. Soil boring and monitoring well installation activities

Field operations are expected to include soil boring completion and sampling of surface and subsurface soils.

Potential health hazards and contaminants

The physical hazards of this operation are primarily associated with operation of the drilling rig and contact with soils and water containing site constituents of concern. Hazards generally associated with drilling operations include carbon monoxide from the drill rig and overhead electrical and telephone wires, which can be hazardous when the drill rig boom is in the upright position. There may be underground utilities in the area where drilling is being performed. Moving parts on the drill rig may catch clothing. Free or falling parts from the cathead may cause head injury. Moving the drill rig over uneven terrain may cause the vehicle to roll over or get stuck in a rut or mud. High-pressure hydraulic lines and air lines used on drill rigs are hazardous when they are in disrepair or incorrectly assembled. Noise levels may exceed the OSHA PEL of 90 dBA. Noise above this level is both a health hazard and a hindrance to communication

During the retrieval of augers, the possibility exists for splashing of exposed subsurface materials onto the workers and release of dust onto workers' bodies and into the workers' breathing zones.

There is the potential for arm and back strain during the purging of the wells.

There is the potential for dust and vapors to be released during the drilling activities. Silica dust may also be generated during placement of sandpack around monitoring wells. Soil potentially contaminated with lead, arsenic, antimony and cadmium may be encountered during drilling.

Hazard and contaminant control

The initial level of protection will be Modified Level D. Personnel must wear safety glasses, steel-toed boots, hard hats and ear muffs and/or ear plugs when working near operating heavy machinery. Coveralls for field clothing will be worn during drilling and when there is a need to handle or work with potentially impacted soil or liquid. Prior to approaching a drill rig, loose clothing will be secured and the boom position will be checked.

O'Brien & Gere personnel will remain upwind from the vehicle exhausts unless required by sampling work. During drilling, if wet methods are not used, air in the breathing zone of the worker will be sampled for respirable dust using a real-time air meter (RAM) at approximately five-minute intervals. Subsequent monitoring and respirator wear will be in accordance with Section 3 of this HASP.

The drilling subcontractor will be required to inspect chains, lines, cables, and high-pressure lines daily for weak spots, frays, and other signs of wear. The kill switch shall be checked daily to verify that it is operable. The drilling subcontractor will be required to make repairs as necessary. To avoid contact with overhead lines, the drilling subcontractor will be required to lower the drill rig boom prior to moving the rig. The drilling subcontractor will be required to verify the location of underground utilities with both the facility and the local power and utility companies prior to drilling. Overhead and underground utilities will be considered "live" until verified otherwise.

Employing proper lifting and bailing techniques can prevent back strain. Heavy equipment, such as pumps and generators, will only be lifted with the legs, preferably using two or three personnel.

Equipment that is potentially contaminated will be cleaned to the satisfaction of the project manager or SSHC. The field sampling equipment will be cleaned and decontaminated using the equipment decontamination procedures outlined in the FSP. The field decontamination wastes will be collected and disposed of according to the FSP.

2.2.3. Surface soil sampling activities

Soil will be collected and examined.

Potential health hazards and contaminants

During the separation of the cores, the process of description and the field screening, the possibility exists for soil to splash from the sample onto workers. There is also the potential for release of dusts and volatile materials into the worker's breathing zone. Soil potentially contaminated with lead, arsenic, antimony and cadmium may be encountered during sampling.

Hazard and contaminant control

The initial level of protection during surface soil sampling will be Modified Level D. This will include wearing chemical resistant coveralls, eye protection (splash goggles or a face shield), and organic solvent resistant gloves. Workers must be able to write with the gloves selected. The field sampling equipment will be cleaned and decontaminated.

2.2.4. Sediment sampling

Samples of sediments will be collected for analysis and evaluation of potential site impacts. Sediment probing data and coring samples will be collected from a boat or, for water depths less than 3 ft, by wading.

Potential health hazards and contaminants

The physical hazards of this operation are primarily associated with the sample collection methods and procedures utilized.

Sediments potentially contaminated with lead, arsenic, antimony and cadmium may be encountered. There is minimal potential for release of these materials into the atmosphere at levels that may present an inhalation hazard. Low pH water may also be present. The contaminants may be splashed onto skin or clothing or within the boat.

Hazards associated with the operation of a boat and working over or near water, including the hazard for drowning, will be present. There is also a potential for slips, trips, and falls due slippery surfaces, debris, and poor visibility through the water.

Other physical hazards associated with sampling procedures are strains \ sprains resulting from sample collection or from working in a boat, and potential eye hazards resulting from splashes during sample collection activities.

Wading is not acceptable in the surface impoundment or pond due to the potential presence of elevated levels of site contaminants and unconsolidated sediments that may not support weight.

Hazard and contaminant control

The initial level of protection will be Modified Level D. Control of water hazards and boating safety are discussed above.

The potential for slipping on wet surfaces will be reduced by keeping work surfaces dry. Discharging water purged from sampling devices to the excavation or pond to avoid getting work surfaces wet is one method of prevention. Also, boots with good treads will be worn and personnel will be reminded to remain alert in the area where they are walking to decrease the chance of slipping.

Wading is not acceptable in the surface impoundment or pond due to the potential presence of elevated levels of site contaminants, debris, and unconsolidated sediments that may not support weight.

2.2.5. Test pit completion

Test pits will be completed around the perimeter of the fill area. The fill material has been found to contain elevated levels of lead. In addition to the backhoe operator and field personnel, it is expected that separate personnel will be at the excavation for the purposes of screening samples with a x-ray florescence (XRF) instrument.

Potential health hazards and contaminants:

Hazards encountered during test pit excavation include both chemical and physical agents. These include exposure to airborne contaminants released during intrusive activities and low pH water. These materials, if encountered, may be spread through the air and through skin contact with contaminated soil or water. The possibility exists for splash of sample onto the workers and release of dust and volatile materials onto workers' bodies and into the workers' breathing zones. During the excavation process the backhoe may slide or sink, causing possible injuries to on-site employees. Workers can fall during access/egress or while monitoring or dismounting equipment, or can stumble into the excavation. An overhead hazard can result from material, tools, rock, and/or soil falling into the excavation. The work area may become congested due to too many workers being present in a small area. The sides of the excavation can cave in, possibly burying or crushing workers, due to:

1. absence of shoring,
2. misjudgment of stability,
3. defective shoring, and/or
4. undercut sides.

Hazard and contaminant control:

The site supervisor will identify the "Competent Person" responsible for proper excavation per 29CFR 1926.652. The initial level of protection will be Modified Level C. Respiratory protection will not be worn unless dust level concentrations in the breathing zone exceed 50 $\mu g/m^3$. The test pits will be monitored for airborne dust and the pits will not be entered until the air quality standards are met. Dust control materials (water hose with sprinkler or low pressure spray gun) will be staged at the site of the excavation.

Personnel must wear safety glasses, steel-toed boots, hearing protection and hard hats when working near operating heavy machinery.

Warning tape will be placed around the work areas to restrict entrance during the excavation process and prevent the spread of contaminants. Each trench, while in use, will be inspected hourly by the site supervisor and changing conditions noted and work modifications made. Ramps or ladders into the trenches will be provided to allow easy access and egress.

Material excavated from each pit will be placed away from the edge of the pit to prevent cave-ins and to minimize the instability of the pit.

Manual lifting will be limited to prevent overexertion, and mechanical means will be used where practical. The site supervisor will minimize the number of workers in the test pit to prevent crowding.

Shoring or sloping of the sides of the excavation in accordance with 29 CFR 1926.256 will be provided. The following sloping will be established:

Solid rock, cemented sand or gravel: 90 degrees
Compact angular gravel: 63 degrees
Compacted sharp sand: 33 degrees
Rounded loose sand: 26 degrees

Equipment that contains gross debris will be wire scrubbed with water to the satisfaction of the project coordinator or the SSHC.

2.2.6. Well development and ground water sampling

Newly installed wells will be developed. Development involves removal of water from the well using a bailer or pump. Ground water will be sampled once in accordance with the Work Plan. Sample collection procedures involve the use of a low flow pump. The samples will be analyzed for indicator compounds as identified in the Work Plan.

Potential health hazards and contaminants:
Low pH ground water may be present in wells on the southern end of the site. Hazards generally encountered during groundwater sampling include exposure to low pH water and back strain from improper lifting of bailers or pumps from down-well depths or from moving equipment such as generators to well locations. There is also the potential for slipping on wet, muddy surfaces created by spilled water, for shock from electrical hazards associated with the use of electrical equipment around water or wet surfaces and for water or dirt splashing into the eyes during sampling.

Hazard and contaminant control:
Initially, Modified Level D protective equipment, to prevent contact with contaminated groundwater will be provided. Workers must wear inner and outer nitrile gloves when collecting samples.

Employing proper lifting and bailing techniques will prevent back strain. Heavy equipment, such as pumps and generators, will only be lifted with the legs, preferably using two or three personnel.

Placing purged water in drums for removal will minimize slipping on wet surfaces. Also, boots with good treads will be worn and personnel will be reminded to remain alert of the area where they are walking to decrease the chance of slipping. Ground fault interrupters will be used in the absence of properly grounded circuitry or when pumps are used around wet conditions. Electrical extension cords will be protected or guarded from damage (i.e., cuts from other machinery) and be maintained in good condition. Eye protection will be worn as appropriate to prevent water splashing into eyes. Equipment that is potentially contaminated will be cleaned to the satisfaction of the project manager or SSHO. The field sampling equipment will be cleaned and decontaminated using the equipment decontamination procedures outlined in the QAPP.

3. Personnel training

3.1. Site workers

O'Brien & Gere employees performing the activities listed in the SOW must have completed a training course of at least 40 hours meeting the requirements of 29 CFR 1910.120(e) for safety and health at hazardous waste operations. If the course was completed more than 12 months before the date of site work, completion of an approved 8-hr refresher course on health and safety at hazardous waste operations is required.

O'Brien & Gere employees must comply with the O'Brien & Gere Quality Assurance Manual. The respiratory protection program is specified in Section 004.2 of Vol. 3. The Hazard Communication Program is specified in Section 003 of Vol. 3. The Audit Program is specified in Section 019 of Vol. 3. The Confined Spaces Entry Program is specified in Section 008 of Vol. 3.

3.2. Management and leaders

In addition to the requirements described in section 3.1 for O'Brien & Gere site workers, O'Brien & Gere field leaders must have completed an off-site training course of at least 8 hours meeting the requirements of 29 CFR 1910.120(e) on supervisor responsibilities for safety and health at hazardous waste operations.

3.3. Emergency response personnel

O'Brien & Gere employees who respond as "Good Samaritans to emergency situations involving health and safety hazards must be trained in how to respond to such emergencies in accordance with the provisions of 29 CFR 1910.120(l). Skills such as cardiopulmonary resuscitation (CPR), mouth-to-mouth rescue breathing, avoidance of blood-borne pathogens, and basic first aid skills may be necessary.

3.4. Site-specific training

Site-specific training will be provided to each O'Brien & Gere employee and reviewed before assignment. O'Brien & Gere personnel will be briefed daily by the Field Leader or by the SSHC as to the potential hazards that may be encountered during that day. Topics will include:

- Availability of this HASP
- Tasks to be performed
- General site hazards and specific hazards in the work areas
- Selection, use, testing, and care of the body, eye, hand, foot, and respiratory protective equipment being worn and the limitations of each
- Decontamination procedures for O'Brien & Gere personnel, their personal protective equipment, and other equipment used on-site
- Emergency response procedures and requirements
- Emergency notification procedures and evacuation routes to be followed
- Time constraints (e.g., rest breaks, cartridge changes)
- Hazards that may be encountered, including their effects, how to recognize symptoms or monitor them, concentration limits, or other danger signals
- Other emergency procedures.

3.5. Training certification

A record of employee training completion will be maintained by the SSHC for each O'Brien & Gere employee who is trained. This record will include the dates of the completion of worker training, supervisor training, refresher training, emergency response training, and site-specific training for on-site O'Brien & Gere employees.

3.6. Medical monitoring

O'Brien & Gere has implemented a medical monitoring program in accordance with 29 CFR 1910.120. The O'Brien & Gere program is designed to monitor and reduce health risks to employees potentially exposed to hazardous materials and to provide baseline medical data for each employee involved in work activities. It is also designed to evaluate the employee's ability to wear PPE such as chemical-resistant clothing and respirators.

Medical examinations are administered on a post-hire and annual basis and as warranted by symptoms of exposure or of specialized activities. The post-hire examination provides baseline data. The examining physician is required to make a report to O'Brien & Gere of any medical condition that would increase the employee's risk when wearing a respirator or other PPE. O'Brien & Gere maintains site personnel medical records as required by 29 CFR 1910.120 and by 29 CFR 1910.1020, as applicable.

O'Brien & Gere employees performing the activities listed in the SOW or this document have or will receive medical tests as regulated by 29 CFR 1910.120. Where medial requirements of 39 CFR 1910.120 overlap those of 29 CFR 1910.134 or 29 CFR 1910.1025, the more stringent standard will be enforced.

3.7. Respirator certification

Employees who wear or may wear respiratory protection have been provided respirators as required by 29 CFR 1910.134. This standard requires that an individual's ability to wear respiratory protection be medically certified before performing designated duties.

3.8. Personnel protection

3.8.1. General

Workers and authorized visitors will be provided with personal protective equipment and clothing appropriate to their work task and potential exposure. The personal protective equipment has been selected in accordance with the applicable provisions of Subpart I, 29 CFR Part 1910. Each individual will be trained in the use of this safety equipment before the start of field activities. Safety equipment and protective clothing will be used as directed by this HASP. Personal protective equipment will be worn at times designated by this HASP. Equipment and clothing will be cleaned and maintained in accordance with manufacturer's instructions and within the guidance of Subpart I, 29 CFR Part 1910 by project personnel. The SSHC will monitor the protective equipment maintenance procedures.

Results from the site walk-through and on-site monitoring will be used to set task and point specific action levels and levels of personal protection with respect to upgrading and downgrading. Each individual will be trained in the use of the protective equipment prior to the start of their on-site activities.

Personal protective equipment will be used during the investigation to minimize exposures to site-related chemical compounds and physical hazards. Levels of protective clothing and equipment have been assigned to specific tasks at Level C, Modified Level C, Modified Level D or Level D as shown in Table 3-1. These personal protection levels are detailed below. If field measurements or observations indicate that a exposure is greater than the protection afforded by the equipment or procedures specified in the following sections of this HASP, work will be stopped and workers removed until the exposure has been reduced and/or the level of protection has been increased. The basic level of PPE to be used during activities is OSHA Level D. PPE may be upgraded based on air monitoring results or at the discretion of the Project Manager and based on the SSHC's recommendations. The SSHC and the Project Manager must approve a downgrade of PPE.

If the SSHC verifies that a potential exposure is greater than the protection afforded by the equipment or procedures specified in this or other sections of this HASP, the work will be stopped. O'Brien & Gere personnel will be removed from the site until the exposure has been reduced or the level of protection has been increased.

O'Brien & Gere respirator users have been trained and medically approved to use respiratory protection. Respirators issued are approved for protection against dust and organic vapors by NIOSH. Respirators are issued for the exclusive use of one worker and will be cleaned and disinfected after each use by the worker. Respirator users must check the fit of the respirator before each day's use and verify the integrity of the respirator and that it seals properly. The respirator must seal against the face so that the wearer receives air only through the air purifying cartridges attached to the respirator. No facial hair that interferes with the effectiveness of a respirator will be permitted on personnel required to wear respiratory PPE. Cartridges and filters for air-purifying respirators in use will be changed daily at a minimum. The user will daily.

Table 3-1 *Project personnel.*

Task	Monitoring	Airborne Action Level *	Initial PPE level
Site reconnaissance, mobilization and observation	Dust	50 $\mu g/m^3$	Level D
Soil borings	Dust	50 $\mu g/m^3$	Modified Level D
Surface soil sampling	Dust	50 $\mu g/m^3$	Modified Level D
Sediment sampling	None	Not Applicable	Modified Level D including Personal floatation device.
Test Pits	Dust	50 $\mu g/m^3$	Modified Level C
Ground Water Sampling	None	Not Applicable	Modified Level D

Note: * Exceendance of action level will require upgrade to Level C respiratory protection.

3.8.2. Protective equipment description

The level of PPE is categorized as Level A, B, C, or D, based upon the degree of protection required. The following is a brief summary of the levels that may be used on this site.

Modified Level C

Modified Level C protection, consisting of Level C protective equipment without the use of a respirator, will be worn initially during soil sampling and overwater work. However, respirators will be available for immediate use in the event that an upgrade to Level C protection, as specified by the action levels, is required. Modified Level C protection consists of the following:

- Chemical-resistant disposable coveralls. For this type of exposure, polyethylene coated Tyvek®, or equivalent, suits will be required. Suits must be one piece with elastic wrist bands. The SSHC may require hoods.
- Outer nitrile gloves (taped to the suit) and inner nitrile gloves.
- Leather, steel-toe boots with rubber overboots (taped to suit).
- Eye protection (goggles, face shield or safety glasses).
- Hard hat.
- Disposable outer boots.
- Options:
- Coveralls
- Escape mask.
- Hearing protection required when heavy equipment is operating.

Level C

All personnel will move upwind or upgrade the level of personal protection to Level C if the particulate concentration is consistently greater than 50 $\mu g/m^3$. When it is necessary to upgrade to Level C, a full-face air-purifying respirator equipped with organic vapor cartridges and P 100 dust filters will be worn in addition to the Level D or Modified level C Protection.

Modified Level D

The concentration(s) and type(s) of airborne substance(s) is known and the criteria for not using air purifying respirators are met. A level of skin protection above Level D is required. The following constitute Modified Level D equipment:

- Chemical-resistant clothing [chemical-splash suit, disposable chemical-resistant overalls (polyethylene coated Tyvek® or equivalent)]
- Coveralls (optional)
- Gloves, outer, chemical-resistant (neoprene)
- Gloves, inner, chemical-resistant (neoprene or latex)
- Boots, outer, leather, with steel toe and shank
- Optional chemical resistant boot covers (neoprene or butyl rubber)

- Hard hat (Class B)
- Personal flotation device with rope when sampling in water greater than 24 inches deep
- Face shield and safety glasses
- Hearing protection when working in noise hazardous areas, as defined in O'Brien & Gere's Quality Assurance Manual.
- A NIOSH-approved, full-face air purifying respirator with organic vapor cartridges and P100 particulate filters available

As required

a. Disposable outer boots.

b. Waders selected for the stream depth.

Level D

A work uniform affording minimal protection, used for nuisance contamination only. Level D protection will be worn for initial entry on-site and initially for all activities. The following constitute Level D equipment:

- Overalls (cloth) or long sleeve shirts and long pants.
- Apron (plastic) for splash protection as necessary
- Gloves (neoprene or leather)
- Boots or shoes, leather, steel toe and shank
- Optional chemical resistant boot covers (neoprene or butyl rubber)
- Safety glasses or chemical splash goggles
- Hard hat (Class B)
- Personal flotation device with rope when sampling in water greater than 24 inches deep
- Escape mask (optional)
- Face shield when not wearing other eye protection.
- Hearing protection when working in noise hazardous areas, as defined in O'Brien & Gere's Quality Assurance Manual.

Level B

All personnel will move upwind or upgrade the level of personal protection to Level B if the following condition is met:

- Particulate concentration consistently greater than 100 mg/m^3.

Level B protection will consist of Modified Level C with the addition of a pressure-demand, full-face Self Contained Breathing Apparatus.

3.9. Monitoring requirements

3.9.1. On-site monitoring

During all air monitoring activities, a reliable indicator of wind direction will be established onsite (e.g. pivoting sock, vane). The reliable indicator will establish appropriate locations for monitoring upwind and

downwind directions, as appropriate, for the monitoring requirements below.

- Upon initial entry onto the site.
- When weather conditions change.
- When work begins on another portion of the site.
- On the hour and half past hour while handling excavated soils

3.9.2. Community air monitoring plan

The New York State Generic Community Air Monitoring Plan (CAMP) will be followed for particulate monitoring. A copy of the CAMP is included as Appendix B.

4. Work zones and decontamination

4.1. Site work zones

To reduce the spread of hazardous materials by workers from the contaminated areas to the clean areas, work zones will be delineated at the site. The flow of personnel between the zones shall be controlled. The establishment of the work zones will help ensure that: personnel are protected against the hazards present where they are working, that work activities and contamination are confined to the appropriate areas, and that personnel can be located and evacuated in an emergency.

An exclusion zone, a contamination reduction zone, and support zone will be established by the SSHC at the site.

Exclusion zone
The exclusion zone is where sampling activities are conducted. The SSHC will identify this zone. It must be at least 30 ft in diameter and centered, when possible, on the work activities. This zone will be designated with red flags attached to portable stakes or cones installed before beginning the field work. The zone may be enlarged to contain the necessary ancillary equipment and personnel for the work to be done.

Contamination reduction zone
The contamination reduction zone (CRZ) contains personnel and equipment decontamination stations. This zone will be established between the exclusion zone and the support zone. Personnel and equipment in the exclusion zone must pass through this zone before entering the support zone. The CRZ will be located upwind from the work activities. It will only be large enough to contain equipment and personnel necessary to keep potentially impacted media and materials in the immediate work area. This area will be designated with yellow flags attached to portable stakes or cones. The CRZ will be established on the day site work commences within a particular exclusion zone, based on the direction of the wind on that day.

Support zone
The remainder of the Site is defined as the support zone. The support zone contains support facilities, extra equipment, transport vehicles, and the additional personnel and equipment necessary to manage and perform work activities. No equipment or personnel will be permitted to enter the support zone from the exclusion zone without passing through the CRZ. Eating, smoking, and drinking will be allowed only in this area

Site communications
A cellular telephone will be used during activities to facilitate communications for emergency response and other purposes and to serve as the primary off-site communication network. Hand signals may be used between on-site personnel during heavy equipment operation.

4.2. Decontamination

4.2.1. Decontamination of personnel

Personnel decontamination will not be necessary if Level D protection is used. However, personnel will be encouraged to remove clothing and shower as soon as is practicable at the end of the day. All clothing should be machine-washed. All personnel must wash hands and face prior to eating.

Decontamination will be necessary if Modified Level D or Level C protection is used. Decontamination involves scrubbing with a soap and water solution followed by rinses with potable water. Dirt, oil, grease, or other foreign materials that are visible will be removed from surfaces. Scrubbing with a brush may be required to remove materials that adhere to the surfaces. Waste waters from personnel decontamination will be disposed of with the waste waters from the sampling equipment decontamination. Respirators will be decontaminated each day as well as sanitized before re-use. The manufacturer's instructions will be followed to sanitize the respirator masks.

A line for decontamination from Modified Level D or Level C, providing the same level of decontamination as the example in the O'Brien & Gere Hazardous Waste Health and Safety Training Manual will be established by the Project Manager and monitored by the SSHC.

4.2.2 Decontamination Equipment

The following equipment will be available on site to decontaminate personnel and equipment.

- Plastic drop cloths
- DOT approved fiberboard drums with plastic liners, to collect non-reusable protective clothing. (unless facility dumpster is available)
- Plastic wash tubs
- Soft bristled toilet brushes
- Plastic drums or carboys, to collect wash and rinse water
- Hand spray units for decontamination
- Sufficient soap, water, alcohol wipes and towels to wash hands, faces and respirators.

4.2.3. Decontamination Protocol

As appropriate given the level of protection worn on site, the following decontamination protocol will be used:

1. Segregated equipment drop on plastic drop clothes. Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. During hot weather operations, a cool down station may be set up within this area.

2. Wash station for gloves, boots and protective suit. Scrub outer boots, outer gloves and splash suit with detergent water. Rinse off using copious amounts of water.

3. Removal and disposal of outer boots. Remove outer boots. Deposit them in a container with a plastic liner. If the boots are to be reused (e.g., when the worker is dressed in Level C or Modified Level D protection), after cleaning, place them in a secure on-site location, preferably in plastic.

4. Removal and disposal of outer gloves. Remove outer gloves. Deposit them in a container with a plastic liner. At this station, the worker's filter can be exchanged, new outer gloves and outer boots donned, joints taped, and the worker can return to duty.

5. Removal and disposal of outer garment. Remove outer garment. Deposit it in a container with a plastic liner.

6. Removal of respirator. Remove respirator. Avoid touching face with fingers. Deposit respirator on a plastic sheet.

7. Removal and disposal of inner gloves. Remove inner gloves. Deposit them in a container with a plastic liner.

8. Field Wash. Wash hands and face thoroughly. Shower if body contamination is suspected.

4.2.4. Monitoring equipment decontamination procedures

Sampling equipment used for health monitoring purposes will be cleaned of visible contamination and debris before initial use on-site, between uses, and after final use. Monitoring equipment that contacts impacted media will be decontaminated after each use by a low-phosphate detergent brushing followed by a clean water rinse. After decontamination, monitoring equipment will be stored separately from PPE. Decontaminated or clean equipment not in use will be covered with plastic and stored in a designated storage area in the support zone.

Non-dedicated sample collecting equipment contacting samples will be decontaminated after each use by a low phosphate detergent brushing followed by a clean water rinse. A methanol rinse followed by a final

rinse with analyte-free deionized or distilled water will complete the decontamination procedure. Decontaminated equipment will be allowed to air dry before wrapping in aluminum foil, shiny side out, for transport.

Monitoring equipment will be cleaned of all visible contamination prior to initial use on site, between each use, and after final use. Monitoring equipment, after decontamination, will be stored separately from personal protective equipment. Decontaminated or clean sampling equipment not in use will be covered with plastic and stored in a designated storage area in the support zone.

The surface of the equipment will be washed as follows:

1. Detergent/water rinse.
2. Tap water rinse.
3. Deionized/distilled water rinse.

4.2.5. Decontamination of other equipment

Decontamination will be applicable to all activities. Construction equipment mobilized to the site will receive initial decontamination. Initial decontamination will consist of steam cleaning of potentially contaminated portions of the rigs to the satisfaction of the site supervisor or SSHC. Dirt, oil grease or other foreign materials that are visible will be removed from metal surfaces. Scrubbing with a wire brush may be required to remove materials that adhere to the surfaces. The rigs used for the well installation must be cleaned with brushes to remove contamination before they are moved off-site. Equipment that contains gross debris will be wire scrubbed with water to the satisfaction of the site supervisor or SSHC.

Decontamination will take place on a decontamination pad as identified in the FSP.

Equipment will be decontaminated in accordance with the protocol provided in the FSP for decontamination of sampling and drilling equipment. Decontaminated or clean sampling equipment not in use will be covered with plastic and stored in a designated storage area in the support zone. Additional information on equipment decontamination is provided in the O'Brien & Gere Hazardous Waste Health and Safety Training Manual.

4.2.6. Collection and disposition of impacted materials and refuse

Field decontamination wastes will be containerized on-site and sampled before disposal. Used PPE will be placed in plastic garbage bags and placed in a 55-gallon drum for off-site disposal.

Investigation derived waste (IDW) will be managed as described in the FSP. If used, commercial laundries or cleaning establishments that decon-

taminate protective clothing or equipment will be informed of the potentially harmful effects of exposures.

5. Accident prevention and contingency plan

5.1. Accident prevention

- All personnel must have received health and safety training prior to the initiation of site activities. While working, personnel must be constantly alert for indicators of potentially hazardous situations and for signs and symptoms in themselves and others warning of hazardous conditions and exposures. Rapid recognition of dangerous situations can avert an emergency and an emergency response requirement.

In an emergency, site personnel will signal distress either verbally or with three blasts from a horn (vehicle horn, air horn, and so forth). The SSHC, Field Leader, or the Project Manager will immediately be notified of the nature and extent of the emergency.

Table 5-1 contains emergency telephone numbers. This table will be kept with the portable telephone and updated as needed by the SSHC. The portable telephone will be used to notify off-site personnel of emergencies. The operating condition of this telephone will be verified daily before initiation of activities.

Table 5-1. *Emergency telephone numbers.*

Location	Telephone
Fire Department	911
Police Department	911
Ambulance	911
Poison Control Center	1-800-942-5969
Horton Medical Center 110 Crystal Run Rd, Middletown, NY (Satellite Facility) 60 Prospect Avenue (Main Facility)	 845-692-0066 845-342-7600
Chemical Emergency Advice (Client is O'Brien & Gere Engineers)	1-800-424-9300
James Rozier, Industrial Medical Associates Medical Director Contact	1-315-478-1977
National Spill Response Center	1-800-424-8802

Source: O'Brien & Gere Engineers, Inc.

Directions to Horton Medical Center (Satellite Facility) from the site are as follows:

Go south on Ballard Road towards West Warren Drive approximately (0.9 miles). Turn right on Crystal Run Road. Hospital 0.5 mile down the road at 110 Crystal Run Rd (Figure 1).

Directions to Horton Medical Center (Main Facility) from the site are as follows:

Go south on Ballard Road towards West Warren Drive approximately (0.9 miles). Turn right on Crystal Run Road. Continue eastward approximately ¾ mile and enter Route 67 west (E. Main Street extension) . Continue on Route 67 (E. Main Street) approximately 2.5 miles to Prospect Avenue. Take a left onto Prospect Ave. and travel 1 block to Horton Medical Center. (Figure 1).

5.2. Responsibilities

The SSHC is responsible for responding to, or coordinating the response of off-site personnel to, emergencies. In the event of an emergency, the SSHC will direct notification and response, and will assist the Field Leader in arranging follow-up actions. Upon notification of an exposure incident, the SSHC will call 911 and request that hospital, fire, and police emergency response personnel as necessary recommend medical diagnosis, treatment if necessary, and provide transportation to the hospital. The Field Leader will contact local, state, and federal government agencies, as appropriate.

Before the start of remedial action activities at the Revere Smelting and Refining Site, the SSHC will:

1. Confirm that the following safety equipment is available: eyewash, first aid supplies, air horn, and fire extinguisher.

2. Have a working knowledge of the O'Brien & Gere safety equipment.

3. Collect and maintain a file of Material Safety Data Sheets (MSDS) for materials used at the site.

Before work may resume following an emergency, used emergency equipment must be recharged, refilled, or replaced and government agencies must be notified as required.

The Project Manager, assisted by the SSHC and the Field Leader, must investigate the incident as soon as possible. The Project Manager will assess whether and to what extent exposure actually occurred, the cause

of exposure, and the means to prevent similar incidents. The resulting report must be signed and dated by the Project Manager, SSHC, and the Field Leader.

5.3. Accidents and injuries

In the event of an accident or injury, workers will immediately implement emergency isolation measures to assist those who have been injured or exposed and to protect others from hazards. Upon notification of an exposure incident, the SSHC will contact emergency response personnel who can provide medical diagnosis and treatment. If necessary, personnel trained in first aid procedures will provide immediate medical care. Personnel competent in on-site medical or first aid response to an injury or illness will provide assistance in such matters. Accidents will be reported to O'Brien & Gere following the procedure in the O'Brien & Gere Quality Assurance Manual (QAM).

If the chemical is on the skin, the skin should be washed with copious amounts of water. If the chemical is on clothing, the chemical should be neutralized or clothing removed. In case of eye contact, use the emergency eyewash. Eyes should be rinsed for at least 15 minutes. All chemical exposure incidents must be reported in writing to the Associate for Safety and Health (Ed Wilson). The SSHC or the Field Team Leader is responsible for completing the accident report. An ambulance should be called to transport the victim to the nearest hospital or medical center. Only persons with very minor injuries should be transported by a company vehicle. Follow-up action should be taken to correct the situation that caused the accident.

5.3.1 Evacuation procedures

In the event the site must be evacuated, the following procedures should be followed:

- The Field Team Leader will initiate evacuation procedure by signaling to leave the site.
- All personnel in the work area will evacuate the area and meet in the designated safe refuge area.
- Al personnel must be accounted for and the whereabouts of missing persons determined immediately.
- The Field Team Leader will give further instruction.

5.4. Safe refuge

Before commencing site activities, a place of refuge for O'Brien & Gere workers will be identified by the SSHC. For the purpose of this HASP, a location on the outside of the gate of the facility will be selected as the place of safe refuge during a site evacuation. In case of an emergency, personnel in the exclusion zone should evacuate the work area both for their own safety and to prevent hampering rescue efforts. Following an evacuation, the SSHC will account for site personnel. If evacuation from the on-site refuge location is necessary, the project vehicles will be used to transport personnel to the place of refuge.

5.5. Firefighting procedures

A fire extinguisher meeting the requirements of 29 CFR Part 1910 Subpart L, as a minimum, will be available in the support zone during on-site activities. This is intended to control small fires. When a fire cannot be controlled with the extinguisher, the exclusion zone will be evacuated, and the fire department will be contacted immediately. The SSHC or the Field Leader will decide when to contact the fire department.

5.6. Emergency equipment

The following equipment, selected based on potential site hazards, will be maintained in the support zone for safety and emergency response purposes:

- Fire extinguisher
- First aid kit
- Eye wash bottles.

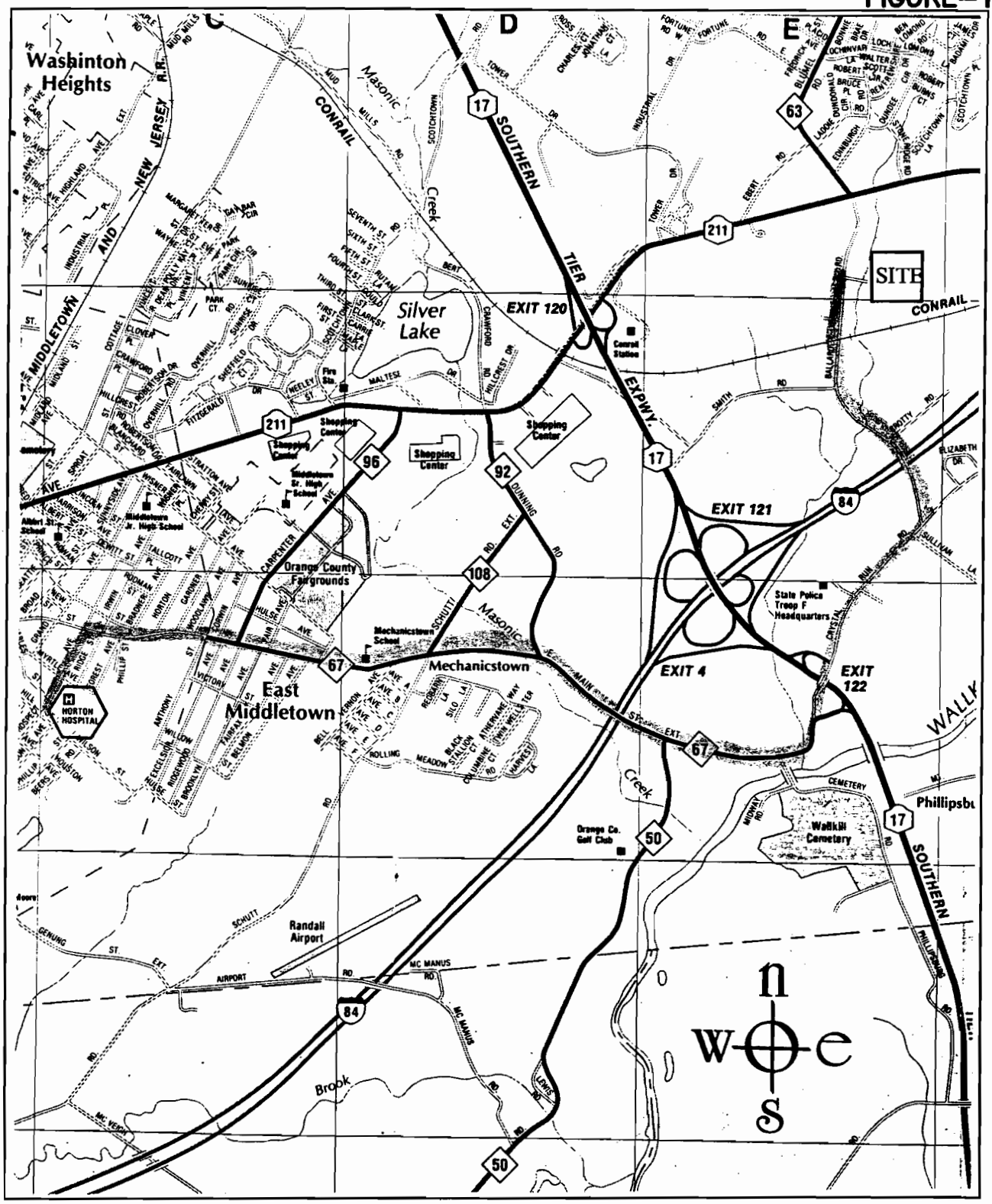
5.7. Emergency site communications

Hand and verbal signals will be used at the Revere Smelting Site for emergency communications.

5.8. Security and control

The SSHC or the Field Leader will monitor work zone security and control during emergencies, accidents, and incidents. The duties of the SSHC or the Field Leader include limiting access to the work zones to authorized personnel and overseeing emergency response activities.

FIGURE-1



REVERE SMELTING AND REFINING
REMEDIAL INVESTIGATION
WALLKILL, N.Y.

HOSPITAL LOCATION MAP

10653.26408
JULY 2001

0 1/4 1/2 3/4 1 MILE

O'BRIEN & GERE ENGINEERS INC.

MSDS for Lead

MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION

Trade Name:	Lead	**Synonym:**	Lead Metal
Chemical Nature:	Metallic Element	**Formula:**	Pb
CAS #:	7439-92-1	**Formula Weight:**	207.20

II HAZARDOUS INGREDIENTS

TLV (Units): Lead 7439-92-1 .15 mg/m^3 TLV.05 mg/m^3 OSHA PEL

III PHYSICAL DATA

Boiling Point 760 mm Hg:	1744 °C	**Melting Point:**	327.5 °C
Density:	11.3437	**Vapor Pressure:**	N/A
% Volatiles by Weight:	N/A	**Solubility in H_2O:**	Insoluble
Appearance and Odor:	Soft Silvery metal, grey powder, no odor		

IV FIRE AND EXPLOSION HAZARDS DATA

Flash Point (Method used): NA
Autoignition Temperature: N/A
Flammability: Slight as powder

Extinguishing Media: Agents for metal fires such as dry graphite, MET-L-X, or TEC.
Special Fire Fighting Procedures: Wear full protective gear including SCBA unit when fighting fires evolving hazardous chemicals.

Unusual Fire & Explosion Hazard: Contamination.

V HEALTH HAZARD INFORMATION

Threshold Limit Value: .15 mg/m^3 TLV .05 mg/m^3

Effects of Over Exposure:

Inhalation: Lead has no immediate effects on the lungs. It is a cumulative poison requiring repeated exposure to induce effects.
Effects: Skin contact may cause irritation. May be an eye irritant. May be absorbed by the skin. Repeated inhalation or ingestion of this compound could cause nausea, vomiting, diarrhea, metallic taste, abdominal pain and tenderness, loss of appetite, headache, irritability and muscle pain. Continued overexposure may lead to permanent neurological injury.

Carcinogenicity: IARC has listed this material in Group 2B as possible carcinogenic to humans.

Reproductive Effects: None identified
Target Organs: GI tract, central nervous system, kidneys, blood, gingival tissue.

Medical Conditions Generally Aggravated by Exposure: Kidney disorders, liver disorders, central nervous system disorders.
Primary Routes of Entry: Ingestion, inhalation, eye contact, skin contact.

EMERGENCY AND FIRST AID PROCEDURES:

EYES: Flush with copious amounts of water for 15 minutes, seek medical attention.
SKIN: Remove any contaminated clothing, brush material off of skin, flush with running water, wash carefully with soap and water.
INHALATION: Remove to fresh air. Observe for signs of lead poisoning.
INGESTION: Give victim plenty of fluids, then induce vomiting. Seek immediate medical attention.

VI REACTIVITY DATA

Stability: Stable
Incompatibility (Material to Avoid): NH_4NO_3, ClF_3, H_2O_2, NaN_3, Na_2C_2, Zr, oxidants.

Hazardous Decomposition Products: Pb fumes
Hazardous Polymerization: Will not occur

VII SPILL OR LEAK PROCEDURES

Steps to be Taken in Case Material is Released or Spilled: Wear appropriate protective gear. Avoid raising dust by using dust suppressor or vacuuming spill with vacuum equipped with HEPA filter. Avoid dry sweeping.

Waste Disposal Method: In accordance with Local, State and Federal Waste Disposal Regulations.
EPA Hazardous Waste Number: DOO8 (EP Toxic Waste).

VIII SPECIAL PROTECTION INFORMATION

Respiratory Protection (Specify Type): Filter - Dust, Fume, Mist
Ventilation: **Local Exhaust**: To control dust and maintain exposure below TLV.**Mechanical**: Not recommended
Protective Gloves: Neoprene**Eye Protection**: Safety Glasses
Other Protective Equipment: Prevent skin or clothing contamination.

IX SPECIAL PRECAUTIONS

Other Handling and Storage Conditions: Wash thoroughly after handling and before eating, drinking or smoking. Keep container closed. Store in tightly closed containers. Store in cool dry location.

Prepared by: S. Dierks
Dated: January 1996

Safety data for lead

General

Synonyms: lead shot, C.I. 77575. [Note: the exact formulation of lead obtained as lead shot may vary; it may contain small amounts of antimony, arsenic and other materials.]
Molecular formula: Pb
CAS No: 7439-92-1
EINECS No:

Physical data

Appearance: grey metal granules, shot or powder
Melting point: 327 C
Boiling point: 1744 C
Vapour density:
Vapour pressure:
Density (g cm^{-3}): 11.34
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility:

Stability

Stable. Incompatible with strong oxidizing agents, potassium, sodium.

Toxicology

Toxic by ingestion or inhalation. Chronic poison. Typical TLV/TWA as powder 0.15 mg/m3. Typical PEL 0.05 mg/m3

Transport information

Non-hazardous for air, sea and road transport.

Personal protection

Solid lead is believed to present a relatively low hazard to health, but it is a cumulative poison, and can cause serious harm if inhaled as a powder, or ingested over a long period. Most lead salts are very poisonous.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Appendix B

NYSDOH Generic Community Air Monitoring Plan

New York State Department of Health
Generic Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical-specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a **continuous** basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored **continuously** at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

All readings must be recorded and be available for State (DEC and DOH) personnel to review.

June 20, 2000

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Plan

Citizen Participation Plan

Revere Smelting & Refining Site
Wallkill, New York

July 2001

O'BRIEN & GERE
ENGINEERS, INC.

10653/26408

PLAN

Citizen Participation Plan

Revere Smelting & Refining Site
Wallkill, New York

James R. Heckathorne, P.E.
Vice President

July 2001

O'BRIEN & GERE
ENGINEERS, INC.

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1. Introduction

New York State Department of Environmental Conservation is committed to a citizen participation program as a part of its responsibilities for the inactive hazardous waste site remedial program. Citizen participation promotes public understanding of the Department's responsibilities, planning activities, and remedial activities at inactive hazardous waste disposal sites. It provides an opportunity for the Department to learn from the public, information that will enable the Department to develop a comprehensive remedial program that is protective of both public health and the environment.

2. Site background

2.1. State remedial program

The Revere Smelting & Refinishing Corporation (RSR) Site is part of the State's remedial program to address sites that have been impacted by past activities.

2.2. Site setting

The RSR Site (the site) is located at 65 Ballard Road in Middletown, Orange County, New York. The site is located in a suburban industrial area and occupies a 61-acre parcel of land. The location of the RSR Site is shown on Figure 2-1.

Approximately one third of the property is used for plant operations. The remainder of the property consists of undeveloped land containing overgrown field, mature woodlands, wetlands, and a pond. A mixture of residential and commercial/industrial properties are located in the vicinity of the site.

2.3. Site history

The RSR facility was constructed in 1970 and was acquired by RSR in 1972. RSR operated a secondary lead smelter and manufactures lead and lead alloys. In addition, RSR reclaims polypropylene from a variety of materials such as battery cases. The process materials used at the plant include spent industrial lead-acid batteries, factory scrap, coal fines, hard rubber battery cases, pebble lime and sodium carbonate. Calcium oxide, ferric sulfate, sodium hydroxide, phosphoric and hydrochloric acids, and flocculants are used for process water treatment.

RSR recycles approximately 4,000,000 to 5,000,000 batteries per year at the facility. During the late 1970's and early 1980's, large quantities of material containing lead slag, battery parts, and other wastes were disposed on the property.

In addition to physical waste disposal, fugitive emissions have contributed to the deposition of metal containing material around the site. Specifically, furnace-feed materials were historically stored in an uncovered area of the property that allowed for erosion and potential transport of materials. In addition, historic use of uncontrolled

ventilation units within the production facility may have resulted in fugitive emissions of airborne materials from the facility.

2.4. Problems identified at the site

In general, based on investigations conducted to date by RSR, concentrations of lead in soil exceeding the screening criteria for total lead (500 mg/Kg) and Federal Maximum Concentration of Contaminants for the Toxicity Characteristic Value (TCLP action level) (5 mg/L) extend in each direction on the site and to a maximum depth of 16 to 18 feet (at LB-10). Concentrations of arsenic exceeding the NYSTAGM (7.5 mg/Kg) are located in surface and subsurface soils along the Containment Building on the southern portion of the site in areas designated as fill areas. Additionally, off-site locations have concentrations of lead and arsenic exceeding NYS TAGMs.

The site has been divided into four separate operable units for the purpose of assessing impacts and evaluating remedial alternatives as follow:

OU-1 On-site soil, surface water and sediment exclusive of the operating facility
OU-2 On-site ground water
OU-3 Off-site media
OU-4 Operating facility (Plant Area)

3. Project description

The project consists of a remedial investigation to characterize OU-1 (on-site site soils, surface water, and sediment) and OU-2, on-site ground water. The investigation will involve collection and analysis of environmental samples. The data will be used in public health and environmental evaluations. If remedial actions are required, potential alternatives will be developed during the feasibility study. The alternatives will be designed to reduce or eliminate hazards to human health and the environment. These alternatives will be screened based on effectiveness, ability to implement, and cost. The overall program is illustrated in the flow diagram presented as Figure 3-1.

3.1. Objectives of the remedial program

The project objectives are to characterize the extent of the contamination in on-site soil and ground water, examine the risks associated with the contamination, and evaluate alternatives for remediating the site.

3.2. Project history

Previous investigations at the RSR Site were conducted by RSR beginning in 1989. The investigations included surface and subsurface soil, ground water, surface water and sediment sampling.

Ground water investigations conducted at the site in 1995 resulted in the installation of seventeen monitoring wells within the fill and natural materials at the site. The depths of these wells ranges from 8 to 33 ft below grade. In 1995, ground water levels from these wells ranged from approximately 1 to 18 ft below grade. Ground water elevation data indicated that ground water flow in the site area is generally to the south-southeast towards the pond under a hydraulic gradient of 0.10 near the process area to 0.04 ft/ft within the fill deposits on the eastern portion of the facility. A slurry wall, partially completed in 1999, may have impacted the natural flow direction and water levels.

Two Corrective Actions (CAs) were completed at the site under direction of the NYSDEC Division of Solid and Hazardous Materials. Both of these efforts involved the excavation and/or off-site disposal of impacted soils. One CA involved the removal of surface soils in the grassy area between the facility and Ballard Road and will be referred to as the North and South Lawn CA. The second CA involved the excavation of soils from behind the containment building and will be referred to as the Back CA. The North Lawn CA was completed in the area north of the

driveway leading to the facility and the South Lawn CA was completed to the south.

The North and South Lawn CAs were conducted between October and December 1998. Confirmation samples were collected from the sidewalls and base of the excavation and analyzed for total lead. The grid spacing was approximately 50 ft by 50 ft.

Based on review of the information available, excavation was completed vertically until the lead concentration at the base of a given grid area was below 500 mg/Kg. In general, the excavations were completed to a depth of 1 ft. In some areas the soil was removed to a depth of between 2 and 3 feet. Laterally, the excavation was completed until the confirmation samples revealed lead levels less than 500 mg/Kg except along the driveway or Ballard Road. In these areas lead concentrations in excess of 500 mg/Kg remain.

The Back CA was initiated between April 11, 1999 and August 12, 1999. The work was stopped due to lack of funding. The activity involved the excavation of approximately 46,508 tons of impacted soil followed by stabilization and offsite disposal of 34,260 tons of material. Approximately 12,125 tons of treated soil and 2,000 cy of unprocessed material currently remains on site in piles. 1,259 tons of clean fill was used to backfill the southernmost portion of the excavation. The exact location of the excavation has not been established. No confirmation samples were collected from the sidewalls of the excavation.

In the summer of 1999, Revere notified the NYSDEC that the company ceased work on the Back CA due to financial hardship. The NYSDEC Division of Environmental Remediation (DER) has assumed control of the remediation of ground water and soil contamination at the site with the exception of the Plant Area (OU-4). At this time, DER has the authority to use State Superfund money to conduct a remedial investigation/feasibility study for OU-1 and OU-2 as described in Section 2.4

An Interim Remedial Measure (IRM) was completed in May 2001 under the jurisdiction of NYSDEC Bureau of Eastern Remedial Action. This activity was be limited to covering of the soil piles generated during the Back IRM excavation program with plastic sheeting. Several piles totaling approximately 11,000 cu yds were covered to minimize the potential for wind and water erosion of the materials. The covered piles will remain in their current locations until the remedy for the on-site soils is implemented.

In general, concentrations of lead exceeding the NYSTAGM for total lead (500 mg/Kg) and Federal Maximum Concentration of Contaminants for the Toxicity Characteristic Value (TCLP action level) (5 mg/L) extend in each direction on the site and to maximum depth of 16-18 feet (at LB-10). Concentrations of arsenic exceeding the NYSTAGM (7.5 mg/Kg) are located in surface and subsurface soils along the Containment Building on the southern portion of the site in areas

designated as fill areas during the cut and fill analysis. Additionally, off-site locations have concentrations of lead and arsenic exceeding NYS TAGMs.

3.3. Key decision points

Milestones in the RI/FS process are summarized below:

- Approval of the RI/FS work plan
- Completion of the RI
- Completion of the FS
- Preparation of the PRAP
- Preparation of the ROD
- Design of the remedy
- Implementation of remedial actions

3.4. Remedial programs planned for site

A flow diagram of the remedial program planned for the site is provided as Figure 3-1. A schedule for the remedial program planned for the site is provided as Figure 3-2.

4. Project contacts

For more information about this project, please contact the following persons:

Environmental Concerns

Kevin Carpenter, P.E.
NYSDEC
625 Broadway
Albany, NY 12233-7015
(518) 402-9620

Health-Related Concerns

Mark Knudson
NYSDOH-BEEI
Flanigan Square
21 South Putt Corners Road
New Paltz, NY 12561
(845) 256-3148

Citizen Participation

Michael Knipfing
NYSDEC
21 South Putt Corners Road
New Paltz, NY 12561-1696
(845) 256-3154

5. Public mailing list

The public mailing list includes representatives from the following types of groups:

- Local citizens
- Elected Officials
- Local media
- Community action groups
- RSR employees
- Regulators

Appendix B includes the list of specific individuals and groups.

6. Identification of document repository

Document repositories for the RSR project are as follow:

Middletown Thrall Public Library
11-19 Depot Street
Middletown, New York 10940
(845) 341-5454

Hours:	M – Th	9AM – 8 PM
	F	9AM – 6 PM
	Sa	10AM – 5 PM
	Su	1PM – 5 PM

Wallkill Town Hall
600 Route 211 East
Middletown, New York 10940
(845) 692-7826

NYSDEC, Region 3
Attn: Mr. Michael Knipfing
21 South Putt Corners Road
New Paltz, New York 12561
(845) 256-3154

Hours:	*By appointment only*	
	M – F	8:30AM – 4:30PM

7. Description of specific citizen participation activities

Public participation meetings or distribution of fact sheets will take place at the completion of each milestone identified in Section 3.3. Table 7-1 provides a summary of the public participation activities planned for this program.

Table 7-1. *Public Participation Milestones*

Milestone activity	Public Participation Action
Approval of the RI/FS work plan	Meeting with CAC Fact Sheet Distribution
Completion of the RI	Fact Sheet Distribution
Completion of the FS	Fact Sheet Distribution
Preparation of the PRAP	Public Meeting Fact Sheet Distribution
Preparation of the ROD	Fact Sheet Distribution
Design of the remedy	Fact Sheet Distribution
Implementation of remedial actions	Fact Sheet Distribution

New York State Department of Environmental Conservation and New York State Department of Health with assistance from O'Brien & Gere Engineers, Inc. will provide details about the present phase of the project at these meetings. The activities identified in this plan were developed to address the NYSDEC's desires to keep the public informed and involved in remedial investigation activities and meet regulatory and Departmental citizen participation requirements and policy. This citizen participation program will be reviewed as the project goes forward. The activities described below may be adjusted based upon project scope, length, public interest and/or other factors.

7.1. General activities

Fact Sheets

Fact sheets summarizing significant activities in non-technical language shall be distributed at all public meetings and placed at document repositories. These will contain names and telephone numbers of individuals to contact for further information. At a minimum, these documents will be prepared at selected milestones of the project as identified in Table 7-1.

Consideration will be given to preparing additional fact sheets or press releases on other aspects of the project as it progresses. These fact sheets would be distributed to the contact list. The timing of additional fact sheet and press release development will be based on input from the State Agencies overseeing the project and input from the public.

Community Advisory Committee (CAC) Meetings

NYSDEC will meet with the CAC at the points outlined on Table 7-1 and Section 7.3. As appropriate, NYSDEC will be available to meet with CAC on other occasions upon request.

Public Meetings

NYSDEC will hold a public meeting to discuss the findings of the RI/FS and present the Preliminary Remedial Action Plan (PRAP) as outlined on Table 7-1 and Section 7.3.

7.2. Project-specific activities

Background Information

The NYSDEC has made copies of previous reports on the site available for public information at the document repositories (Section 4).

Work Plan Review and Comment

Prior to commencement of field activities, public participation and comment on the Work Plan will be sought. The following activities will take place:

- Place final draft Work Plan at the document repositories.
- Mail notice to the interested parties listed in Appendix B. This will describe the site, summarize the RI/FS, identify local repositories, request general information and comments on the work plan, and identify contact personnel.
- Hold a meeting with the Community Advisory Committee (CAC) to describe results of Data Gap Analysis and RI/FS Work Plan.

Final Draft RI/FS Report/PRAP

The following activities will take place when the final draft of the RI/FS report and PRAP is completed.

- Place final draft RI/FS and PRAP in local repository
- Mail public notice on final draft RI/FS and PRAP to contact list that briefly describes site, provides overview of work completed, summarizes findings, provides brief analysis of proposed remedial program schedule for future work, summarizes reasons for selecting chosen alternative, requests information and comments, identifies local repository, names DEC (DOH/DOL) contact, and announces date/time/place of public meeting and 30-day comment period.

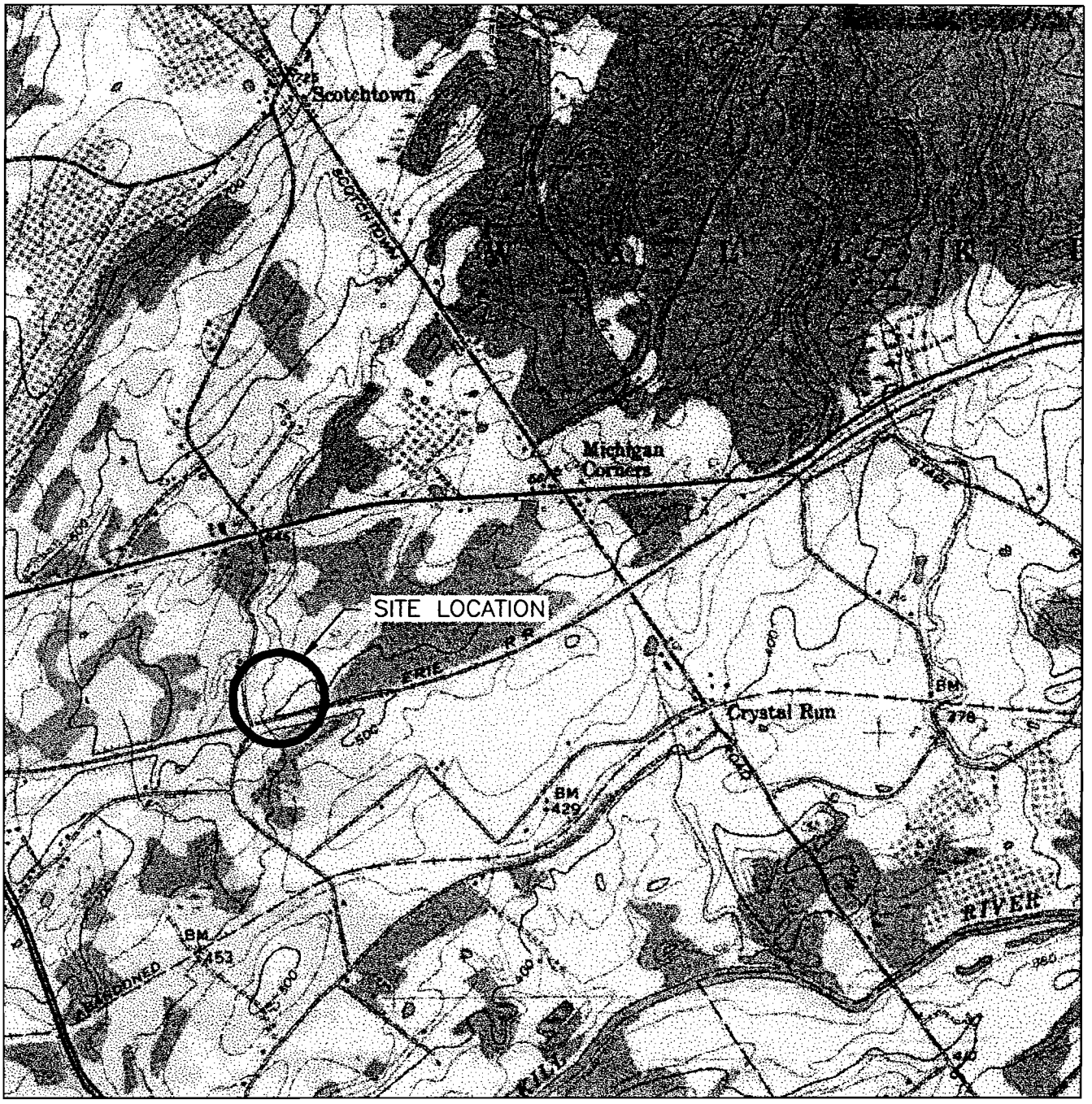
- Hold public meeting
- Thirty day comment period

Record of Decision (ROD) Execution

The following activities will take place when the ROD is completed.

- Prepare and mail Fact Sheet presenting the RODs that briefly describes site, summarizes findings, summarizes rationale for selecting chosen alternative, provides responses to comments on the PRAP, provides anticipated remedial program schedule, identifies local repository, names DEC (DOH/DOL) contact.
- Place a copy of the ROD in the repositories.

FIGURE 2-1



ADAPTED FROM: GOSHEN, NEW YORK U.S.G.S. 7.5 MIN. QUAD

NEW YORK STATE D.E.C.
REVERE SMELTING AND REFINING
WALLKILL, NEW YORK

SITE LOCATION MAP

QUADRANGLE LOCATION

1 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

FILE NO. 10653.26408.018
MARCH 2001

SCALE: 1:24000

CROMEN & GENE ENGINEERS INC.

DWG PATH: I:\DIV71\PROJECTS\10653\26408\DWGS\018.DWG-1

PLOT DATE: 03/01/01 SYR PWW

Figure 3-1
Program Flow Chart

Remedial Investigation/Feasibility Study
OU1 and OU-2
Revere Smelting and Refining Site
Wallkill, New York

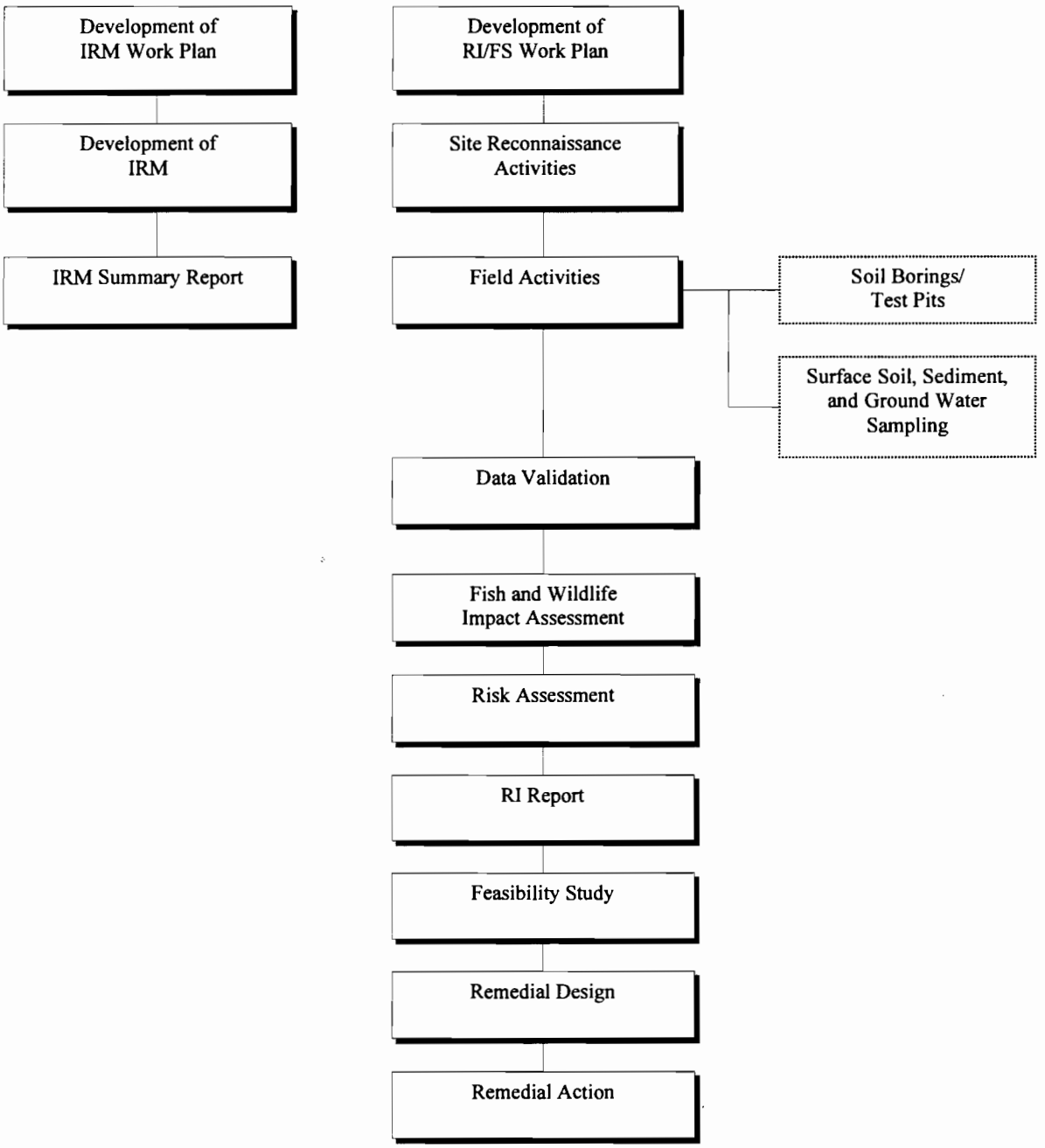
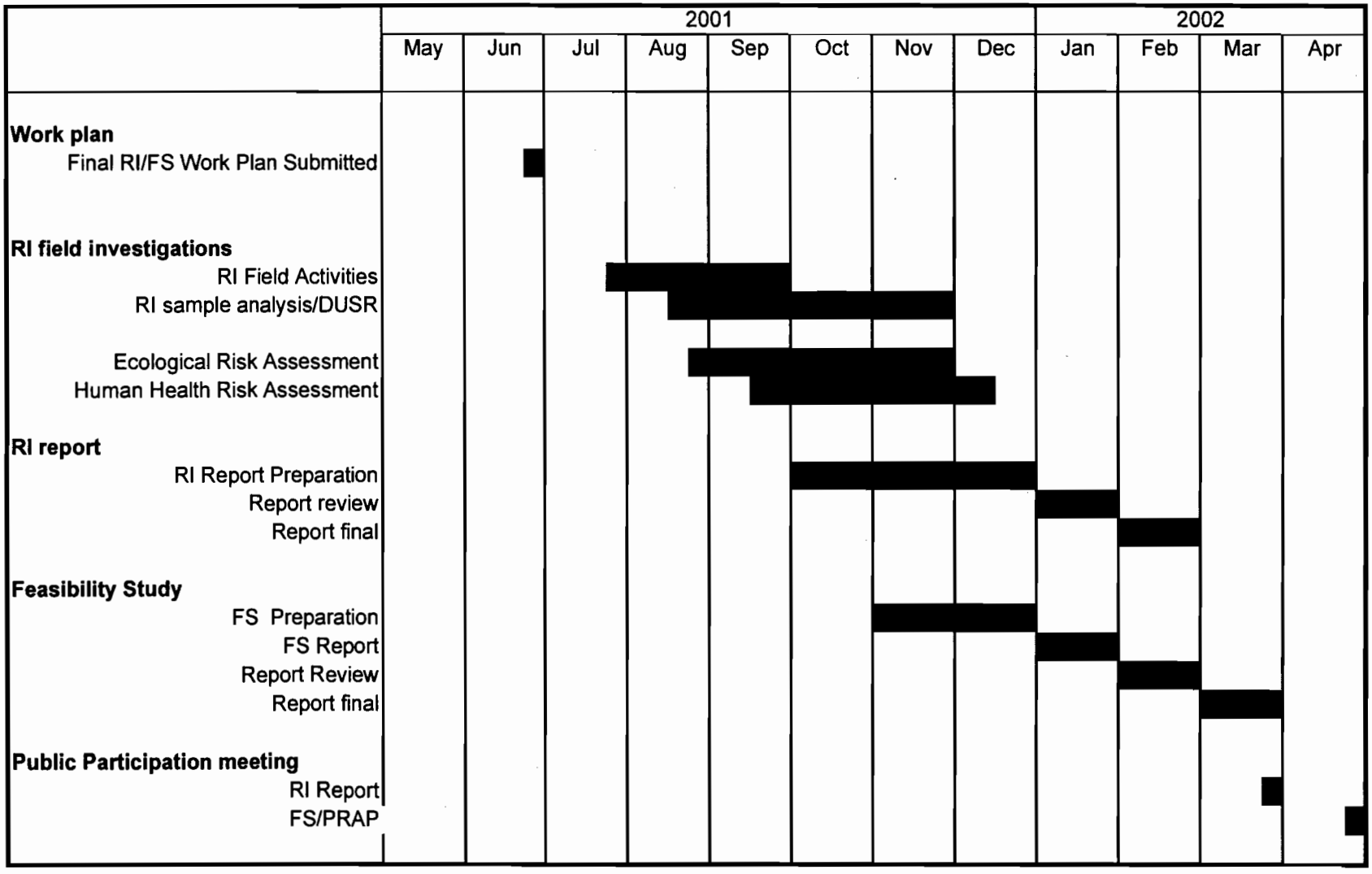


Figure 3-2
Project Schedule

Revere Smelting and Refining
Wallkill, New York



8/13/01

O'Brien Gere Engineers, Inc.
i71/10653/26408/5/RIWP/projschedcpp.xls

Appendix A

Hazardous Waste Site Program Glossary and Acronyms

Hazardous Waste Site Program
Glossary and Acronyms

Citizen Participation - A process to inform and involve the interested/affected public in the decision-making process during identification, assessment and remediation of inactive hazardous waste sites. This process helps to assure that the best decisions are made from technical, environmental, human health, and economic perspectives.

Citizen Participation Plan - A document that describes the site-specific citizen participation activities that will take place to complement the "technical" (remedial) activities. It also provides site background and rationale for the selected citizen participation program for the site. A plan may be updated or altered as public interest or the technical aspects of the program change.

Consent Order - A legal and enforceable negotiated agreement between the NYSDEC and responsible parties where responsible pates agree to undertake investigation and cleanup or pay for the costs of investigation and cleanup work at a site. The order includes a description of the remedial actions to be undertaken at the site and a schedule for implementation.

Contact List - Names, addresses and/or telephone numbers of individuals, groups, organizations and media interested and/or affected by a particular hazardous waste site compiled and updated by the NYSDEC. Interest in the site, stage of remediation and other factors guide how comprehensive the list becomes. Used to assist the NYSDEC to inform and involve the interested/affected public.

Document Repository - Typically a regional NYSDEC office and/or public building, such as a library, near a particular site, at which documents related to remedial and citizen participation activities at the site are available for public review. Provides access to documents at times and a location convenient to the public. Environmental Management Councils (EMCs), Conservation Advisory Committees (CACs) as well as active local groups often can serve as supplemental document repositories.

Feasibility Study (FS) - A process for developing, evaluating and selecting remedial actions, using data gathered during the remedial investigation to: define the objectives of the remedial program for the site and broadly develop remedial action alternatives; perform an initial screening of these alternatives; and perform a detailed analysis of a limited number of alternatives which remain after the initial screening stage.

Information Sheet - A synopsis of all or a portion of the project prepared by NYSDEC to disseminate information. Uses may include discussion of an element of the remedial program, opportunities for public involvement, availability of a report or other information, or announcement of a public meeting.

Preliminary Site Assessment (PSA) - Preliminary characterization of a site; identifies surface or subsurface potential migration pathways; identifies populations or resources which could be affected by the site; and describes past site operations/history. After a PSA, DEC may choose to nominate the site for the National Priorities List, or, where appropriate, conduct additional investigations.

Project Manager - Responsible for the day-to-day administration of the site investigation, and ultimate remediation/closure. The Project Manager works with the Office of Public Affairs and Corporate Communications, as well as fiscal and legal staff to accomplish site-related goals and objectives.

Public - The universe of individuals, groups and organization: a) affected (or potentially affected) by an inactive hazardous site and/or its remedial program; b) interested in the site and/or its remediation; c) having information about the site and its history.

Public Informational Meeting - A scheduled gathering of the NYSDEC, NYSDOH, and the public to give and receive information, ask questions and discuss issues. May take one of the following forms: large-group meeting called by the NYSDEC; participation by the NYSDEC at a meeting sponsored by another organization such as a town board; working group or workshop; or tour of the site.

Public Notice - Written or verbal communication to the public regarding an update on the site investigation (including a forthcoming meeting and/or report). Includes newspaper advertisements, telephone calls to key citizen leaders, targeted mailings, etc.).

Remedial Design - Once a remedial action has been selected, technical drawings and specifications for remedial construction at a site are developed, as specified in the final *RIIFS* report. Design documents are used to bid and construct the chosen remedial actions. Remedial design is prepared by consulting engineers with experience in environmental remediation.

Remedial Investigation (RI) - A process to determine the nature and extent of contamination by collecting data and analyzing the site. It includes sampling and monitoring, as necessary, and includes the gathering of sufficient information to determine the necessity for, and proposed extent of, a remedial program for the site.

Responsible Parties - Individuals, companies (e.g. current or past site owners or operators, transporters or generators of hazardous waste) responsible for or contributing to the contamination of an industrial waste site. PRP is an acronym for potentially responsible party.

Toll-Free "800" Telephone Information Number, - Provides members of the public who have questions, concerns or information with cost-free access to agencies or companies. The NYSDEC Toll-Free Information Number takes or records calls 24 hours a day, and a Department staff member contacts the caller as soon as possible (usually the same day). The NYSDOH Environmental Health Information Line is staffed from 8:00 a.m. to 4:30 p.m. on business days. After business hours, callers can leave a message which will be returned the next business day.

Appendix B

List of Interested Public Groups

CAC and RSR Members and Employees

Andy Levi
CAC on Revere
28 Amy Lane
Middletown, NY 10940

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Middletown, NY 10941

S. Daniel DeMercurio
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63 Ballard Road
Middletown, NY 10941

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Media

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40 Mulberry Street
Middletown, NY 10940

City Editor
Hudson Valley Black Press
PO Box 2160
Newburgh, NY 12550

City Editor
The Cornwall Local
PO Box B
Cornwall, NY 12518

City Editor
The Sentinel
PO Box 406
Vails Gate, NY 12584

City Editor
Greenwood Lake & West Milford News
PO Box 1117
Greenwood Lake, NY 10925

City Editor
Independent Republican
PO Drawer A
Goshen, NY 10924

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News of the Highlands
PO Box 278
Highland Falls, NY 10928

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Ottaway Newspaper, Inc.
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Campbell Hall, NY 10916

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US Cablevision
Box 889
Wappingers Falls, NY 12590

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Strauss Newspaper
PO Box 190
Warwick, NY 10990

City Editor
Warwick Advertiser
PO Box 190
Warwick, NY 10990

City Editor
Photo News
45 Gilbert St.
Monroe, NY 10950

Wayne Hall
Times Herald Record
233 Broadway
Newburgh, NY 12550

City Editor
Mid Hudson Times
PO Box 434
Walden, NY 12586

City Editor
Warwick Valley Dispatch
PO Box 594
Warwick, NY 10990

City Editor
Hudson Valley Business Journal
PO Box 339
Pine Island, NY 10969

News Director
Orange Co. Cablevision
PO Box 887
Middletown, NY 10940

News Director
WTBY-TV
PO Box 534
Fishkill, NY 12524

News Director
WRNN-TV
721 Broadway
Kingston, NY 12401

News Director
TKR Cable Co.
19 South Street
Warwick, NY 10990

News Director
Cable 6-TV
Industrial Drive
Middletown, NY 10940

News Director
Time Warner Cablevision
PO Box 887
Middletown, NY 10940

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WALL 1340 AM/WKOJ 92.7 FM
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Middletown, NY 10940

New Director
WDST 100 FM
118 Tinker Street
Woodstock, NY 12498

News Director
WGNY 103.1 FM
PO Box 2307
Newburgh, NY 12550

New Director
WDLC 1490 AM/WTSX 96.7 FM
PO Box 920
Port Jervis, NY 12771

News Director
WHUD/WLNA/WSPK/WBNR
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Beacon, NY 12508

News Director
WELV/WTHN
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Poughkeepsie, NY 12601

Lisa Phillips
WAMC
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Kingston, NY 12401

City Editor
Orange County Post
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Washington, NY 10992

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Middletown, NY 10940

Hillary Rodham Clinton
US Senate
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Room B40, Suite 6
Washington, DC 20510

Charles E. Schumer
US Senate
Everett Dirkson Senate Office Bldg.
Room 229
Washington, DC 20510

Senator John Bonacic
NYS Senate
Legislative Office Bldg.
Room 815
Albany, NY 12247

William J. Larkin, Jr.
NYS Senate
Legislative Office Bldg.
Room 915
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Howard Mills
NYS Assembly
Legislative Office Bldg.
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Edward Smith
Sewer and Water Superintendent
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Edward Diana, Chairman
Orange County Legislature
County Government Center
Goshen, NY 10924

Michael D. Paduch
Orange County Legislature
County Government Center
Goshen, NY 10924

Joseph Rampe
Orange County Executive
County Government Center
Goshen, NY 10924

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